

Design Guidance

Clinical Noting in Forms: Admissions Clerking

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Prepared by
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PREFACE

Documents replaced by this document

Document Title	Version
None	

Documents to be read in conjunction with this document

Document Title	Version
Design Guidance – Displaying Adverse Drug Reaction Risks	1.0.0.0
Design Guidance – Terminology – Matching	1.0.0.0
Design Guidance – Terminology – Elaboration	1.0.0.0
Design Guidance – Terminology – Display Standards for Coded Information	1.0.0.0
Design Guidance – Date Display	2.0.0.0
Design Guidance – Date and Time Input	2.0.0.0

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1 INTRODUCTION

This document provides guidance for the design of User Interface (UI) controls that enable clinical noting, specifically in the area of acute admissions clerking. It describes the area of focus, lists mandatory and recommended guidance points with usage examples and explains the rationale behind the guidance.

In recent years, admissions clerking pro-forma standards have been the focus of the UK-based Royal College of Physicians' (RCP) Health Informatics Unit (HIU), culminating in the 2008 release of record-keeping standards on the topic (see *A Clinician's Guide to Record Standards – Part 2 {R1}*). Typically, in acute care, the admissions clerking form has been the starting point for documenting the patient's stay in hospital. In some hospitals, this clerking form will become the cover-sheet for the patient's progress notes. During the patient's hospital stay, the admissions clerking documentation is often used as the first point of reference for clinicians unfamiliar with the patient, with sections such as the 'presenting complaint' and 'Past Medical History' sections providing an important overview of the patient.

From an electronic UI design perspective, the admissions clerking pro-forma standards raise a number of interesting challenges. There are some categories of data implied under the RCP standard headings that may be best handled as a small set of fixed choices from which the clinician may choose one or more; whereas other data entry items require the flexibility of free text or a combination of choices and free text. Some of the data entry items imply lists of summarised clinical situations, observations or opinions, such as the patient's 'Past Medical History'. These may require the input of some structured data, including dates, durations and encoded clinical concepts, which may help future data queries, but may also need some flexible noting, such as free text entry.

Therefore, the admissions clerking form serves as a good exemplar for a set of wider clinical noting user interface issues. The aim of the current guidance is to highlight some of the more general issues and solutions involved in electronic clinical noting and form completion, but specifically within the context of admissions clerking. To this end, the structure of the current guidance document does not mirror the structure of the RCP admissions clerking pro-forma (see *Hospital Admission Pro-forma Headings and Definitions {R2}*), nor do the illustrations featured within the guidance show a complete admissions clerking form. Designers and developers who wish to develop an electronic admissions clerking interface should use the current guidance when addressing some of the individual UI elements that may comprise the form, but the overall structure of and navigation through the form is outside of the current scope. Conversely, there are some aspects of the current guidance that can apply to other areas of clinical noting, for example, to a discharge form or an interface for recording examination notes.

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: <ul style="list-style-type: none"> ■ 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): <ul style="list-style-type: none"> ■ Low: <ul style="list-style-type: none"> ■ 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: <ul style="list-style-type: none"> ■ Mitigates specific patient safety hazards ■ User research findings clear but with few participants ■ References old authoritative guidance (for example, from the UK-based 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: <ul style="list-style-type: none"> ■ 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 10.2 for definitions of the specific terminology used in this document.

1.1 Customer Need

The delivery of safe and efficient patient care requires accurate and complete clinical noting that does not compromise other aspects of clinical welfare.

Clinical noting data should be partly or completely structured using an accepted clinical coding method so that data may be retrieved and re-used quickly and safely. It is generally true that an item of clinical data, having been entered once, will then be retrieved many times over. Therefore, effort must be made to ensure that on a range of levels the data supports browsing and searching, and the assembly of subsets of data into sensible context-specific views. The ability of the UI to ‘slice and dice’ data is very important, given the fact that an electronic screen often offers less space than its paper equivalent, and because navigation through the data is often less convenient and intuitive than physically flipping through a stack of paper notes. In the absence of true machine intelligence, this can only be achieved effectively if some of the data is encoded and that sufficient structure is captured during noting. This requirement for structured data encoding may increase the time and effort needed to initially record notes, but it should lead to larger efficiencies during the retrieval and update of these notes. Capturing encoded data, while simultaneously capturing, but separating out details of its associated context, means that a single data item can be safely retrieved in a range of different ways.

For example, the following data recorded as a block of narrative text may be accurate and complete, but can only be viewed in one way, namely as a block of text:

'Previously had gangrene (toes on left foot) and ketoacidosis (both last year), diabetes type 1 for past 22 years – poor glycaemic control, poor insulin compliance.'

However, by recording it as follows, as separate encoded statements, the clinician may be able to run a query to find out, for example, whether the patient has suffered from gangrene in the past or find out when the patient was first diagnosed with asthma:

- Gangrene – toes left foot, *occurred* March-2008
- Ketoacidosis, *occurred* March-2008
- Diabetes type 1 – from 1987 (approx) – poor glycaemic control, poor insulin compliance

It is important to note that the context in which each of these statements has been recorded is very important to interpreting them in a safe manner. For example, if readers of a note that a patient had gangrene did not know the date of the gangrene and/or the context in which it was written (namely 'Past Medical History'), they could wrongly think that the patient had gangrene at the time of writing the note, which could obviously affect any subsequent thinking about their care.

Against this requirement for structured encoded noting, however, we must consider the context and environment in which the clinicians have to complete the form. Training grade doctors, in particular, face great time pressures and at certain points the clinical noting is of secondary importance to actually providing care to the patient. Often they will only have time to write very brief notes, often incorporating shorthand and, if presented with an electronic system, they will follow 'the path of least resistance', in that they will choose those options which allow them to do the noting in the shortest time possible, while still accurately documenting the clinical situation.

1.2 Scope

In the context of the data that needs to be captured as part of Admissions Clerking (as defined in the RCP Admissions Clerking Standard, *Hospital Admission Pro-forma Headings and Definitions {R2}*), the guidance produced in this document will address the following Clinical Noting areas:

- Entering a list of note entries
- Revealing and hiding sections of a set of data fields
- Indicating required fields
- Displaying previous values
- Automatic calculations
- Adding free text
- General form designs

It is recognised that there are a number of potential approaches to entering clinical data into an electronic system. For example, the style of entry could range from one that is highly rigid and structured, through to one that is fluid and flexible, such as allowing the clinician to type in or hand write free text. Which style is appropriate may depend in part upon the situation in which the clinician is making the notes or upon the data requirements (for example, should the data be highly structured and encoded).

The current guidance focuses upon a style that is semi-structured, allowing some of the flexibility of free-text entry, but also imposing some structure in the form of fixed-choice data selection controls. This is deemed the most appropriate approach given the usage requirements and the level of technological sophistication that is currently available.

However, this does not aim to prohibit future development of data entry controls that feature a more flexible or, indeed, more constrained style, as long as the usage requirements are satisfied and mandatory guidelines are followed.

1.2.1 In Scope

Table 2 lists the functional areas covered in this guidance:

In Scope Item	Details
Entering a list of note entries	How to enable the clinician to enter lists of information quickly and safely
Revealing or hiding sections of a set of data	How to show that further fields for capturing related data are available for a particular type of data
Required fields	How you indicate that data must be entered into a particular section or field on the form
Displaying previous values	For example, how to show previously taken Blood Pressure reading(s) when recording a current reading for the same patient
Automatic calculations	How to distinguish between data which has been entered by the user from data that has been automatically calculated by the system. Also how to indicate the source of the data used in an automatically calculated field, such as Body Mass Index (BMI)
Adding free text	How to enable the clinician to add free text notes to any item on the form
General form designs	How to employ standard controls in a form

Table 2: In Scope Requirements

Also considered was the notion of how to communicate certain default contextual information to the clinician as they are recording notes. For example, such 'soft defaults' could include that a clinical statement applies to the patient as opposed to another family member, unless stated otherwise. Another default could be that a problem represents a new rather than an ongoing clinical episode. However, following early design analysis, the conclusion was that such 'soft defaults' could be captured and communicated through the use of section headings and choice of clinical terms entered by the clinician.

For example, if the clinician were to record the phrase 'Family history of asthma', it is clear that the clinical statement applies to other family members, rather than necessarily to the patient. Likewise, if the clinician enters 'asthma' under the heading 'Family history', the clinical statement does not necessarily apply to the patient, but instead applies to members in their family.

1.2.2 Out of Scope

This section 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 admissions clerking in many of the areas listed below.

Table 3 lists the subject areas that are not covered in this guidance:

Out of Scope Item	Details
Entering frequencies	Entering the frequency with which clinical events occur, such as 'weekly' or 'three times a day'.
Summarising multiple occurrences of a clinical situation	Instead of entering multiple occurrences of a clinical situation multiple times into the form, the clinician can just enter the term once and record next to it how many times it occurred. For example, instead of recording 'myocardial infarction, 1994', 'myocardial infarction 1998', record 'myocardial infarction x 2, 1994, 1998'.
Entering tabular data	Entering data into cells in a table.

Out of Scope Item	Details
Displaying edit history	For each item of data, display: <ul style="list-style-type: none">■ If it has been edited (after having been saved to record)■ The previous versions of the edits■ The relevant context of the edits, such as the date and author of the edit
Browsing terminology hierarchy	Allowing the clinician to browse for SNOMED CT terms by navigating through its hierarchical structure. For example, the clinician could select 'fracture of forearm', and then browse down to a more specific instance of the term, such as 'fracture of radius'.
Manipulating subsets (R4 guidance update)	Allowing the clinician to choose which subsets the system searches when they enter clinical phrases to be matched against SNOMED CT terms.
Linking between concepts	Allowing the clinician to indicate links between concepts. For example, linking a patient's diabetes with their ketoacidosis.
'Free text parsing'	Allowing the clinician to enter text from which the system matches SNOMED CT expressions.

Table 3: Out of Scope Requirements

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.

1.3 Assumptions

ID	Assumption
A1	The structured terminology used for this guidance will be SNOMED CT.
A2	Appropriate subsets within SNOMED CT will be available.
A3	This guidance applies to computer-screen-based applications that allow dynamically changing screen views, linked into a database. It does not apply to mobile devices, electronic paper or voice-recognition software although some of the principles that apply in the current guidance could also apply to applications delivered by those types of mechanism.
A4	The RCP standards addressing record keeping in acute admissions will be applied to the creation of a pro-forma (<i>A Clinician's Guide to Record Standards – Part 2 {R1}</i> and <i>Hospital Admission Pro-forma Headings and Definitions {R2}</i>).
A5	The data fields and options populating the form will be provided by an appropriate clinical authority.
A6	The clinician records the data in front of the patient or soon afterwards at a workstation.
A7	Suppliers who implement this guidance in their designs should also follow relevant national or international accessibility standards and guidelines. For further details see <i>Design Guidance – Accessibility Principles {R3}</i> .

Table 4: Assumptions

1.4 Dependencies

ID	Dependency
D1	The availability of appropriate data sets, for example, SNOMED CT subsets and clinical content service archetypes.
D2	The following design guidance documents (changes in these documents may affect the current guidance): <ul style="list-style-type: none">■ Design Guidance – Terminology – Matching■ Design Guidance – Terminology – Elaboration■ Design Guidance – Terminology – Display Standards for Coded Information■ Design Guidance – Date and Time Input■ Design Guidance – Date Display■ Design Guidance – Displaying Adverse Drug Reaction Risks■ Design Guidance – Recording Adverse Drug Reaction Risks

Table 5: Dependencies

2 ADMISSIONS CLERKING GUIDANCE OVERVIEW

As outlined in section 1, the current guidance addresses a set of data entry UI mechanisms that can be employed in the context of completing an admissions clerking form. In doing so, it will show not only how to feature standard UI fields, but also how to employ some specialised data entry field structures. In this way, the admissions clerking form is used simply as an exemplar that illuminates a set of wider clinical noting user interface challenges.

The guidance covers a range of data entry situations relevant to admissions clerking, starting with how to record a list of clinical note entries quickly and easily, such as is needed when writing a 'Past Medical History' (see section 3). The sections that follow section 3 then address a number of other issues associated with form entry.

The use of standard fields is covered in section 9 and is largely drawn from well established UI style guidance, and therefore was not the subject of any design analysis.

Note

The guidance in that section does not prohibit the use of non-standard controls; instead, it demonstrates how standard controls should be used, if the designer chooses to use them.

Throughout the various sections, the current document will indicate to which of the RCP admissions clerking headings the specific guidance can apply, because data items with the various RCP headings will demand different entry mechanisms. For example, the guidance that addresses the entry of a list of note entries can be applied to the RCP 'Past Medical History' and 'Problem list' headings. For a more thorough discussion of the use of RCP headings, see *A Clinician's Guide to Record Standards – Part 2 {R1}*.

Important

The visual representations used within this document to display the guidance are illustrative only. They are simplified in order to support 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.

2.1 Rationale Summary

The rationale for the current guidance draws on several pieces of evidence.

Research:

- **Secondary research:**
 - Existing guidelines and standards
 - UI best practice
 - Clinical noting practice
- **Primary research:**
 - Interviews with healthcare professionals, including doctors
 - A series of usability tests where we iteratively updated our designs (implemented in a set of prototypes) and tested them, a process often labelled Rapid Iterative Test Evaluation (RITE). Each design underwent up to five iterations, with a range of clinicians participating in each set of tests
- **Regular consultation with experts:**
 - A panel of clinical experts
 - A technical audience (developers)

Usability Principles (see APPENDIX A for details on these principles):

- Nielsen's usability heuristics
- Shneiderman's eight golden rules of interface design
- ISO 9241: Characteristics of presented information (taken from *ISO 9241-10: 1996 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 10: Dialogues principles {R8}*)

Existing Standards:

- BS ISO 9241-14:1997 *Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 14: Menu dialogues {R5}*
- BS ISO 9241-17:1998 *Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 17: Form-filling dialogues {R6}*
- BS ISO 9241-12:1999 *Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 12: Presentation of information {R7}*
- BS ISO 9241-10:1996 *Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 10: Dialogues principles {R8}*

Evolving Standards:

- *Design Guidance – Date Display {R11}*
- *Design Guidance – Date and Time Input {R12}*
- *Design Guidance – Terminology – Matching {R13}*
- *Design Guidance – Terminology – Elaboration {R14}*
- *Design Guidance – Terminology – Display Standards for Coded Information {R15}*
- *Design Guidance – Recording Adverse Drug Reaction Risks {R16}*
- *Design Guidance – Displaying Adverse Drug Reaction Risks {R17}*

2.2 Summary of Guidance

Table 6 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.

Notes

- Table 6 lists possible clerking data to which the guidelines may apply. These are not intended to be exhaustive. The guidance may apply to other data which is not outlined in the table.
- Design illustrations are best viewed on a screen in colour.

Areas of Guidance	Visual Summary
<p>Section 3 – Entering a list of note entries</p> <p>Possible clerking data:</p> <ul style="list-style-type: none"> ■ Past Medical History ■ Problem list 	
<p>Section 4 – Revealing and Hiding Sections of a Set of Data</p> <p>Possible clerking data:</p> <ul style="list-style-type: none"> ■ Observations/ findings <ul style="list-style-type: none"> ■ Cardiovascular system ■ Respiratory system ■ Abdomen ■ Genitourinary ■ Nervous system ■ Musculoskeletal system ■ Skin 	

Areas of Guidance**Visual Summary****Section 5 – Required Fields**

Possible clerking data:

- Presenting complaint
- History of presenting complaint

Presenting Complaint(s)

Presenting Complaint(s) *

Enter a Presenting Complaint

* Indicates Required Field

History of Presenting Complaint(s) *

Enter History of Presenting Complaints

Section 6 – Displaying Previous Values

Possible clerking data:

- Vital signs

Comment

Position: Lying
Previous values

Cuff size: Pulse rate (beats per minute)

Location: 92 15-Apr-2009, 11:52
110 15-Apr-2009, 12:30
112 15-Apr-2009, 13:00

Pulse

Pulse rate: 112 Beats per minute
Volume: 112

Respiration

Respiratory rate: 112 Breaths per minute
Rhythm: 112
Character: 112
Depth: 112

Oxygen support: 112 %
Oxygen saturation: 112 %

Section 7 – Automatic Calculations Data

Possible clerking data:

- Glasgow Coma Scale
- BMI
- Vital signs
- Duration/date

Pulse

Oximetry

Early warning score

Calculated from data entered in the following fields:

	Score
Vital signs/ Blood pressure/ Systolic	168 2
Vital signs/ Pulse/ Rate	122 2
Vital signs/ Respiration/ Rate	24 1
Vital signs/ Oximetry/ Oxygen saturation	96 0
Total score	5

Details on scoring

Early warning score 5 Patient requires medical attention. Repeat observations after 30 minutes

Section 8 – Adding Free Text

Possible clerking data:

- Observations/ findings
 - Cardiovascular system
 - Respiratory system
 - Abdomen
 - Genitourinary
 - Nervous system
 - Musculoskeletal system
 - Skin

Breathing

Breathing description: wheeze
Rhythm:
Character:
Sign of increased effort:
Chest wall:
Chest expansion:
Chest expansion (symmetry):
Trachea position:

Additional text

expiratory, polyphonic |

Clear OK Cancel

Section 9 – General Form Designs

Possible clerking data:

- Any of the data areas

CVS normal on examination Not known
 Yes
 No

Patient declined examination

Table 6: Summary of Guidance

3 ENTERING A LIST OF NOTE ENTRIES

3.1 Introduction

These design guidelines address the creation of any list that comprises brief notes about a set of clinical situations, where efficiency and accuracy are prioritised over capturing detail.

This guidance applies to situations where the clinician is making a list of clinical items, such as problems or procedures, where each clinical note entry is summarised in a concise, but accurate format.

The designs shown in this guidance aim to allow a clinician to quickly and safely make a list of entries.

The basic guidelines can apply to the following, amongst other areas:

- Past medical history
- Problem list
- Summary of procedures
- Action list

In some of the cases, further customisation may be required, but the basic guidelines will apply to all of them.

The following list outlines the main user requirements for the feature addressed by the guidance in this section. These user requirements were elicited following discussions with a panel of expert clinicians and a series of interviews with training grade doctors:

- User must be able to enter text and match an appropriate SNOMED CT concept in the context of the admissions clerking form
- User must be able to match multiple SNOMED CT concepts sequentially under a single heading or subheading within the admissions clerking form
- User must be able to elaborate a single concept (or post-coordinated expression) with free text
- User must be able to delete matched concepts within the form before it is committed to the record
- Users must be aware of the fixed choice attribute options available to them when they are entering free text, for example for selecting laterality of a body site
- User must be encouraged to select or enter encoded options, where possible
- If appropriate, allow users to specify duration and dates for a concept

3.2 Principles

The following key principles inform the guidance in this section:

- Improving speed of entry whilst maintaining accurate data:
 - The list could be fairly long and therefore speed, in addition to accuracy, is a key factor.
 - Unlike other situations, such as during a detailed physical examination, the UI will not require the clinician to enter a lot of detail, structured or otherwise.
 - Instead, the emphasis is on capturing the main clinical details and moving on to the next entry as quickly as possible.

- Encourage structured (encoded) data entry:
 - Given the potential reuse of the data (for example, during the patient's hospital stay), capturing the accurate meaning of the clinical entries plus any relevant context is essential to avoid its later misinterpretation, which could compromise the care delivered to the patient.
 - Therefore, the designs also encourage structured (encoded) data entry in order to ensure accurate, unambiguous data entry.
- Arrange entries so that they are easy to scan visually. As clinicians are building up a list, which could be ordered chronologically or otherwise, it will be necessary for them to scan this as they are entering it, in order to:
 - Maintain an ordered 'picture' in their mind
 - Ensure that they have not missed or duplicated anything
- Screen design heuristics:
 - Flexibility and efficiency of use
 - Aesthetic and minimalist design
 - Error prevention

3.3 Guidelines

The guidelines in this section are based around the following actions:

- Entering the clinical concept
- Entering additional details
- Editing the main clinical concept or the additional details
- Deleting an entry

This assumes a distinction between the main clinical concept and its additional details. Our research (see APPENDIX B) has shown that clinicians understand this distinction, in the specific context of entering a 'Past Medical History' list, and find it intuitive to enter one or two words which describe the clinical situation and then add some further details associated with that situation.

Also, our analyses showed that it would be more efficient and intuitive for clinicians to enter the additional details for a concept immediately after entering it, rather than entering all the main concepts followed by all their associated details. This ordering was shown to be intuitive in the user testing (see APPENDIX B) we later conducted.

In the context of the current guidance, editing the concept and/or its additional details would only be done **before** the data was committed to record and shared with other clinicians. This editing could be done, for example, if the patient told the clinician some additional facts or corrected details during the course of the noting, or if the clinician decided immediately after writing an entry that it would be better expressed in a different manner. Therefore, this guidance is not covering the action of updating data.

Likewise, guidance relating to deleting entries in the list would only apply to data that had not yet been committed to record.

Editing and deletion of data after it has been committed to record, and thus potentially seen by other clinicians, may also require a tight system of audit which itself could require warnings and other relevant interface controls. However, these situations are not covered in the current guidance.

It is assumed in this guidance that the clinician will be recording multiple entries sequentially.

Finally, this guidance only addresses the action of entering data and the display of data *during its entry*. It does not cover how the data should be displayed at a later time.

3.3.1 Entering the Clinical Concept

The first action that the clinician will perform will be to enter a clinical concept into the list, prior to entering associated details.

This guidance includes:

- Entering and encoding the clinical concept
- Entering and encoding the next clinical concept
- Displaying common matches (where appropriate)
- Handling 'match not found'

ID	Guideline	Conformance	Evidence Rating
Entering the Clinical Concept			
CNA-0010	Provide a mechanism into which the user can type in list of clinical phrases while the system returns matched terms from the appropriate terminology	Mandatory	High
CNA-0020	Provide a single field into which the user can type a clinical term (search entry field)	Recommended	High
CNA-0030	Provide a visible cursor in the search entry field when the field is in focus (without a matched term)	Mandatory	High
CNA-0040	Do not display associated fields, such as an 'Additional text' field, until the user has searched for and selected a clinical term	Recommended	High
CNA-0050	Progressively match terms as the user types in text	Recommended	High
CNA-0060	Allow search results to be displayed as they are matched against the text entered by the user	Recommended	Medium
<p>Note</p> <p>This may mean that the list needs to reorder itself.</p>			
CNA-0070	If the search facility features progressive matching, do not feature a search button	Recommended	High
CNA-0080	If the search facility does not feature a search button, feature a search icon instead (for example, a magnifying glass)	Recommended	High
CNA-0090	If there is a significant delay between the user triggering the matching process and the system returning matches, provide an indication that there is search activity occurring until matches are returned	Recommended	High
<p>Note</p> <p>Any time period longer than a second could be defined as a significant delay.</p>			
CNA-0100	Indicate that search activity is occurring by providing an animation	Recommended	Medium
CNA-0110	Display the activity animation in a position that is prominent, but that does not visually obstruct the search facility	Recommended	High
CNA-0120	Provide sufficient contrast (shading and/or colour) in order to ensure that the search entry field is sufficiently prominent	Recommended	Low
CNA-0130	Label the search entry field with appropriate instructional text (for example, inform the user that there will be further fields appearing into which they may add additional details)	Mandatory	High

CNA-0140	Feature a prompt within the search entry field	Recommended	Medium
CNA-0150	Provide additional prompting text which communicates what the user should do	Recommended	High
CNA-0160	Display additional prompting text immediately below the search entry field in a low prominence text size and colour	Recommended	Medium
CNA-0170	Provide an example in the additional prompting text of what the user can type into the search entry field	Recommended	High
CNA-0180	Do not display multiple search entry fields simultaneously in a single list, except where the user has gone back in to edit a matched term	Recommended	Medium
CNA-0190	Left-align the search entry field	Recommended	Medium
CNA-0200	Ensure that the search entry field can display 32 characters' simultaneously	Recommended	High
<p>Note</p> <p>Use the character 'M' as the standard character width.</p>			
CNA-0210	Create a list of common matches from within the clinical terminology (SNOMED CT) against which the user can search for matches	Recommended	High
CNA-0220	During the searching process, visually distinguish the common matches from the remaining matches	Recommended	High
CNA-0230	Display the common matches above the remaining matches	Recommended	High
<p>Notes</p> <p>This guideline is a workaround in the absence of a terminology service that can provide well-ranked matching.</p> <p>Common matches should be determined by the relevant clinical authority.</p>			
CNA-0240	Provide labels that distinguish common matches from the remaining matches	Recommended	High
CNA-0250	Visually distinguish prompt text in the field from data typed into the field	Mandatory	High
CNA-0260	Distinguish prompt text in the field by displaying it in grey italic text	Recommended	High
CNA-0270	Do not feature example data in the prompt text in the field	Recommended	Medium
CNA-0280	If the field features an in-field prompt, ensure that this prompt is still visible when the cursor moves into the field (but disappears when text is typed into the field)	Mandatory	High
CNA-0290	After the user has selected a matched term, automatically move the focus to the next field in the tab order	Recommended	High
CNA-0300	After the user has selected a matched term, display the term in bold text	Recommended	High
CNA-0310	After the user has selected a matched term, do not truncate it	Mandatory	High
Entering Next Clinical Concept			
CNA-0320	Just after the user has selected a matched term, automatically display a new field for entering the next list entry	Recommended	Medium
CNA-0330	Next entries will be displayed directly below the preceding entry	Recommended	High

Usage Examples

Past Medical History

Enter a problem 

e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.



Example of the selected search entry field with a visible cursor (CNA-0020, CNA-0030)

Past Medical History

Enter a problem 

e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.

Enter date and/or duration

Enter additional text



Example of incorrect display of additional attributes prior to matching with a clinical term (CNA-0040)

Past Medical History

diabe| 

Common matches

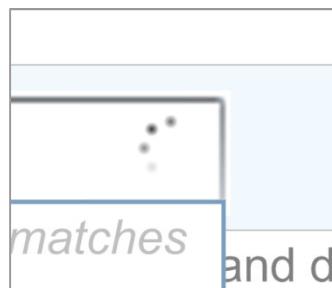
diabetes mellitus type 1
diabetes mellitus type 2

All matches

Searching...



Example of progressive matching, with animation in place of the search icon, and indicating 'Searching' within the results field (CNA-0050, CNA-0060, CNA-0070, CNA-0080, CNA-0090, CNA-0100, CNA-0110)



Close up on the animation:

Past Medical History

Enter a problem 

e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.



Example of a shaded area surrounding the search field, with in-field prompt text as the label and instructional text below the field (CNA-0120, CNA-0130, CNA-0140, CNA-0150, CNA-0160, CNA-0170, CNA-0190)

Past Medical History

Enter a problem 

e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.

Enter a problem 

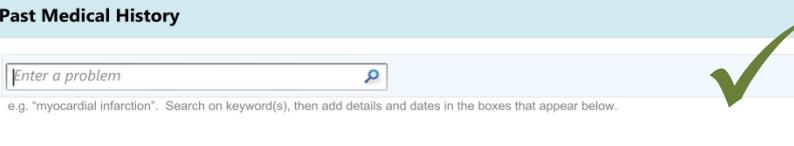
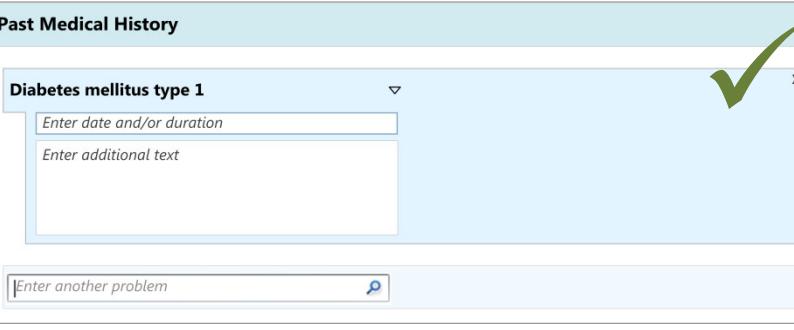
e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.

Enter a problem 

e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.



Example of incorrectly displaying multiple search fields prior to matching any clinical terms (CNA-0180)

 <p>Past Medical History</p> <p>diabe </p> <p>Common matches and dates in the boxes that appear below.</p> <p>All matches</p> <ul style="list-style-type: none"> diabetes mellitus type 1 diabetes mellitus type 2 diabetes type renal diabetes bronze diabetes labile diabetes latent diabetes brittle diabetes unstable diabetes diabetes mellitus 	<p>Example showing 'Common matches' and 'All matches' within a progressive search (CNA-0210, CNA-0220, CNA-0230, CNA-0240)</p> 
 <p>Past Medical History</p> <p>Enter a problem</p> <p>e.g. "myocardial infarction". Search on keyword(s), then add details and dates in the boxes that appear below.</p>	<p>Example of in-field prompt text within the search field in grey, italic text and with the cursor (CNA-0250, CNA-0260, CNA-0280)</p> 
 <p>Past Medical History</p> <p>Diabetes mellitus type 1</p> <p>Enter date and/or duration</p> <p>Enter additional text</p> <p>Enter another problem</p>	<p>Example showing a matched term in bold and the addition of a new search field below (CNA-0320, CNA-0330)</p> 

Alternative Technology Implementation

The designs illustrating the guidance preceding this example assume a Web-based solution (such as a rich Internet application) in which the control largely behaves in the same way as a list control in a desktop application. However, the guidance could also apply if one was using a technology for desktop applications (such as Windows Forms).

The diagram illustrates a Windows Forms application for entering medical history. It consists of three windows connected by yellow arrows:

- Past Medical History**: The main window where a user types "diabe". A dropdown menu shows "Common matches" like "diabetes mellitus type 1" and "diabetes mellitus type 2". Below is a list of "Other matches" including various types of diabetes. A green checkmark icon is positioned to the right of the search field.
- Pop-up Window**: A modal dialog box titled "diabetes mellitus type 1" with fields for "Date and/or duration" and "Additional text". It has "Cancel" and "OK" buttons at the bottom.
- Past Medical History**: The main window again, now showing the selected item "diabetes mellitus type 1" in the list, along with other entries like "asthma" and "ketoacidosis".

Example of a Windows Forms version of the entry mechanism, featuring a pop-up window instead of an expanding area below the search field

Rationale

Design Analysis:

During the design analysis we considered several ways in which a clinician could enter a list of clinical statements quickly and easily. The design implied by the guidance above has the following advantages:

- Provides clinicians with the flexibility to enter as many list items as they need
- Minimises the number of key presses that the clinician needs to perform
- Maintains the visual focus, so that a clinician can intuitively attend to the entry fields

A key usability principle is to minimise the visual clutter so that a clinician's attention is focused upon the most appropriate field (see APPENDIX A). Therefore, the design does not show any further associated fields until the main concept has been entered. Also, as soon as the clinician has selected a term, the focus should move automatically to the next field, in order to minimise the number of key presses that the clinician must make and to ensure that the process flows smoothly. Finally, the design only features one single entry field at a time (except where the clinician has gone back to edit a previously entered item). This is to prevent confusion as to which field the clinician should enter data into, which could result in delays.

In addition to the field label (in-field prompt), the design provides additional instructional text, given that clinicians may not be aware of what to do during their initial use of the form. This was supported by the user testing (see APPENDIX B).

The design shows the list entry items vertically stacked, rather than oriented horizontally, because items are easier to scan down when vertically stacked (see the *Guide to Presentation of tables and graphs {R10}*).

Desk Research:

The mechanism for SNOMED CT matching, including the entry field size and the visual display used for distinguishing common matches with other matches are based upon previous Microsoft Health Common User Interface (CUI) guidance. For example, the width of the search entry field (32 characters) was determined in *Design Guidance – Terminology – Matching* {R13}, based upon analysis of the lengths of SNOMED CT terms. Additionally, the display of the encoded term is also drawn from previous Microsoft Health CUI guidance (see *Design Guidance – Terminology – Display Standards for Coded Information* {R15}).

The use of ‘common’ items is sometimes used in existing paper forms in order to provide quicker entry and prompting (for example, in *Hospital Admission Pro-forma Headings and Definitions* {R2}). This feature is also supported by an international standard, which states that if the “frequency of option use is known (or can be determined) and option groups are small (eight or less), the most frequently used options should be placed first” in a menu (see *Menu dialogues* {R5}).

In a recent paper outlining principles for effective clinical decision support, the authors referenced research that suggested clinicians’ satisfaction with a clinical system markedly declines if the time taken to provide system feedback exceeds one second. The authors therefore suggested ‘subsecond screen flips’ (see *Ten Commandments for Effective Clinical Decision Support: Making the Practice of Evidence-based Medicine a Reality* {R4}). This supports the need for an animation to appear if the screen change exceeds one second {R4}. The need for “timely and perceptible feedback” associated with “normal task performance” which is “non-intrusive” and does not “distract the user from the task” is also supported by international standards (see *User guidance* {R9}). Another standard indicates that “if the system response to option execution” is delayed, “an indication should be provided to the user that the system is processing the request” {R5}. This standard defines a delay as being “more than 3 s[econds] after initiation” {R5}, although the current guidance authors argue that the need to reduce frustration on the part of the clinician would point to providing the indication quicker than 3 seconds.

International standards also recommend that prompts (“user guidance information”) should be “readily distinguishable from other displayed information” and that such messages “should provide the user with specific information relative to the task context rather than generic messages” {R9}. It also states that such text “should not disrupt the user’s task and the continuation of the dialogue” {R9}.

The need for a visible cursor is also underlined by a relevant standard, which states that “cursor position should always be clearly visible if it is within the currently displayed portion of the form” (see *Form-filling dialogues* {R6}).

User Research:

A series of iterative usability tests (see APPENDIX B) showed that:

- Failure to provide a visible cursor encourages unnecessary mouse clicks and causes confusion
- Some clinicians would try to (incorrectly) type in a full sentence into the search entry field, prior to the introduction of progressive matching and prompting text
- Where progressive matching had been implemented, providing a search button confuses clinicians
- Failure to provide an indication of search activity leads to unnecessary mouse clicks and user frustration
- Initially, clinicians can find it difficult to find the search entry field if it is not sufficiently prominent in relation to other fields
- Clinicians expected a list of common ‘Past Medical History’ matches and found it difficult to find a common match when there was no separate list of common matches

Speed is a priority factor when completing an admissions clerking form. The UI should be geared towards reducing the time that it takes to return matched results

Hazard Risk Analysis Summary:**Potential Hazards:**

- Clinician tries to enter text that does not match the encoding terminology
- Mechanism is so time consuming that the clinician does not have sufficient time to complete the form

Mitigations:

- Provide progressive matching and instructional text
- Minimise number of user actions, such as number of keystrokes

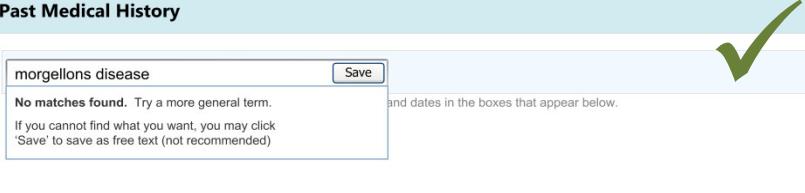
3.3.2 Dealing with 'Match Not Found'

This section addresses how the UI should behave, and what options it should offer, if clinicians cannot find the term for which they are searching. This guidance has implications beyond the scope of entering a list, and could apply to any matching of encoded terminology.

ID	Guideline	Conformance	Evidence Rating
CNA-0340	Clearly indicate when no matches have been found	Mandatory	High
CNA-0350	Provide a control that allows the user to retain the unencoded text in the form	Mandatory	High
CNA-0360	Provide a message that instructs users to try to select a more general term, but which also instructs them that if they cannot find anything that is appropriate, then they are to activate the control that retains the unencoded text	Recommended	Medium
CNA-0370	In the message, communicate to the user that retaining the unencoded text is not recommended	Recommended	Medium
CNA-0380	Display the message in the same location as the results would otherwise be displayed	Recommended	High
CNA-0390	If the user activates the control that retains the unencoded text, display the text in normal weight	Recommended	High

Usage Examples

Past Medical History

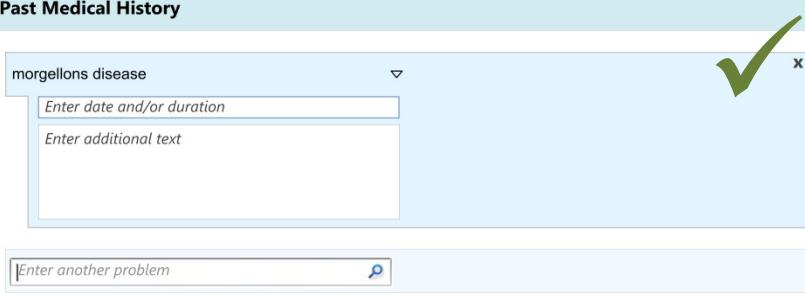


morgellons disease

No matches found. Try a more general term.
If you cannot find what you want, you may click 'Save' to save as free text (not recommended)

Example showing 'No matches found' within the results field (CNA-0340, CNA-0350, CNA-0360, CNA-0370, CNA-0380)

Past Medical History



morgellons disease

Enter date and/or duration
Enter additional text

Enter another problem

Example showing an unmatched term, identified as unencoded by not being bold (CNA-0390)

Rationale

Design Analysis:

Given that the encoding terminology is not infinite, nor is complex post-coordination possible given the current technological limitations, there will be occasions where clinicians will want to match a single term that does not exist in the terminology. In this case, it will be necessary to provide a mechanism that allows them to save the text, but not as an encoded term.

User Research:

Clinicians who were shown a design (see APPENDIX B) that illustrates this guidance understood what it meant and what they should do.

Hazard Risk Analysis Summary:**Potential Hazards:**

- Clinicians select a sub-optimal term because they cannot find the exact term that they seek
- Clinicians do not make an entry because they cannot find the exact term that they seek
- Clinicians choose to save free text, when there is an acceptable term available in the terminology

Mitigations:

- Allow users to enter the exact phrase they seek, but as free text
- Allow users to enter the exact phrase they seek, but as free text
- Provide progressive matching
- Provide a message that warns that saving free text is not recommended and that entries are monitored for data quality

3.3.3 Entering Additional Details

In addition to entering an encoded concept, it is often necessary to record some additional details, for example dates, durations and free text to elaborate the description of the situation. In the context of admissions clerking, this guidance focuses upon entering the duration and dates of the clinical situation that is being summarised, in addition to entering free text which elaborates the main concept. However, this guidance could also apply to other attribute fields, depending upon the clinical noting need.

Note

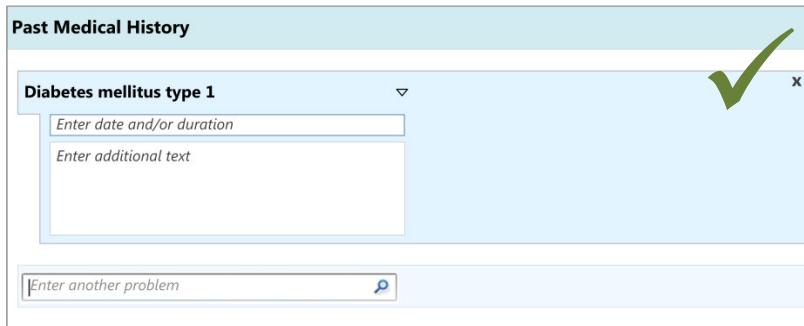
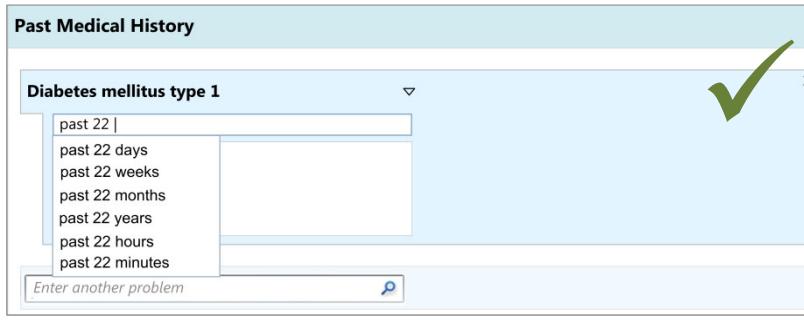
In this context, the term ‘attribute’ refers to a concept which in some way further describes, characterises or contextualises another concept. For example, ‘severe’ could be an attribute of ‘gastroenteritis’, as could the date on which it occurred.

This guidance includes:

- Entering duration and/or date(s)
- Entering free text elaboration
- Entering other structured attributes (including additional fields for capturing context-specific or concept-specific attribute data)
- Matching SNOMED CT qualifiers

ID	Guideline	Conformance	Evidence Rating
Associated Attribute Fields (General)			
CNA-0400	Provide a mechanism which allows the user to type in attribute data associated with the clinical phrases which they are entering	Mandatory	High
CNA-0410	As soon as the user has selected a suitable matched term, automatically display the associated attribute fields	Recommended	High
CNA-0420	Upon the user selecting the matched term, display corresponding attributes fields plus a field for entering additional text	Recommended	Medium
CNA-0430	Slightly indent the attributes and free text field	Recommended	Medium
CNA-0440	Feature labels for all the corresponding attributes and additional text fields	Mandatory	High
CNA-0450	Display associated attribute field labels as in-field prompt text	Recommended	Medium
CNA-0460	Present important structured data fields before the additional text field in the tabbing order	Recommended	Medium
CNA-0470	Upon moving the focus away from the associated attribute fields, the attribute fields become hidden	Recommended	High

CNA-0480	Upon hiding the associated attribute fields, display the data in these fields entered to the right of the main concept	Recommended	High
CNA-0490	If the width of the displayed associated attribute data exceeds the width available to the right of the main concept, wrap the text	Recommended	High
CNA-0500	Ensure that the user can navigate through the fields using keyboard tabbing, both forwards and backwards	Recommended	High
Entering Duration and/or Dates			
CNA-0510	In the case of the 'Past Medical History', allow the user to enter the duration and/or dates when the clinical situation occurred	Mandatory	High
CNA-0520	Provide an entry field into which the user can type the duration and/or dates	Recommended	High
CNA-0530	Provide suggested matches immediately below the 'Duration and/or date(s)' field, as the user types in the field, which the user can select in order to populate the field	Recommended	High
CNA-0540	Ensure that matches are only returned when: <ul style="list-style-type: none"> ▪ A minimum number of letters have been entered ▪ The matched terms are sufficiently similar to the input text See <i>Design Guidance – Terminology – Matching {R13}</i> for further details about matching.	Recommended	High
CNA-0550	Do not feature a drop-down control button in the 'Duration and/or Dates' field	Recommended	High
CNA-0560	Allow the user to type in text descriptions of duration and date(s) (for example, 'past', 'last', 'for', 'during')	Recommended	High
CNA-0570	Ensure that the UI can recognise and match a set of simple duration and date 'natural language' constructs <div style="border-left: 1px solid black; padding-left: 10px; margin-top: 10px;">Note In this instance, 'natural language' refers to words which give a temporal context to dates and durations, such as 'past', 'last' or 'for'. Additionally, natural language terms could also include approximate periods of time, such as 'summer' or 'Christmas'.</div>	Recommended	High
CNA-0580	If there is an exact match between the user's input text and a matched duration or date construct, automatically select the match	Recommended	High
CNA-0590	After a match has been made, the UI should display a confirmation of the duration and/or date(s) in terms of a formal structure, such as: <ul style="list-style-type: none"> ▪ Start date or time ▪ End date or time ▪ Duration 	Recommended	High
CNA-0600	Label the various categories of duration and date displayed in the confirmation, such as: <ul style="list-style-type: none"> ▪ 'From' ▪ 'To' ▪ 'For' 	Recommended	High
CNA-0610	Display the duration and/or date(s) confirmation display to the right of the input field	Recommended	Medium
CNA-0620	Where appropriate, indicate where duration and date data are approximate (for example, if the user writes 'past 10 years', a start date of '1999' would be assumed to be approximate, and should feature the suffix 'approximate' in parentheses)	Recommended	High

CNA-0630	Provide access to a control for selecting duration and/or dates from a menu or similar mechanism	Recommended	Low
CNA-0640	The display-version of the associated attribute data should be formatted thus: <ul style="list-style-type: none">■ Arrange horizontally (that is, in a line or multiple wrapped lines)■ Separate each chunk of data with a semi colon■ Display calculated or encoded data in bold text■ Display the calculated confirmation of the duration and/or date(s) data, and not the user-matched text <p>Do not provide a label for the additional text</p>	Recommended	Medium
Entering Additional Free Text			
CNA-0650	Provide a field into which the user can enter additional free text	Mandatory	High
CNA-0660	If there is a dedicated additional free text field, ensure that it is clearly labelled, for example, 'Enter additional text'	Mandatory	High
CNA-0670	Ensure that the 'Additional free text' field is a minimum two lines high	Mandatory	High
Matching SNOMED CT Qualifiers			
CNA-0680	Where post-coordination is possible between the main matched concept and qualifier text in the additional text field, offer these text matches as potential encoded terms (for example, 'severe')	Recommended	Medium
CNA-0690	Offer the user the option of encoding post-coordinated qualifier terms by providing a check box immediately adjacent to the additional text field, where the check box is labelled with the term's label (such as its 'preferred term' or 'synonym' label)	Recommended	Medium
Entering Other Associated Attributes			
CNA-0700	Where clinically appropriate, provide fields to select other associated attributes (for example, 'Current active problem', 'Laterality')	Recommended	Medium
CNA-0710	Ensure that the tabbing order of the dialog matches the left-to-right and top-to-bottom order of the dialog	Mandatory	High
Usage Examples			
		Example showing the automatic display of the additional attribute fields after a term has been encoded, with in-field prompts within each additional field (CNA-0410, CNA-0420, CNA-0430, CNA-0440, CNA-0450)	
		Example showing 'natural language' input of duration and/or dates (CNA-0570, CNA-0510, CNA-0520, CNA-0540, CNA-0550, CNA-0560)	

Past Medical History

Diabetes mellitus type 1

Enter date and/or duration
Enter additional text

Enter another problem

Example showing where the user can enter additional text to support the matched term (CNA-0650, CNA-0660, CNA-0670)

Past Medical History

Diabetes mellitus type 1

Past 22 years start 1987; end ongoing; for 22 years
Severe. Poor compliance, poor glycaemic control | Severe

Enter another problem

- Duration and dates confirmation displayed to the right of the date input field (CNA-0590, CNA-0600, CNA-0610)
- Post-coordination with the matched term in the form of check boxes to the right-hand side of the additional text field (CNA-0680, CNA-0690)

Note About Keyboard Navigation

The example below highlights where each tab stop lands on each additional attribute.

Scrolling away using the arrow keys automatically reduces this row, taking the user to the next row. Tabbing within this row takes the user through all of the tab stops and, once completed within this row, moves the user to the next tab stop, which is the encoded term of the next row (or potentially the search field, depending where the user is within the list).

Using the arrow keys, the user can navigate up and down the list of encoded terms or to the blank row to enter a new problem.

Each encoded row contains two tab stops in the collapsed view (as shown in the example below):

- The encoded term
- The summary of entered information

Pressing ENTER on either of these tabs will enable those interactions allowing the user to make changes or enter new information.

After the user opens a row by either pressing ENTER or by clicking on the row, the attribute fields account for two further tab stops:

- 'Date and/or duration'
- 'Enter additional text'

Past Medical History

Diabetes mellitus type 1

Past 22 years start 1987; end ongoing; for 22 years
Severe. Poor compliance, poor glycaemic control Severe

Asthma start 1999; end ongoing; for 10 years

Ketoacidosis Mar-2007

Enter another problem

Rationale

Design Analysis:

The current designs were chosen:

- For speed of use: the number of tab and click actions have been minimised
- Because the current arrangement draws the clinician's attention to the fields: they are located immediately below the previous one, which is an intuitive location to look for the next field

Visually communicating a visual hierarchy between the fields, for example by indenting those lower in the hierarchy, can indicate that the associated attribute fields 'belong' to the main concept.

Locating the duration and/or date field **before** the additional text field is suggested in order to encourage clinicians **not** to enter duration and/or date information as free text.

Analysis of SNOMED CT indicates that single concepts are often not sufficient on their own to express realistic clinical statements. Therefore, a field for recording additional free text is required in addition to the main concept field.

The design should be 'expandable' to be able to feature fields for other attributes, depending upon the concept matched, such as 'laterality' (that is, whether the relevant body site is on the left, right, both or neither), as some attributes may be very important for the safe communication of the clinical concept.

Desk Research:

Relevant ISO guidance states that 'all fields should be clearly and unambiguously labelled to describe what kind of content should be entered' (see *Form-filling dialogues* {R6}) and that these labels must be 'distinctive' in relation to data or instructions, for example, using visual cues such as position, font or colour, and that these visual cues should be applied consistently throughout the form. Therefore, provide sufficient labelling of the fields. These labels can be in-field 'prompts', as defined in the *Microsoft Windows User Experience Interaction Guidelines* {R21}.

Previous Microsoft Health CUI guidance on terminology matching and elaboration demonstrates the need for an additional text field to complement the single concept matching field. It also demonstrates how qualifier concepts, such as severity, can be matched within the additional text field (See *Design Guidance – Date and Time Input* {R12} and *Design Guidance – Terminology – Matching* {R13}).

Style guidance for established UIs indicates that the free text field must be a minimum of two lines high and that a vertical scroll bar appears after the clinician's typed entry exceeds the visible space (see *Essential guide to user interface design* {R20}).

The need to allow the clinician to complete the entry fields just using the keyboard is supported by relevant international standards indicate that "the need for users to switch between different input devices when filling in a form should be minimized" {R6}. Another standard also states that "if a keyboard is available, a keyboard method for selecting and executing options should be provided in addition to the pointing device method" {R5}.

User Research:

Previous Microsoft Health CUI user research, addressing the input of adverse drug reaction risks, has shown that clinicians did not understand a control whereby the clinician can select a matched term and then type in additional text within the same field. In that set of test, the clinicians also tended to want to click into the next input field below, rather than the one adjacent (see *Design Guidance – Terminology – Display Standards for Coded Information* {R15}).

In recent research (see APPENDIX B), clinicians indicated that they felt that the designs lacked order and felt too time consuming, even though they were using them quickly and without errors. Therefore, the current designs feature the associated attribute fields close together, well-aligned and slightly indented from the main concept in order to imply that they hierarchically 'belong' to the main concept.

As part of recent research (see APPENDIX B), interviews with clinicians indicated that, while writing the 'Past Medical History' they often record dates and durations, where known and where relevant. However, these interviews and the subsequent usability testing showed that these date and durations are often recorded in a more colloquial and approximate manner than the more formal way often required for the electronic input of dates and durations. For example, they may write 'past 10 years' or simply 'during childhood'. Therefore, the design allows for this type of input. During the user testing, a more formal method of date and duration capture was evaluated that used calendar boxes, which was understandable and usable, but that some clinicians indicated would be too complicated and 'fussy' for noting as part of the 'Past Medical History'.

User testing (see APPENDIX B) showed that the 'suggested matches' design of the date entry field was understood and easily used by clinicians, although it did suggest the need to ensure that if there is a perfect match between the input text and the matched date or duration item, then the item should be selected automatically. This was because the clinicians did not always scroll down and select from the list. Clinicians tended to appreciate the 'confirmation display of their 'natural language' input in terms of the more formal 'Start', 'End' and 'Duration'.

User testing (see APPENDIX B) also revealed that providing a button which initiates a 'drop-down' list on the 'duration and/or date(s)' field encourages clinicians to click on the button without typing anything in.

Hazard Risk Analysis Summary:**Potential Hazards:**

- Start-date automatically calculated from an entered duration falsely implies a precision that is not correct
- If the system encodes free-text durations entered by the clinician, and the system sorts data by date, records with encoded free-text duration dates may not show correctly in the sorted list

Mitigations:

- Indicate that a date is approximate if it has been derived from words such as 'past 22 years' or '10 years ago'. Feature the date at an appropriate level of detail, depending upon the user's input
- Convert durations provided in free-text format into standard format where at least two of the following values are recorded:
 - Start date
 - End date
 - Duration

3.3.4 Editing and Deleting Entries

This section focuses upon the actions of editing and deleting entries in a list. These are obviously important, given the fact that clinicians may need to go back and change the document during the process of writing it: they may remember relevant details later in the process of writing, or maybe, if they are noting at the same time as clerking the patient, the patient may correct themselves or remember further details after a clinical situation has been noted. Anecdotal evidence suggests that patients often forget diseases or conditions that only become apparent when their drug history is taken.

Note

The guidance below does not account for situations where the notes have been saved to the patient's record and the information has been effectively shared with the wider health team. In those cases, any edits or deletions must be accompanied by a rigorous auditing mechanism, given the dangers and legal implications involved in changing aspects of a patient record.

This guidance addresses:

- Editing the main concept
- Editing additional details
- Deleting entries

ID	Guideline	Conformance	Evidence Rating
CNA-0720	Allow the user to edit either the main concept, the associated additional details or both, if the entry has not already been saved	Mandatory	High
CNA-0730	Ensure that the user can edit the main concept and the associated additional details independently of each other	Mandatory	High
CNA-0740	If the user hovers the mouse pointer over the main concept, visually indicate that it can be clicked (for example, shade the area with a yellow gradient upon hover-over)	Recommended	High
CNA-0750	If the user hovers the mouse pointer over the summarised associated additional details, visually indicate that the area can be clicked (for example, shade the area with a yellow gradient upon hover-over)	Recommended	High
CNA-0760	If the user clicks on the main concept, open up the list of results for the text that had originally been input	Recommended	High
CNA-0770	If the user clicks on the summarised associated additional details, open up the dialog area, with the fields populated with the data entered by the user	Recommended	High

CNA-0780	If the user is editing the main concept and decides to delete it (for example, using backspace) and then leaves the field, the UI should treat this action as an intended deletion and should behave correspondingly.	Mandatory	High
CNA-0790	Provide a control for deleting an entry	Mandatory	High
CNA-0800	Provide a delete button located to the right of the entry line	Recommended	Medium
CNA-0810	The control for deleting an entry will simultaneously delete both the main concept and its associated additional details	Recommended	High
CNA-0820	When the user clicks the 'delete' button, provide an appropriate confirmation message and options to either continue with or cancel the delete	Recommended	High

Note

This feature could be replaced by a well-designed 'undo' system.
Please refer to the 'Rationale' section for details.

Usage Examples

Past Medical History

Diabetes mellitus type 1

start 1987; end ongoing; Poor compliance

Delete Entry
Are you sure you want to delete this entry?
Yes No

Enter another problem

Example showing a clicked delete control, which automatically displays a message to request confirmation of deleting the entry (CNA-0790, CNA-0800, CNA-0820)

Past Medical History

Diabetes mellitus type 1

start 1987; end ongoing; for 22 years

past 22 |
past 22 days
past 22 weeks
past 22 months
past 22 years
past 22 hours
past 22 minutes

Enter another problem

Example showing the date and duration field being edited independently from the other associated fields (CNA-0720)

Past Medical History

Diabetes mellitus type 1

start 1987; end ongoing; for 22 years; Severe. Poor compliance, poor glycaemic control

Enter another problem

Example showing the main concept when hovered over, visually indicating the clickable area (CNA-0750)

Rationale

Design Analysis:

It is logical that the main concept and its associated attributes can be edited independently. That is, it should be possible to edit the clinical concept without editing the associated attribute details and vice versa.

Regarding the deletion of entries, although during the user research clinicians made it clear that they would like a set of 'confirmation' options if they clicked on the delete button, an argument could be made that, if the UI provides a clearly visible and easy-to-use system of 'undo' and the visual design is such that it is immediately obvious when an entry disappears, then this 'confirmation' could be avoided. The disadvantage of such a 'confirmation' could be that it becomes annoying to a clinician if they keep having to confirm deletions during what is a time-pressured activity. However, currently this is the safest default option that the current guidance authors have considered.

Desk Research:

The visual cue for indicating that a display field can be clicked in order for it to become editable is used elsewhere in Microsoft Health CUI guidance (see *Design Guidance – Terminology – Matching {R13}*) and this standard colour and shading is used in the 2007 Microsoft® Office System.

User Research:

This mechanism was tested and clinicians used it correctly (see APPENDIX B). They found it natural to click on the associated attribute details in order to edit them.

During the early design iterations, participants were provided with a control for deleting an entry. Although they could clearly see how to delete an entry, participants indicated that there should be a 'confirmation' message which contained a set of options to either go ahead with the deletion or to cancel it, as they were worried they could delete an entry by accident. Indeed, one participant had deleted an entry by accident in a previous task without initially realising he had done, and he indicated that a confirmation message would have been useful.

It is worth noting that the researchers did not test an 'undo' function, nor did they explore other ways of ensuring that the visual design made it very clear if something had been deleted. In further discussions with clinicians following the testing, the issue was raised that the confirmation dialog box could be annoying to frequent users, but no alternative designs have been tested.

4 REVEALING AND HIDING SECTIONS OF A SET OF DATA

4.1 Introduction

In this section, the guidance explores how to hide and reveal sections of a form. This will be an important feature in clinical noting, given the vast array of potential data entry fields in contrast to the limited number of fields that any given clinician will require in the case of a specific patient. Simply presenting all the possible fields and allowing the clinician to pick and choose which ones to complete would be prohibitive in terms of the clinician's time and effort, not to mention the negative impact on the clinician's satisfaction with the system: imagine having to scroll through twenty fields to get to the field that one wants. It would be overwhelming and fields could be missed or not found. Therefore, some fields should be hidden when the clinician first views the form.

The current guidance is limited to traditional form designs and does not explore in detail complex navigational structures. Instead, it seeks to show how a form can be expanded and contracted to reveal sections of data-entry fields.

This guidance demonstrates how a form can be expanded and contracted in a basic manner. It does not prohibit other more complex navigational structures in forms. The research showed that clinicians understood and could use this basic mechanism for revealing and hiding data fields. But, it also showed that, where there were a lot of data fields, clinicians felt that this basic form design could be laborious and time consuming to use (see APPENDIX B). Therefore, this guidance should be used only in situations where a traditional form design is deemed appropriate.

The user requirements for this section of the guidance are:

- Ensure that in a given view, the UI can filter out optional data fields in a set of data, until the point at which the user requests them or they are triggered by the UI (contingent upon data entered or selected)
- Provide a control for revealing optional data fields
- Ensure that users are aware of the type of data fields that they are able to access (prior to them accessing them)
- Allow users to hide optional data fields that have not been completed
- Do not allow users to hide data fields that have been completed, unless the data is summarised elsewhere. The default view will be that the data that has been recorded by the user is always visible

4.2 Principles

The following key principles inform the guidance in this section:

- Screen design heuristics:
 - User control and freedom
 - Visibility of system status
 - Consistency and standards
- A clinician dealing with an individual patient in a given clinical situation is likely to only need to complete a proportion of the possible fields available
- Do not present all possible data entry fields to a clinician at any one time
- Help clinicians to quickly find the fields that they need to complete
- Reduce visual distractions to the clinician's current task

4.3 Guidelines

This guidance comprises four main areas:

- Communicating that there are more hidden fields
- Accessing hidden fields
- Hiding fields
- Displaying hierarchically nested sets of fields

4.3.1 Accessing Hidden Fields

The UI must allow the clinician to quickly and easily access hidden fields.

ID	Guideline	Conformance	Evidence Rating
CNA-0830	The UI must be capable of limiting the visible data entry fields to a proportion of the total number data fields available	Mandatory	High
CNA-0840	Provide a visible control for revealing hidden fields	Recommended	High
CNA-0850	The user must be able to access hidden fields.	Mandatory	High
CNA-0860	Clearly distinguish the 'reveal' control from data entry controls	Recommended	Medium
CNA-0870	Provide a shading around the control	Recommended	Medium
CNA-0880	Where appropriate, automatically reveal fields dependent upon a data selection	Recommended	Medium
Usage Examples			
<p>Observations and Findings: Cardiovascular System</p> <p>CVS Normal on Examination <input checked="" type="radio"/> Unknown <input type="radio"/> Yes <input type="radio"/> No <i>Selecting 'No' automatically opens the details section</i></p> <p><input type="button" value="Further details: CVS examination"/></p>			 <p>Example of a control for revealing hidden fields ('Further details') (CNA-0840, CNA-0860, CNA-0870)</p>
Rationale			
<p>Design Analysis:</p> <p>The design allows flexibility in revealing hidden fields by providing two types of mechanism.</p> <p>The first mechanism reveals fields when the clinician selects a data item (namely, selecting that the patient's Cardiovascular System (CVS) is not normal upon examination). This optimises the speed of entry: the clinician does not need to select the data item and then activate another control in order to reveal further fields. This mechanism also has the advantage of encouraging the clinician to fill in fields that naturally follow on from an indication of abnormal examination results. In other words, the system is encouraging the clinician to say <i>how</i> the CVS was not normal upon examination.</p> <p>The second mechanism ('Further details: CVS examination') is a dedicated field for opening the further details. This allows the clinician to view the further details without having to answer whether the CVS was normal or not. Clinicians may want to scan ahead to see what options will be available to them. Additionally, they may want to complete some of the hidden fields in order to conclude if the CVS can be deemed normal or not.</p> <p>Also, the second mechanism is visually distinct from the data entry fields, which should make it easier for the clinician to scan down the form and find the hidden fields more easily than having to work out which data selections automatically reveal hidden fields.</p>			

Desk Research:

The mechanism for revealing the hidden fields has precedence in a number of existing applications, some of which will be very familiar to clinicians. A good example is the '+' button in Microsoft Outlook, a popular desktop email application.

Additionally, the automatic revealing of fields through a data selection is a common feature on many desktop and Web applications, many of which will be familiar to clinicians.

Indeed this feature is recommended by relevant international standards which state that “if/then” interdependency rules among entry fields” should either be avoided or should “automatically be handled by the system by constraining user choices and visible fields”. In this way the form hides fields until a data selection logically implies that these fields should be completed and the UI automatically reveals the fields {R6}. A further standard also supports the notion of hiding options that are not relevant to the user at a given point in time, which states that if “information concerning unavailable options is not required for the task”, then “only options available to the user should be presented” {R5}.

User Research:

Testing (see APPENDIX B) revealed that just making a data selection was not sufficient and that the dual route to revealing fields was necessary in order to be usable. Participants indicate that they did not want to be forced to make a data selection in order to see what fields could be made available to them. However, they did understand how to open fields automatically by selecting ‘No’ (for the field ‘CVS normal on examination’)

4.3.2 Communicating That There Are Hidden Fields

The first requirement for revealing hidden fields is to communicate to the clinician that there are hidden fields which may be revealed. If the UI does not communicate that there are hidden fields, then the clinician may not be aware that such fields exist and may not find them. The existence of the fields should be communicated along with a brief description of what topic the fields cover.

This section addresses how this should be done in a basic manner, which conforms to traditional electronic form design (for details of traditional electronic form designs, see *Essential guide to user interface design* {R20}).

ID	Guideline	Conformance	Evidence Rating
CNA-0890	The UI must communicate if there are hidden fields which the user can potentially access.	Mandatory	High
CNA-0900	Provide a prompt or label for all controls that reveal hidden fields	Recommended	High
CNA-0910	Locate the prompt or label in a prominent and appropriate position	Recommended	High
CNA-0920	Locate the prompt next to the control that reveals the fields	Recommended	High
Usage Examples			
Observations and Findings: Cardiovascular System CVS Normal on Examination <input checked="" type="radio"/> Unknown <input type="radio"/> Yes <input type="radio"/> No <i>Selecting 'No' automatically opens the details section</i>  <small>[+] Further details: CVS examination</small>		Example of prompts indicating there are further fields (CNA-0900, CNA-0910, CNA-0920)	

Observations and Findings: Cardiovascular System

CVS Normal on Examination Unknown Yes No *Selecting 'No' allows the addition of further details*

+ Further details: CVS examination

Description / Comment on Cardiovascular System

JVP CM

Position of Apex Beat

Character

Heart Sounds Normal Unknown Yes No *Selecting 'No' allows the addition of further details*

+ Further details: Heart sounds

Oedema Evidence of Oedema

Example of a 'reveal' control
(CNA-0900, CNA-0910,
CNA-0920, CNA-0840, CNA-0860,
CNA-0870)

Observations and Findings: Cardiovascular System

CVS Normal on Examination Unknown Yes No *Selecting 'No' allows the addition of further details*

- Further details: CVS examination

Description / Comment on Cardiovascular System

JVP CM

Position of Apex Beat

Character

Heart Sounds Normal Unknown Yes No *Selecting 'No' allows the addition of further details*

+ Further details: Heart sounds

Oedema Evidence of Oedema

Example of a data selection that automatically reveals further fields
(CNA-0880)

Observations and Findings: Cardiovascular System

CVS Normal on Examination Unknown Yes No

Open



Example of a poor control for revealing hidden fields ('Open'). This does not sufficiently communicate what fields are hidden behind it.

Also, the 'No' selection does not feature a prompt indicating that it will automatically reveal fields.
(CNA-0900, CNA-0910, CNA-0920)

Rationale

Design Analysis:

The design ensures that any control that reveals further fields is adequately labelled and that the clinician is made aware of what will happen if they activate the control. In the examples above, there are two types of control.

The first control reveals the fields when the clinician selects data item (namely, selecting that the patient's CVS is not normal upon examination). In this case, a prompt by the side of the data label ('No') explains that selecting the data option will automatically open the details section. Care has been taken to ensure that the prompt is sufficiently prominent, but does not interfere with the clinician's understanding of the data label ('No').

The second control is a dedicated field for opening the further details. In this case, the control itself is labelled with a description which indicates that this control is associated with further details and a phrase that summarises the fields found in these further details (for example, 'CVS examination').

User Research:

Testing (see APPENDIX B) revealed that clinicians need to have a label prompting them that there are further data entry fields available. Without the additional text prompt next to the 'No' selection of the field 'CVS normal on examination', participants could not immediately identify that there were additional fields available, nor how to access them.

Hazard Risk Analysis Summary:

Potential Hazards:	Mitigations:
<ul style="list-style-type: none"> ■ The clinician does not realise there are additional fields available into which to populate data 	<ul style="list-style-type: none"> ■ Visually indicate that further data entry fields are available

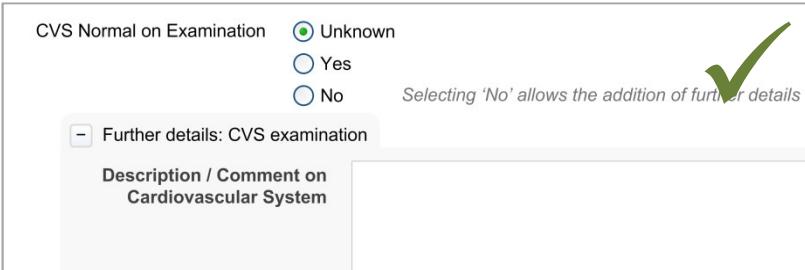
4.3.3 Hiding Fields

Upon opening a section of fields, the clinician may decide not to enter any details into that section, and then hide those fields again, in order to focus on other fields.

This will be an important action as, if the clinician cannot hide fields after opening them, the form could become overwhelming and unwieldy.

This section of the guidance addresses how sections of fields can be hidden. It is worth noting that the solutions explored in this section are limited in that they do not explore how a section of fields can be hidden even if data has been entered into one or more of its fields. The designs shown in the current guidance assume the safest default position; namely that if a section contains any data entered by the clinician, it cannot be hidden. Also, the current design guidance does not explore the automatic hiding of data fields, which could, if a safe solution is found, improve the clinician's experience by reducing the numbers of actions required.

Future design research could identify a safe solution that allows fields to be hidden, manually or automatically, even if data has been entered into them, but this is not covered in the current design guidance.

ID	Guideline	Conformance	Evidence Rating		
CNA-0930	Provide a visible control for hiding fields	Recommended	Medium		
CNA-0940	Clearly distinguish the 'hide' control from data entry controls	Recommended	Medium		
CNA-0950	Provide a shading around the 'hide' control	Recommended	Medium		
CNA-0960	Do not allow users to hide fields into which they have entered data	Recommended	Medium		
CNA-0970	Disable the 'hide' control when the fields to be hidden have data entered into them	Recommended	Medium		
CNA-0980	Provide a prompt or label for all controls that hide fields	Recommended	High		
CNA-0990	Locate the prompt or label in a prominent and appropriate position	Recommended	High		
CNA-1000	Locate it next to the control that hides the fields	Recommended	Medium		
CNA-1010	Provide a label for the control that summarises what the fields it reveals will capture	Recommended	Medium		
Usage Examples					
 <p>CVS Normal on Examination <input checked="" type="radio"/> Unknown <input type="radio"/> Yes <input type="radio"/> No Selecting 'No' allows the addition of further details</p> <p>Further details: CVS examination</p> <p>Description / Comment on Cardiovascular System</p>					
Rationale					
<p>Design Analysis:</p> <p>The design allows the clinician to hide the fields by using the same controls as were used to reveal them. In this way a consistency of usage can be maintained and it is easy for the clinician to find the 'hide' control after revealing a section. Also, this means that, if the clinician is simply browsing the form, they can check what fields are found in a hidden section and can then hide them again without having to change the focus or move the mouse.</p> <p>In the absence of a safe solution for hiding sections that contain fields in which the clinician has entered data, the safest default guideline is to prohibit the hiding of sections that contain data. This means that the 'hide' control will be disabled once the clinician has entered data into the section. It also means that, once the section is open, although the clinician may select an alternative data option to the one which automatically revealed the section, the section will not hide automatically if data has been entered.</p> <p>Desk Research:</p> <p>The use of a '-' button is widely used in a number of existing, familiar applications, some of which will be very familiar to clinicians, including Microsoft Outlook.</p> <p>Relevant standards also indicate that 'Coding techniques should be used to indicate different states of graphical objects' (see <i>Form-filling dialogues</i> {R6}). This control shows two states:</p> <ul style="list-style-type: none"> ■ 'revealed, with the option to hide' ■ 'hidden with the option to reveal'. <p>Hazard Risk Analysis Summary:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> <p>Potential Hazards:</p> <ul style="list-style-type: none"> ■ Clinician hides a section that contains data and does not see that data when he or she reviews what they have entered. </td> <td style="width: 50%;"> <p>Mitigations:</p> <ul style="list-style-type: none"> ■ Do not allow the user to hide fields that contain data (entered by the same user) </td> </tr> </table>				<p>Potential Hazards:</p> <ul style="list-style-type: none"> ■ Clinician hides a section that contains data and does not see that data when he or she reviews what they have entered. 	<p>Mitigations:</p> <ul style="list-style-type: none"> ■ Do not allow the user to hide fields that contain data (entered by the same user)
<p>Potential Hazards:</p> <ul style="list-style-type: none"> ■ Clinician hides a section that contains data and does not see that data when he or she reviews what they have entered. 	<p>Mitigations:</p> <ul style="list-style-type: none"> ■ Do not allow the user to hide fields that contain data (entered by the same user) 				

4.3.4 Displaying Hierarchically Nested Fields

Where there is a section of fields that is located within another section, it may be important to communicate the hierarchical structure so that clinicians can easily orientate where they are in the form and to understand which fields will be hidden if they activate a given 'Hide' control. Failure to adequately communicate which fields will be hidden by activating a 'hide' control could result in confusion on the part of the clinician and accidental hiding of relevant fields.

This section of the guidance addresses how to communicate that one set of fields is 'nested' within another.

ID	Guideline	Conformance	Evidence Rating
CNA-1020	Clearly communicate which fields have been opened by a reveal control	Recommended	Medium
CNA-1030	Provide a common shading between the reveal control (which is appropriately labelled) and the fields it reveals	Recommended	Medium
CNA-1040	Ensure that the shading is sufficiently light in order to maintain a good contrast of the foreground elements (the data fields) against their background (for example, 25% grey screening)	Recommended	Medium
CNA-1050	Ensure that the font sizes used in the fields and in the reveal control label are consistent	Recommended	Medium

Usage Examples

Observations and Findings: Cardiovascular System



CVS Normal on Examination Unknown Yes No *Selecting 'No' allows the addition of further details*

- Further details: CVS examination

Description / Comment on Cardiovascular System

JVP 3 CM Please Select

Position of Apex Beat Displaced

Character Apex rate displaced

Heart Sounds Normal Unknown Yes No *Selecting 'No' allows the addition of further details*

- Further details: Heart sounds

Added Sounds Please Select

Murmur Please Select

Description

Site Please Select

Grade Please Select

Radiation Please Select

Oedema Evidence of Oedema

Observations and Findings: Respiratory System

Example of visually distinguishing hierarchical sections (CNA-1020, CNA-1030, CNA-1040, CNA-1050)

Observations and Findings: Cardiovascular System

X

CVS Normal on Examination Unknown
 Yes
 No Selecting 'No' automatically opens the details section

Further details: CVS examination

Description / Comment on Cardiovascular System

JVP cm

Details

Position of Apex Beat

Character

Heart Sounds Normal Unknown
 Yes
 No Selecting 'No' automatically opens the details section

Further details: Heart sounds

Added Sounds

Murmur

Description

Site

Grade

Radiation

Example of a form that does not visually distinguish nested sections, for example by shading (CNA-1030, CNA-1040, CNA-1050)

Rationale

Design Analysis:

Shading is an unobtrusive mechanism for indicating grouping of screen elements. Likewise, indenting is a conventional way of indicating a hierarchical nesting of items.

Desk Research:

There are many examples of the use of shading to imply grouping in both desktop and Web applications. Literature on the topic supports the notion of using shading to emphasise grouping. For example, see *Essential guide to user interface design* {R20}. This same literature also supports the notion of keeping the shading light enough to maintain a good contrast.

User Research:

Testing (see APPENDIX B) revealed that clinicians understood the visual grouping of sections. They showed evidence of being able to tell which fields had just been revealed and which belonged to which section.

5 REQUIRED FIELDS

5.1 Introduction

In clinical noting, as in most data entry tasks, there will be data fields that the relevant authority will deem to be necessary for the data author to address; that is, they must provide a selection or enter text for that field. These fields are often referred to as 'required' fields and must be completed in order for the data to be successfully saved to the record.

The current guidance is limited to situations where:

- Only a proportion of the total available fields are 'required'
- There is a linear sequence of fields (and an accompanying tabbing order)
- Logically, the clinician can complete fields further in the sequence without having completed a required field
- Clinicians need some degree of flexibility when completing the form

Where these conditions do not apply, other solutions may be applied that do not feature the designs outlined in this section.

The user requirements for this section of the guidance are:

- The UI must be able to indicate to the user that one or more data fields are required
- Ensure that users are aware if they have 'missed' one or more required fields

Note

'Missed' is defined in terms of the user addressing other fields that are positioned later in the tabbing order.

5.2 Principles

The following key principles inform the guidance in this section:

- Screen design heuristics:
 - Visibility of system status
 - Flexibility and efficiency of use
 - User control and freedom
 - Match between system and the real world
 - Recognition rather than recall
- Do not overly restrict clinicians' freedom to complete the form in the way they want
- Do not obstruct the clinician's primary tasks
- Ensure that the clinician is aware of which fields are required and which are not
- Do not rely upon clinicians to remember which field(s) they have missed

5.3 Guidelines

This guidance comprises two main areas:

- Proactively indicating required fields
- Reactively indicating required fields that have been missed

5.3.1 Proactively Indicating Required Fields

When clinicians are faced with a set of fields, some of which are required, the UI must distinguish ‘up front’ which ones are required and which are not.

This ‘proactive’ indication of required fields contrasts with a ‘reactive’ indication of required fields that have been missed. ‘Reactive’ is when the UI indicates an uncompleted required field only when the clinician attempts to move on. Reactive indication of required fields is discussed in the next guidance section.

ID	Guideline	Conformance	Evidence Rating
CNA-1060	The UI must make clear the distinction between fields which are required and fields which are optional	Mandatory	High
CNA-1070	Provide ‘proactive’ visual indications of which fields are required to be completed	Mandatory	High
CNA-1080	Feature a red asterisk next to those fields which must be completed	Recommended	High
CNA-1090	Feature the asterisks next to each field rather than for a whole section	Recommended	High
CNA-1100	If in-line asterisks are to be used to indicate required fields, provide a key on the same page or dialog as the indicators	Mandatory	High
CNA-1110	Feature the asterisk immediately to the right of the field label	Recommended	High
CNA-1120	If in-line asterisks are to be used to indicate required fields, place each asterisk in a consistent location (in relation to the field labels)	Mandatory	High
CNA-1130	Keep the ‘required’ indication visible, even after the user has entered information into the field	Recommended	Medium

Usage Examples

Presenting Complaint(s) <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> Presenting Complaint(s) * <input style="width: 100%; height: 20px; border: 1px solid #ccc; margin-bottom: 5px;" type="text" value="Enter a Presenting Complaint"/> ✓ <small>* Indicates Required Field</small> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> History of Presenting Complaint(s) * <input style="width: 100%; height: 50px; border: 1px solid #ccc;" type="text" value="Enter History of Presenting Complaints"/> </div>	Example showing visual indications of required fields within a form (CNA-1070, CNA-1080, CNA-1090, CNA-1100, CNA-1110, CNA-1120, CNA-1130)
--	--

Rationale

Design Analysis

Indicating a characteristic of a data field, such as whether its completion is required, is best communicated 'in line' with the field itself, rather than, for example, providing some kind of look up reference elsewhere. Red asterisks are good because they are sufficiently prominent to be seen, but are not so overly-prominent that they hinder the clinicians' understanding of the fields and their labels.

The location of the asterisk to the immediate right of the label means that, if the fields are located to the right of the label and the labels are therefore right-aligned, the asterisks will be aligned on a vertical plane, thus making it easy for the clinician to scan down and see which fields are required.

Desk Research:

Analysis of relevant international standards on this topic indicates that if 'a form contains both required and optional fields within a functional or logical grouping of fields, required fields should be positioned first unless such positioning is inappropriate to the user's task' (see *Form-filling dialogues* {R6}) Also, the standards indicate that '[r]equired and optional entry fields should be presented so that the difference between them should be immediately perceptible to any user' {R6}.

The red asterisk design is indicated as a strong convention in screen design in relevant literature (see *Forms that work* {R23}).

User Research:

Testing showed that clinicians immediately understood the 'red asterisk' convention.

Hazard Risk Analysis Summary:

Potential Hazards:

- Clinician misses a field, thus providing an incomplete clerking form, which could mean that vital data is missing from the patient's record

Mitigations:

- Provide mechanisms that warn the user that required fields have not been completed

5.3.2 Reactively Indicating Required Fields That Have Been Missed

In addition to 'proactively' indicating required fields, and if the clinician is to be allowed some flexibility in the order in which they complete the form, the UI must also warn the clinician where they have missed out any required fields.

In this case, the term 'missed' refers to a situation where the clinician has not completed a required field and has moved the focus to a point beyond the field in the tabbing order.

This guidance has been written with the assumption that, at any specific point in the completion of the form, the required fields may not be visible. For example, in a form comprising ten pages, the clinician might be viewing page 8, although there is a required field that they have missed on page 2. Therefore, a mechanism may be required to indicate the fields that are required, which is not in-line with these required fields.

ID	Guideline	Conformance	Evidence Rating
CNA-1140	Provide 'reactive' indications of required fields that the user has missed	Recommended	High
CNA-1150	If the user moves the focus to a field that is further along in the order than an empty required field, the system should communicate to the user that the required field has been missed	Recommended	Medium
CNA-1160	Feature a yellow shading in those required fields which have been 'missed'	Recommended	Medium
CNA-1170	Do not solely rely upon shading to communicate missed fields	Recommended	High
CNA-1180	Provide non-visible labels associated with missed fields that also communicate that the fields have been missed	Recommended	Medium
CNA-1190	Provide a (non-modal) message that communicates to the users that they have missed a required field	Recommended	High
CNA-1200	Ensure that this message does not obstruct the user from filling in any field on the screen	Recommended	High

CNA-1210	The message should list all the required fields which have been missed	Recommended	High
CNA-1220	The message should remain in view even when the relevant fields are not in view	Recommended	High
CNA-1230	The message could provide links which will navigate the screen to the relevant required fields (by scrolling the page)	Recommended	Medium
CNA-1240	Provide a suitable heading for the message, which appropriately expresses how important it is to complete the fields (for example, 'required', 'mandatory', 'recommended')	Recommended	High
CNA-1250	Do not hide required fields under tabs or in a collapsed view	Recommended	Medium

Usage Examples

Presenting Complaint(s)

Presenting Complaint(s) *

Enter a Presenting Complaint 

History of Presenting Complaint(s) *

Enter History of Presenting Complaints 

* Indicates Required Field 

Example showing further visual indication of missed required fields (CNA-1140, CNA-1160)

Presenting Complaint(s)

Presenting Complaint(s) *

Enter a Presenting Complaint 

History of Presenting Complaint(s) *

Enter History of Presenting Complaints 

* Indicates Required Field 

Required Fields

Presenting Complaint(s) 

Presenting Complaint(s)
History of Presenting Complaints

Example showing a panel ('Required Fields') indicating which fields have been missed and the section in the form where they can be found. Clicking on a missed field scrolls to it (CNA-1190, CNA-1200, CNA-1210)

Rationale

Design Analysis:

The design aims to provide a warning, but not one that overly distracts the clinician or that forces the clinician to complete all required fields before moving to the next field in the form.

This solution also warns the clinician of the existence of missed required fields before reaching the point of submitting the whole form. This approach aims to avoid the situation where the clinician tries to activate the submission of the form and is then presented with a list of fields that they must complete. It could be that the clinician has not allowed for the time it would take to go back and complete those fields and therefore has to abandon the form in an unsubmitted state. Communicating that required fields have been missed immediately after they have been missed enables the clinician to allow for time to complete these fields.

This solution provides navigation (for example, by automatic scrolling) back to the missed fields. It also communicates to the clinician where in the form the missed fields are, through the use of headings in the side panel.

Finally, the solution also provides a clear in-line indication of missed fields in order to immediately inform the clinician of a missed field. As the clinician's attention will be focused upon the field area anyway, this in-line visual communication will be the most immediate. The yellow shading shown in the example allows for a sufficient contrast with dark foreground text, but is also sufficiently prominent.

User Research:

Research (see APPENDIX B) showed a positive response to this side panel approach, although some participants did not notice it immediately, as they focused upon the red asterisk instead. Therefore, the shading solution was added, which clinicians saw and understood immediately.

Hazard Risk Analysis Summary:**Potential Hazards:**

- If clinicians are forced to complete required fields at the end of the admissions clerking process, rather than as they go along. Risk that clinicians are forced to close the form without saving it because they do not have time to go back and search for the fields which are missing data
- If clinicians are unable to skip past required fields whilst populating the form with data

Mitigations:

- Encourage users to complete required fields as they progress through the form, although without forcing them to do so
- Indicate to users that a missed field is required whilst allowing them to progress and navigate through the form

6 DISPLAYING PREVIOUS VALUES

6.1 Introduction

At the point of entering new data about a patient, it may be useful for the clinician to be able to see any previous instances of the same type of data. For example, if the clinician is about to enter the patient's pulse rate, it could be useful to see the previous pulse rate entries for that patient.

This contextual information may influence the clinician's actions:

- They may change line of questioning or examination that they perform with the patient.
Obviously this is only applicable if the clinician is entering the notes at the same time as the examination.
- They may search for other data from the patient's record in order to help their interpretation of the data. For example, they may access the patient's vital signs chart in order to see the full trend of the data.

Therefore, it will be useful to display the last few values of a type of data as the clinician is about to enter a new value.

Note

This feature is not intended to replace the graphical display of a full set of values; instead it is only aiming to provide a limited window onto the most recent values.

Moreover, this guidance focuses upon the display of numerical values. Potentially this guidance could apply to other types of data, such as descriptions of illnesses, but this has not been explored in the designs nor in the research, and therefore any application of this guidance to non-numerical data must be accompanied by further design and testing in order to ensure patient safety.

The user requirements for this section of the guidance are:

- Ensure that the user can access a sequence of recent values when entering the current value into a field (for example, the last three values)
- Ensure that the dates and/or times of the previous values are clearly indicated when they are being displayed
- Ensure that the order in which the previous values have been recorded is clearly evident to the user
- Indicate that the data displayed may only be a proportion of the total data available
- Link to historical data or a graphical representation

6.2 Principles

The following key principles inform the guidance in this section:

- Screen design heuristics:
 - Recognition rather than recall
 - Aesthetic and minimalist design
- Do not obstruct the clinician's primary tasks
- Values must be displayed with sufficient context to be meaningful and unambiguous
- Provide the clinician with sufficient context which may influence what questions they ask

6.3 Guidelines

This section addresses how to display the previous values at the point at which the clinician is about to enter a new value. In the current designs, this point is defined as the point at which the focus moves into the relevant field.

In the examples shown below, the number of previous values shown has been set at three. However, this is an arbitrary number, and the guidance urges that the number of previous values shown be determined by an appropriate clinical authority, which accounts for the specific clinical contexts.

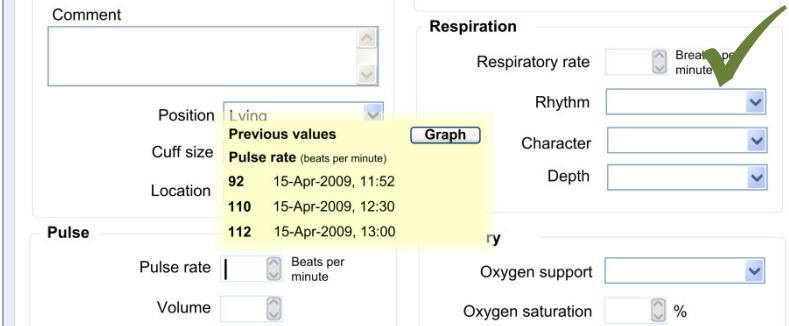
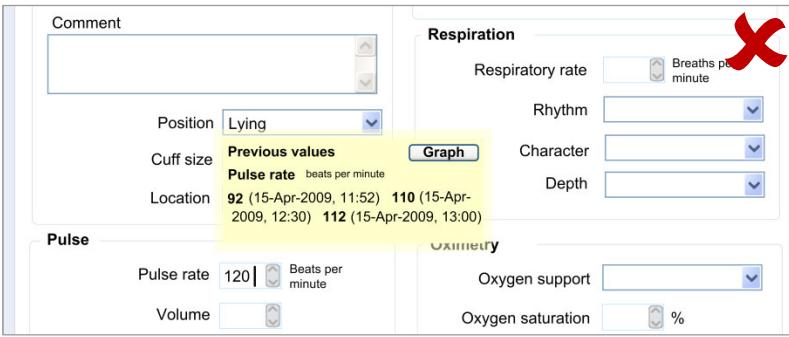
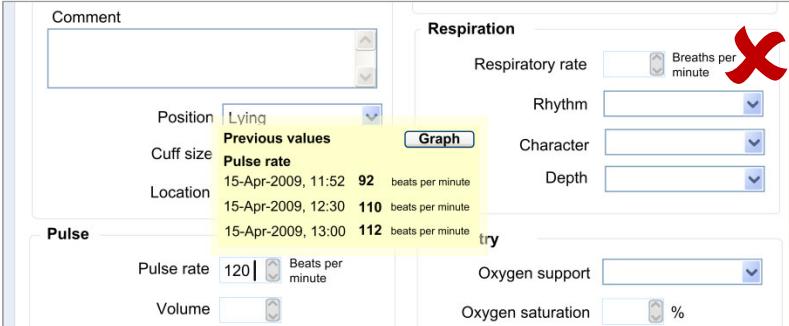
6.3.1 Displaying Previous Values

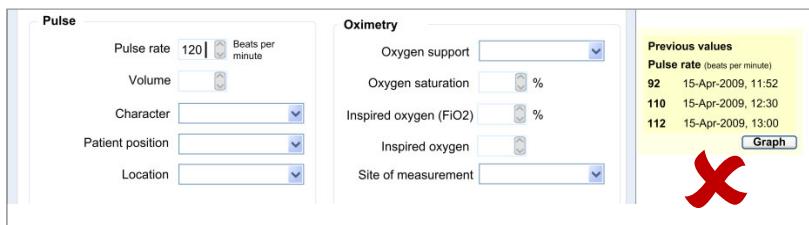
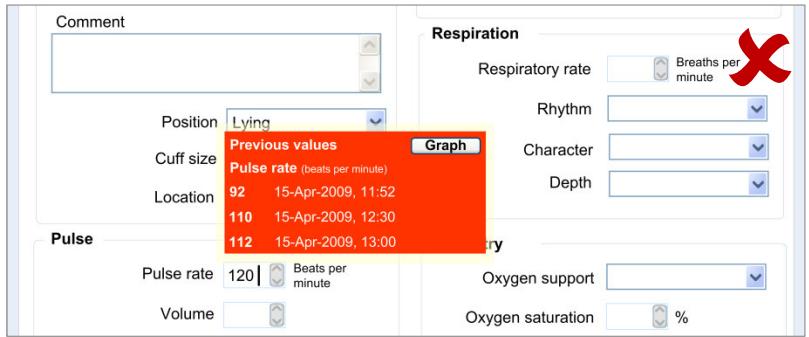
This guidance area is focused on how to make previous values known to the clinician in a way that aids the clinician without detracting from the process of recording the new data values.

ID	Guideline	Conformance	Evidence Rating
CNA-1260	Upon moving the focus to the data field, display a number of the most recent previous values for that data, where such values exist	Recommended	High
CNA-1270	If there are no previous values for a field, do not show previous values	Recommended	Low
CNA-1280	Display the previous values as the user is typing the current value	Recommended	High
CNA-1290	Display the previous values in a dialog which appears on top of the form and remains open as the focus is in the associated entry field	Recommended	Medium
Note Although this guideline does not specify the exact mechanism to display these values, developers may consider a pop-up or a floating palette design for this dialog.			
CNA-1300	Limit the number of previous values up to an agreed number. The number should be determined by the relevant clinical authority and should remain consistent.	Recommended	Medium
Note The illustrations featured in the current guidance assume that the agreed number of previous values to display is three.			
CNA-1310	Display the previous values as a vertical stack	Recommended	Medium
CNA-1320	Display the previous values immediately above the relevant field	Recommended	Medium
CNA-1330	Left-align the values with the digits in the entry field	Recommended	Medium
CNA-1340	Display the previous values in bold	Recommended	Medium
CNA-1350	Display the previous values in an appropriate format (and to an appropriate decimal place)	Recommended	Medium
CNA-1360	In all situations, display the previous values according to a consistent order	Recommended	High
CNA-1370	Display the previous values on the far left of the previous values dialog	Recommended	Medium
CNA-1380	Ensure that the previous values are not displayed as a column in the middle of the additional contextual information	Recommended	Medium
CNA-1390	If the previous numerical values are displayed immediately above the relevant field, show them in ascending order of numerical value	Recommended	Low

CNA-1400	If the previous values cannot be displayed immediately above the relevant field, then show them immediately horizontally adjacent	Recommended	Low
CNA-1410	Clearly label the previous values	Recommended	High
CNA-1420	Ensure that the previous values are visually distinct from the entry field by displaying them on a different colour background	Recommended	Low
CNA-1430	Ensure that the background to the previous values is in a low-saturation, muted colour, such as a pastel shade	Recommended	Low

Usage Examples

	<p>Example of an indication of previous values (CNA-1260, CNA-1290, CNA-1310, CNA-1320, CNA-1330, CNA-1340, CNA-1390, CNA-1410, CNA-1420, CNA-1430)</p>
	<p>Example of indication of previous values, shown immediately adjacent (CNA-1400)</p>
	<p>Example of 'previous values' which are not vertically stacked (CNA-1320)</p>
	<p>Example where the 'previous values' are hidden in the middle of the dialog (CNA-1370, CNA-1380)</p>

	<p>Example where the 'previous values' are located away from the relevant data entry field (CNA-1320)</p>
	<p>Example of an overly prominent 'previous values' dialog (CNA-1430)</p>
<h3>Rationale</h3> <p>Design Analysis:</p> <p>This design displays the previous values in a sufficiently prominent position, aligning the values with the input area so that the clinician can quickly look up the values.</p> <p>Desk Research:</p> <p>The relevant desk research indicates that "different visual coding" should be used between "user entries, defaults, and previously entered data" (see <i>Form-filling dialogues {R6}</i>). This supports the notion of displaying the previous values on a different background from the entry field.</p> <p>User Research:</p> <p>Research (see APPENDIX B) showed that those clinicians who saw this design believed that it was a good idea, as long as they could also access a graphical view of the data as well.</p>	

6.3.2 Contextual Attributes to Display for Previous Values

In addition to displaying the previous values, there is a requirement to display information about the context in which the previous values were recorded. This provides valuable meaning about the values, and reduces the likelihood that they are misinterpreted; a value without a date or time is fairly meaningless.

ID	Guideline	Conformance	Evidence Rating
CNA-1440	If the UI displays previous values for a data item, display the dates of each previous value	Mandatory	High
CNA-1450	If the UI displays previous values for a data item and if more than one value was observed on the same day, display the times of each previous value	Mandatory	High
CNA-1460	Ensure that the unit of the values is displayed	Recommended	High
CNA-1470	Display the unit only once, next to the title label	Recommended	High

Usage Examples

Comment

Position Lvina

Cuff size Previous values

Location 92 15-Apr-2009, 11:52

Pulse 110 15-Apr-2009, 12:30

112 15-Apr-2009, 13:00

Pulse rate 120 Beats per minute

Volume

Respiration

Respiratory rate Breaths per minute

Rhythm

Character

Depth

Oxygen support

Oxygen saturation %

Graph

Feature the dates and times of each previous value (CNA-1440, CNA-1450, CNA-1470)

Comment

Position Lvina

Cuff size Previous values

Location 92

Pulse 110

112

Pulse rate 120 Beats per minute

Volume

Respiration

Respiratory rate Breaths per minute

Rhythm

Character

Depth

Oxygen support

Oxygen saturation %

Graph

Do not just feature the previous values without date/time context (CNA-1440)

Rationale

Design Analysis:

Providing sufficient context is very important. If dates and times are not shown, clinicians may assume the wrong intervals between the values, which could negatively affect their interpretation.

Desk Research:

Relevant standards documentation states that "symbols or units should be displayed as an additional label when it is required by the user for interpretation of the data" (see *Form-filling dialogues {R6}*). This standard is referring to data entry fields, but this could also apply to the display of previously entered values displayed in the context of data entry. The standards also indicate that the unit can be added once to a "column label" if the display allows it, which is an efficient way of communicating the unit and which is featured in the current design {R6}.

User Research:

Research (see APPENDIX B) showed that clinicians understood the design.

Hazard Risk Analysis Summary:

Potential Hazards:

- If the clinician assumes the previous values shown are all taken on the same date as the first value displayed
- If the clinician assumes the previous values shown are equally spaced in time

Mitigations:

- Show the dates (and times, if multiple readings from the same day) that the reading was taken along with the reading itself
- Show the dates (and times, if multiple readings from the same day) that the reading was taken along with the reading itself

7 AUTOMATIC CALCULATIONS DATA

7.1 Introduction

Within clinical noting, there will be many occasions where values, such as scores, can be automatically calculated by the system in order to reduce the clinician's workload. For example, a Body Mass Index (BMI) score could be instantly calculated by the system, thus saving the clinician the vital seconds it would take them to manually calculate the score.

This feature becomes more important where the scoring system is more complex and there is more room for errors to be made. Calculating an early warning score is an example where the calculations are more complex and where the implications of miscalculation could be quite dangerous.

Other situations where values could be automatically calculated include the calculation of an end date, if the start date and duration have been entered by the clinician. This would prevent the entry of inconsistent data, which could happen if the clinician were to enter all three data.

The guidance outlined in this section applies only to use in traditional form design. It does not preclude different displays in other more innovative clinical noting interfaces. Also, the features relating to displaying details of a score only apply where a score has been calculated. Such a feature may not be necessary. For example, where an end date has been calculated from a start date and duration, this calculation would be fairly obvious and would not require further explanation.

The second half of this guidance addresses another important feature: communicating to the clinician that a score has been calculated, but owing to missing data, the system has had to make assumptions about the value of the missing data. This can be useful in that it could encourage the clinician to enter this missing data. It is also useful in those situations where a 'partial' score is more informative to the clinician than no score.

The user requirements for this section of the guidance are:

- Ensure that the user is aware when a value has been calculated by the system rather than having been entered by the user
- Communicate to the user the data that has been used to calculate the automatically calculated value
- Communicate both the field labels and the values of the data which contribute to the calculated value
- Provide sufficient information to communicate the location of data items used in the calculation (for example, in the form, in the record)
- Provide a mechanism that allows the user to easily access the data that has been used to calculate the automatically calculated value
- Allow the user to identify where there are missing values that affect the calculation of a derived value
- Ensure that the UI can cope with both simple and complex calculations

7.2 Principles

The following key principles inform the guidance in this section:

- Screen design heuristics:
 - Visibility of system status
 - Consistency and standards
 - Help and documentation
- Clinicians must be aware of the relationship between values that they have entered and values that have been calculated
- Clinicians must be able to easily find out more information about a value, if appropriate and available

7.3 Guidelines

This guidance comprises two main areas:

- Displaying calculated values
- Displaying scores where values are missing

7.3.1 Displaying Calculated Values

In this section, the guidance addresses the mechanisms required to distinguish calculated values from user-entered values. It also addresses how the UI can communicate how the value was calculated and, importantly, which input values contributed to the calculated value (including an indication of where these entry fields are located).

This is particularly important as it not only provides meaning to the calculated value, but it also teaches the clinician which values must be entered in order for the system to calculate the value. It also helps clinicians to go back and check the input values if they want to question the calculated value.

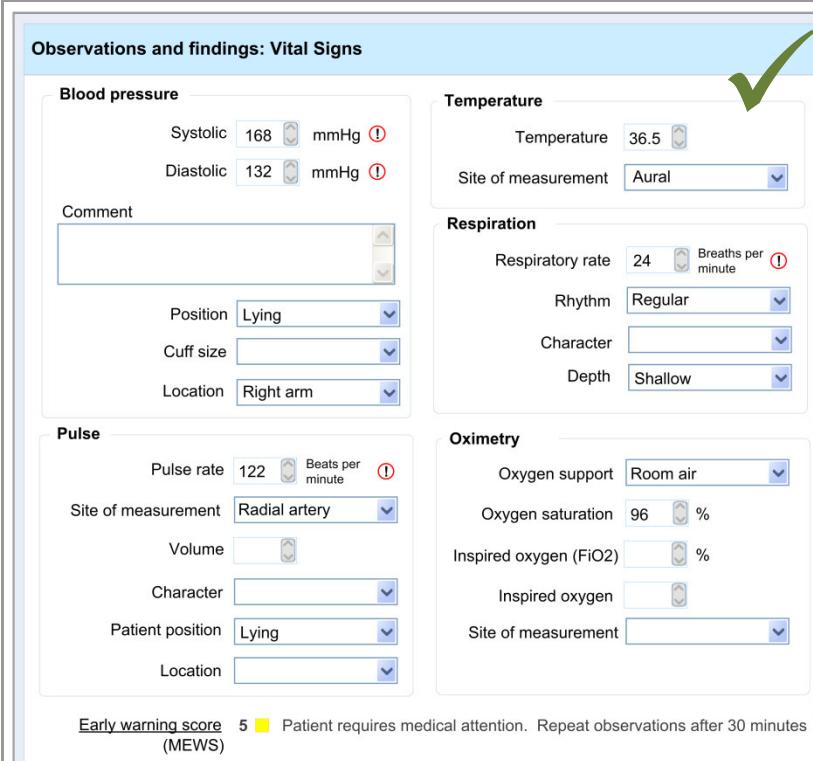
Further details about the calculated value, which could typically be a score, could also be displayed. For example, in the case of displaying an early warning score or a Glasgow Coma Scale score, the UI could also show the normal value ranges and any other ranges available.

ID	Guideline	Conformance	Evidence Rating
CNA-1480	The UI must make clear the distinction between values which have been directly entered by the user and values which have been calculated by the system	Mandatory	High
CNA-1490	Display calculated values in bold	Recommended	Medium
CNA-1500	Do not display calculated values in an editable field	Recommended	Medium
CNA-1510	Where appropriate, provide text that briefly explains the meaning of the calculated value (for example, if the value is a score, indicate the clinical meaning of the score)	Recommended	High
CNA-1520	Where appropriate, provide access to details of: <ul style="list-style-type: none"> ■ Which values entered by the user have contributed to the calculation ■ Which other values have contributed to the calculation ■ In which fields and under which headings were the values entered ■ The scoring system applied (if appropriate) ■ Link(s) to further details about the calculation (if appropriate) 	Recommended	High

CNA-1530	Provide a label to the calculated value that, when it is in focus, reveals the calculation details and links	Recommended	Medium
CNA-1540	Moving the focus onto the calculated value label (for example, by clicking on it) opens a dialog that appears over the form and contains the calculation details and links	Recommended	Medium
Note			
Although this guideline does not specify the exact mechanism to display these values, developers may consider a pop-up or a floating palette design for this dialog.			
CNA-1550	Ensure that the 'calculated values' dialog is appropriately labelled	Recommended	High
CNA-1560	Moving the focus away from the calculated value label closes the dialog	Recommended	Low
CNA-1570	Visually communicate that the label will reveal further details when in focus (for example, when it is clicked)	Recommended	Medium
CNA-1580	Provide the application's visual standard for denoting a link for the label in order to communicate that it can be clicked to reveal details of the scoring	Recommended	Medium
CNA-1590	Upon hover-over, the label should visually change to indicate that it will perform an action (namely, reveal details of the calculation) when clicked	Recommended	Medium
CNA-1600	Provide a button that opens further details of the calculation (if such details are available). This button will automatically be in focus when the dialog is open	Recommended	Medium
CNA-1610	Where appropriate, provide visual indications in-line with the fields that led to the calculation (for example, 'out-of-normal-range' icons)	Recommended	High

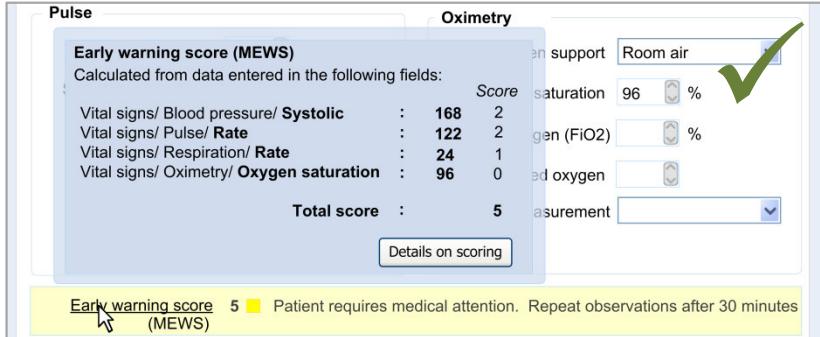
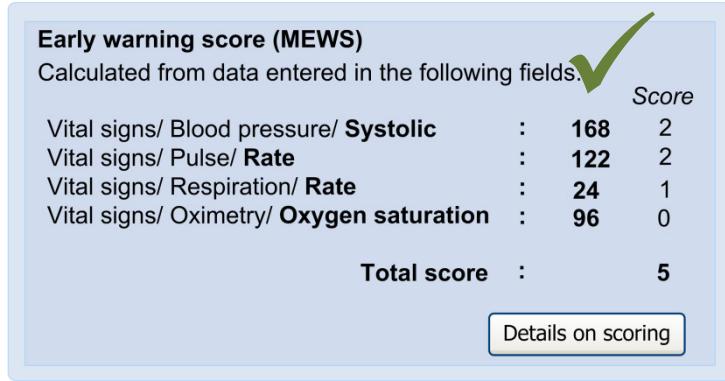
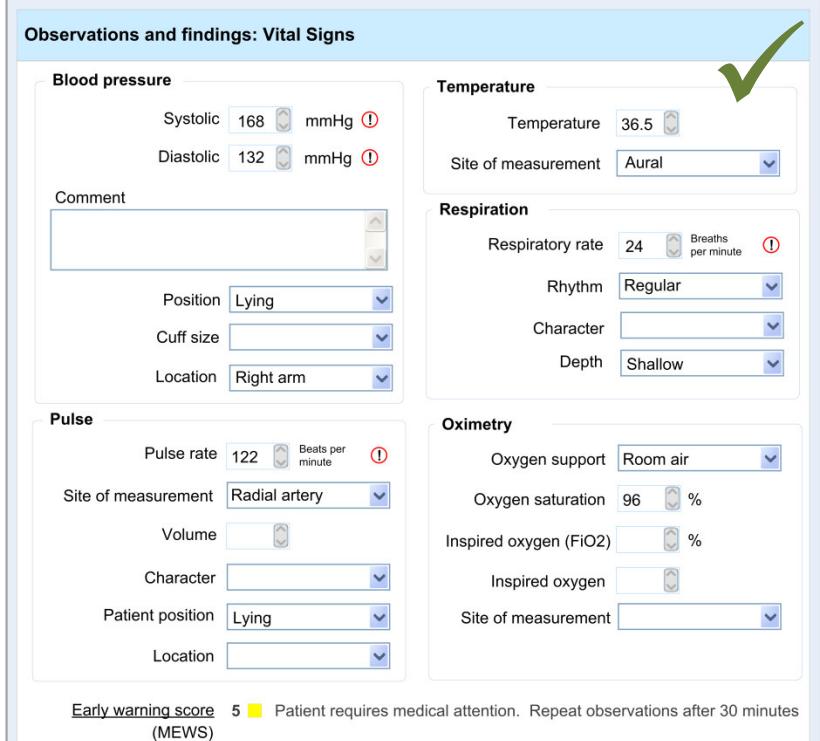
Usage Examples

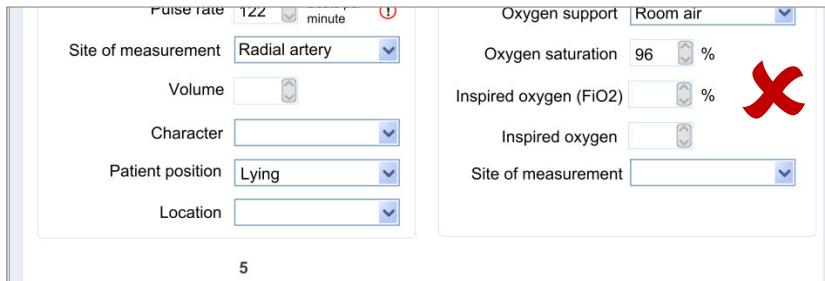
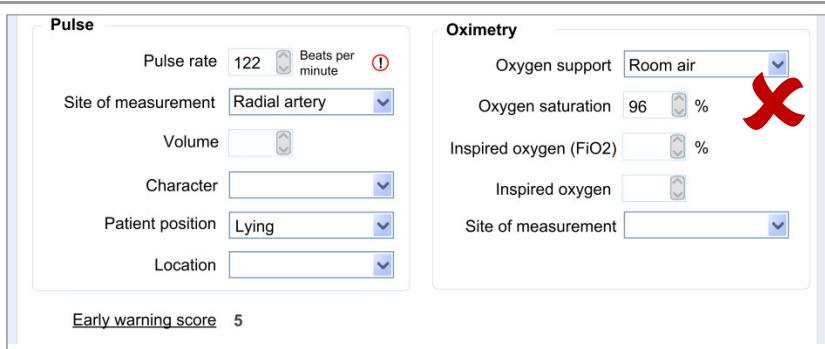
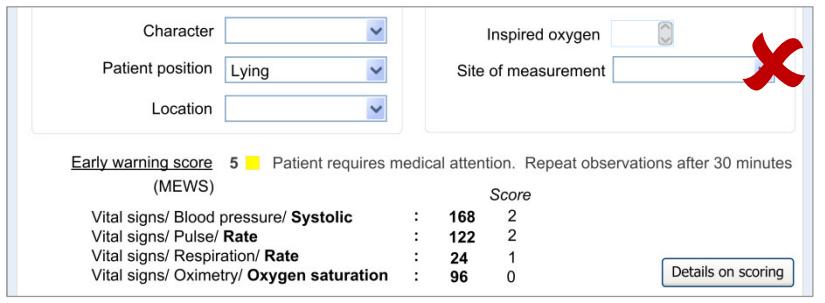
Observations and findings: Vital Signs



The screenshot shows a 'Vital Signs' section of a clinical notes application. It includes fields for Blood pressure (Systolic: 168 mmHg, Diastolic: 132 mmHg), Temperature (36.5), Respiration (Respiratory rate: 24 breaths per minute, Rhythm: Regular, Character: Shallow), Pulse (Pulse rate: 122 beats per minute), and Oximetry (Oxygen support: Room air, Oxygen saturation: 96%, Inspired oxygen (FiO2): 0%, Inspired oxygen: 0%). A comment section is also present. At the bottom, a note states: 'Early warning score 5 [yellow square] Patient requires medical attention. Repeat observations after 30 minutes (MEWS)'.

Example of a calculated value ('Early warning score') (CNA-1490, CNA-1510, CNA-1520, CNA-1530, CNA-1610)

 <p>Character Patient position Location</p> <p>Inspired oxygen Site of measurement</p> <p>Early warning score 5 Patient requires medical attention. Repeat observations after 30 minutes (MEWS)</p>	<p>Example of a calculated value highlighted upon hover-over (CNA-1530, CNA-1570, CNA-1580, CNA-1590)</p>																																
 <p>Pulse</p> <p>Oximetry</p> <p>Early warning score (MEWS)</p> <p>Calculated from data entered in the following fields:</p> <table border="0"> <tr> <td>Vital signs/ Blood pressure/ Systolic</td> <td>:</td> <td>168</td> <td>Score</td> <td>Oxygen saturation</td> <td>:</td> <td>96</td> <td>%</td> </tr> <tr> <td>Vital signs/ Pulse/ Rate</td> <td>:</td> <td>122</td> <td></td> <td>Inspired oxygen (FiO2)</td> <td>:</td> <td>0</td> <td>%</td> </tr> <tr> <td>Vital signs/ Respiration/ Rate</td> <td>:</td> <td>24</td> <td>1</td> <td>Inspired oxygen</td> <td>:</td> <td>0</td> <td></td> </tr> <tr> <td>Vital signs/ Oximetry/ Oxygen saturation</td> <td>:</td> <td>96</td> <td>0</td> <td>Site of measurement</td> <td>:</td> <td></td> <td></td> </tr> </table> <p>Total score : 5</p> <p>Details on scoring</p> <p>Early warning score 5 Patient requires medical attention. Repeat observations after 30 minutes (MEWS)</p>	Vital signs/ Blood pressure/ Systolic	:	168	Score	Oxygen saturation	:	96	%	Vital signs/ Pulse/ Rate	:	122		Inspired oxygen (FiO2)	:	0	%	Vital signs/ Respiration/ Rate	:	24	1	Inspired oxygen	:	0		Vital signs/ Oximetry/ Oxygen saturation	:	96	0	Site of measurement	:			<p>Example of a calculated value with its details revealed (CNA-1540, CNA-1550, CNA-1600)</p>
Vital signs/ Blood pressure/ Systolic	:	168	Score	Oxygen saturation	:	96	%																										
Vital signs/ Pulse/ Rate	:	122		Inspired oxygen (FiO2)	:	0	%																										
Vital signs/ Respiration/ Rate	:	24	1	Inspired oxygen	:	0																											
Vital signs/ Oximetry/ Oxygen saturation	:	96	0	Site of measurement	:																												
 <p>Early warning score (MEWS)</p> <p>Calculated from data entered in the following fields.</p> <table border="0"> <tr> <td>Vital signs/ Blood pressure/ Systolic</td> <td>:</td> <td>168</td> <td>Score</td> <td>2</td> </tr> <tr> <td>Vital signs/ Pulse/ Rate</td> <td>:</td> <td>122</td> <td></td> <td>2</td> </tr> <tr> <td>Vital signs/ Respiration/ Rate</td> <td>:</td> <td>24</td> <td>1</td> <td></td> </tr> <tr> <td>Vital signs/ Oximetry/ Oxygen saturation</td> <td>:</td> <td>96</td> <td>0</td> <td></td> </tr> </table> <p>Total score : 5</p> <p>Details on scoring</p>	Vital signs/ Blood pressure/ Systolic	:	168	Score	2	Vital signs/ Pulse/ Rate	:	122		2	Vital signs/ Respiration/ Rate	:	24	1		Vital signs/ Oximetry/ Oxygen saturation	:	96	0		<p>Close up of an example of a calculated value details panel (CNA-1600)</p>												
Vital signs/ Blood pressure/ Systolic	:	168	Score	2																													
Vital signs/ Pulse/ Rate	:	122		2																													
Vital signs/ Respiration/ Rate	:	24	1																														
Vital signs/ Oximetry/ Oxygen saturation	:	96	0																														
 <p>Observations and findings: Vital Signs</p> <p>Blood pressure</p> <p>Systolic 168 mmHg ⓘ Diastolic 132 mmHg ⓘ</p> <p>Comment</p> <p>Pulse</p> <p>Pulse rate 122 Beats per minute ⓘ Site of measurement Radial artery Volume Character Patient position Lying Location</p> <p>Temperature</p> <p>Temperature 36.5 ⓘ Site of measurement Aural</p> <p>Respiration</p> <p>Respiratory rate 24 Breaths per minute ⓘ Rhythm Regular Character Depth Shallow</p> <p>Oximetry</p> <p>Oxygen support Room air Oxygen saturation 96 % Inspired oxygen (FiO2) Inspired oxygen Site of measurement</p> <p>Early warning score 5 Patient requires medical attention. Repeat observations after 30 minutes (MEWS)</p>	<p>Example of 'in-line' indications of 'out of range' using red circle icons (CNA-1610)</p>																																

 <p>Character <input type="button" value="▼"/></p> <p>Patient position <input type="button" value="Lying"/></p> <p>Location <input type="button" value="▼"/></p> <p>Early warning score 5 Patient requires medical attention. Repeat observations after 30 minutes (MEWS)</p>	Example of a calculated value displayed in an entry-field (CNA-1500)										
 <p>Pulse rate <input type="button" value="122 minute"/> </p> <p>Site of measurement <input type="button" value="Radial artery"/></p> <p>Volume <input type="button" value=""/></p> <p>Character <input type="button" value="▼"/></p> <p>Patient position <input type="button" value="Lying"/></p> <p>Location <input type="button" value="▼"/></p> <p style="text-align: center;">5</p>	Example of a calculated value without any labels (CNA-1540)										
 <p>Pulse</p> <p>Pulse rate <input type="button" value="122 Beats per minute"/> </p> <p>Site of measurement <input type="button" value="Radial artery"/></p> <p>Volume <input type="button" value=""/></p> <p>Character <input type="button" value="▼"/></p> <p>Patient position <input type="button" value="Lying"/></p> <p>Location <input type="button" value="▼"/></p> <p>Early warning score 5</p>	Example of a calculated value without a text description of what it means (CNA-1510)										
 <p>Character <input type="button" value="▼"/></p> <p>Patient position <input type="button" value="Lying"/></p> <p>Location <input type="button" value="▼"/></p> <p>Early warning score 5 Patient requires medical attention. Repeat observations after 30 minutes (MEWS)</p> <table border="1" style="margin-top: 10px; width: 100%;"> <thead> <tr> <th colspan="2" style="text-align: left;">Score</th> </tr> </thead> <tbody> <tr> <td>Vital signs/ Blood pressure/ Systolic</td> <td>: 168 2</td> </tr> <tr> <td>Vital signs/ Pulse/ Rate</td> <td>: 122 2</td> </tr> <tr> <td>Vital signs/ Respiration/ Rate</td> <td>: 24 1</td> </tr> <tr> <td>Vital signs/ Oximetry/ Oxygen saturation</td> <td>: 96 0</td> </tr> </tbody> </table> <p style="text-align: right;">Details on scoring</p>	Score		Vital signs/ Blood pressure/ Systolic	: 168 2	Vital signs/ Pulse/ Rate	: 122 2	Vital signs/ Respiration/ Rate	: 24 1	Vital signs/ Oximetry/ Oxygen saturation	: 96 0	Example where the details of the calculated value are shown all the time (CNA-1520)
Score											
Vital signs/ Blood pressure/ Systolic	: 168 2										
Vital signs/ Pulse/ Rate	: 122 2										
Vital signs/ Respiration/ Rate	: 24 1										
Vital signs/ Oximetry/ Oxygen saturation	: 96 0										
Rationale											
<p>Design Analysis:</p> <p>This design provides a solution where the calculated value is unobtrusive, but clearly discernible.</p> <p>Desk Research:</p> <p>Best practice analysis showed that there is no one way in which applications display calculated values. The convention of displaying the calculated value in a non-editable entry field box is used elsewhere in software applications.</p> <p>Relevant standards documentation indicates that users "should be able to easily distinguish between fields that can be modified and those that cannot ("read-only" fields) by appropriate coding" {R6}. It goes on to state that "entry fields and read-only fields should be visually distinct" and that "user-entered data should be distinguishable from system-generated data in entry fields" {R6}.</p> <p>User Research:</p> <p>Clinicians understood (see APPENDIX B) that the value was calculated and that they should click on the label to find more information.</p>											

Hazard Risk Analysis Summary:**Potential Hazards:**

- If the calculation method employed is not obvious (for example, type of Early Warning Score) clinicians may misinterpret the calculated value

Mitigations:

- Where appropriate, provide access to the type of scoring system applied

7.3.2 Displaying Scores Where Values Are Missing

In certain situations, an automatic calculation, such as a score, can and should be calculated even if there are values missing that would ideally contribute to the calculated score.

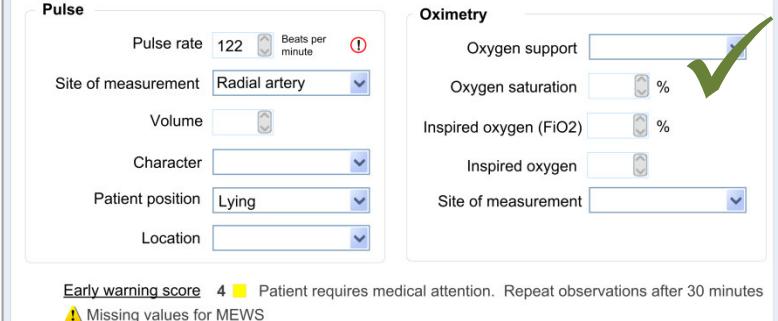
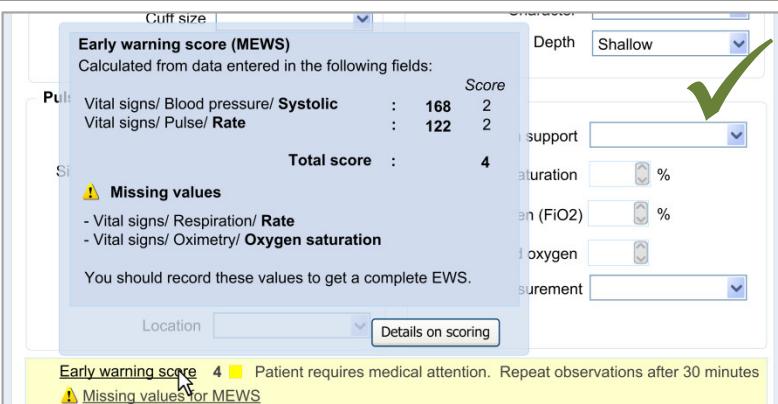
In these situations, one option would be to indicate that the score cannot be calculated owing to missing values. Where it is deemed useful to do so, the UI should indicate that a score could not be calculated and allow the clinician to access a dialog that specifies where the relevant data entry fields can be found.

However, another option will be to calculate the score by substituting the missing values with assumed (default) values, while clearly communicating that values are missing. A default value could be, for example, the value representing 'normal' as part of an early warning score.

As often only some values of the potential full set will be known, it is important to be able to display partial scores in some situations.

ID	Guideline	Conformance	Evidence Rating
CNA-1620	Where appropriate, display a score where only some of the necessary values are known	Recommended	Low
	<p>Note</p> <p>There may be occasions where it is definitely not appropriate to display a partially calculated value, such as BMI. The suitability of showing a particular partial score should be determined by the appropriate clinical authority.</p>		
CNA-1630	If a score has been calculated which makes assumptions about missing values, the UI must clearly communicate this to the user	Mandatory	High
CNA-1640	Where the UI displays a score with missing values, clearly indicate where values have been assumed	Recommended	Low
CNA-1650	Where a score cannot be calculated and it's deemed necessary to communicate this to the user, provide a message which communicates this to the user and which provides a link to further details	Recommended	Low
CNA-1660	Where there are missing values, allow the user to access details of where the relevant fields can be found, so that the user can enter the missing data, if known	Recommended	Low
CNA-1670	In the 'calculated values' dialog indicate which values are missing and where their corresponding entry fields can be found in the form	Recommended	Low

Usage Examples

 <p>Pulse</p> <p>Pulse rate: 122 Beats per minute</p> <p>Site of measurement: Radial artery</p> <p>Volume:</p> <p>Character:</p> <p>Patient position: Lying</p> <p>Location:</p> <p>Oximetry</p> <p>Oxygen support:</p> <p>Oxygen saturation: %</p> <p>Inspired oxygen (FiO2): %</p> <p>Inspired oxygen:</p> <p>Site of measurement:</p>	<p>Example of a partially calculated score indication (CNA-1620, CNA-1640)</p>															
<p>Early warning score 4 ■ Patient requires medical attention. Repeat observations after 30 minutes ⚠ Missing values for MEWS</p>																
 <p>Early warning score (MEWS) Calculated from data entered in the following fields:</p> <table border="0"> <tr> <td style="width: 15%;">Pulse</td> <td>Vital signs/ Blood pressure/ Systolic</td> <td>:</td> <td>168</td> <td>2</td> </tr> <tr> <td></td> <td>Vital signs/ Pulse/ Rate</td> <td>:</td> <td>122</td> <td>2</td> </tr> <tr> <td></td> <td colspan="3">Total score :</td> <td>4</td> </tr> </table> <p>Note Missing values: - Vital signs/ Respiration/ Rate - Vital signs/ Oximetry/ Oxygen saturation</p> <p>You should record these values to get a complete EWS.</p> <p>Location: Details on scoring</p> <p>Early warning score 4 ■ Patient requires medical attention. Repeat observations after 30 minutes ⚠ Missing values for MEWS</p>	Pulse	Vital signs/ Blood pressure/ Systolic	:	168	2		Vital signs/ Pulse/ Rate	:	122	2		Total score :			4	<p>Example where a score cannot be shown and the user has accessed further details (CNA-1640)</p> <p>Note Accessing further details could reveal information such as normal value ranges (CNA-1670)</p>
Pulse	Vital signs/ Blood pressure/ Systolic	:	168	2												
	Vital signs/ Pulse/ Rate	:	122	2												
	Total score :			4												

Rationale

Design Analysis:

There are occasions where a score can be calculated even though there are missing values, but where it is still clinically valuable to display the score, but with assumed values. However, it is vital to communicate that there are missing values, as the score could be misinterpreted if this is not understood. For example, the clinician could see a 'normal' score and think that the patient is well, even though if he or she added another constituent to the score it would push the score to a 'warning' level.

Hazard Risk Analysis Summary:

Potential Hazards:

- If the clinician believes the calculated value shown is based upon all data being present when this is not the case
- If the clinician is unable to determine which fields have been taken into account (including items not selected) for the calculation the meaning may be misinterpreted

Mitigations:

- Do not show a partial score on its own. Instead, show the score with a label indicating that it is only a partial score and that values are missing
- Where appropriate, provide access to details of:
 - Which values entered by the user have contributed to the calculation
 - Which other values have contributed to the calculation
 - In which fields and under which headings were the values entered

8 ADDING FREE TEXT

8.1 Introduction

Completing an electronic admissions clerking form will be a relatively, if not completely, new experience for many clinicians, and an argument can be made that, in many circumstances selecting from fixed-choice options cannot match the extent of expression that is afforded by noting on paper. The relevant authorities may regularly increase the range of the fixed-choice options but, in the near future, it is unlikely that these fixed-choice options will be able to express all that the clinician wishes to express. There must be scope for the clinician to supplement the fixed-choice options and encoded matches with free text.

The clinician could wish to add free text to any fixed-choice option, and the interface should allow them to do this. This feature is addressed in the current section of the guidance.

This section of the guidance comprises four main areas:

- Add free text
- Display free text
- Edit free text
- Required or recommended free text fields

The user requirements for this section of the guidance are:

- Allow the user to add free text to any fixed-choice or encoded data field in the form
- Display any associated free text in a location that is visible and clearly associated with its data item
- Allow the user to delete the free text, but only before it has been committed to the record
- Allow the user to edit the free text
- Delete the free text if the user deletes the associated data item
- Warn the user before deleting any free text
- Allow the free text to remain if the user changes the data item

8.2 Principles

The following key principles inform the guidance in this section:

- Match the flexibility of expression that clinicians currently have on paper
- Screen design heuristics:
 - Match between system and the real world
 - User control and freedom
 - Flexibility and efficiency of use

8.3 Guidelines

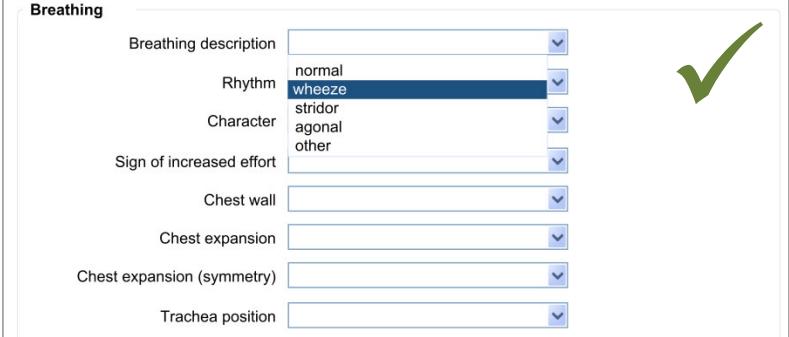
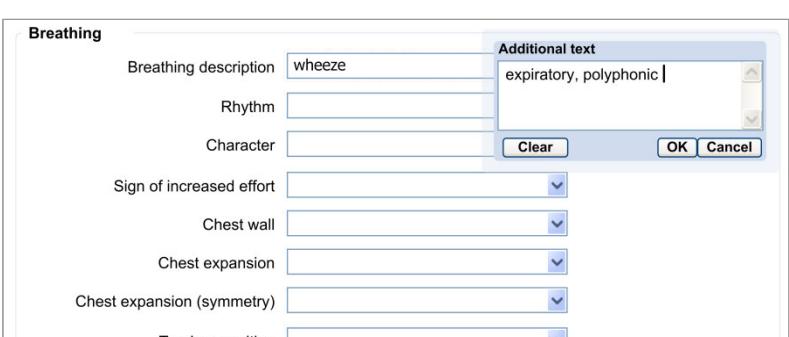
8.3.1 Add New Free Text

The approach taken by this guidance regarding adding new free text is to allow the clinician to enter the free text at the same point (or rather, just after) selecting from a fixed-choice data field or entering and selecting an encoded term. It is intuitive to feature the entry of free text 'in-line' with the fixed-choice data field it is elaborating.

ID	Guideline	Conformance	Evidence Rating
General			
CNA-1680	Provide a mechanism that allows the user to add free text to a fixed choice selection	Mandatory	High
CNA-1690	The entry control mechanism will comprise a pop-up dialog box featuring a single text field	Recommended	High
CNA-1700	In the free text entry mechanism, provide a control that allows the user to clear the free text from within the text field	Recommended	High
Revealing the Text Field			
CNA-1710	Reveal the control for activating this mechanism where any of the following situations exist: <ul style="list-style-type: none"> ■ When the user has moved the focus to a fixed-choice data control ■ At the point that the user has selected from a fixed-choice data field ■ Upon mouse-over of the associated control or the location of the 'add free text' control 	Recommended	High
CNA-1720	Do not display the associated free text field until after the user has selected from the fixed-choice control or selected a matched term	Recommended	High
CNA-1730	The control will feature in the normal tabbing order	Recommended	High
CNA-1740	Move the focus to this control immediately after the user has selected from a list box	Recommended	Medium
CNA-1750	Hide the control: <ul style="list-style-type: none"> ■ By default ■ When the user has moved the focus away from either the control itself or the associated fixed-choice data field 	Recommended	Medium
Text Field Size			
CNA-1760	If the user is expected to be able to type in multiple lines in a text field, ensure that the height of a free text field is a minimum of two lines	Recommended	High
CNA-1770	Do not feature a horizontal scroll bar	Recommended	High
CNA-1780	When the text that the user is typing exceeds the visible area in the text field, provide a vertical scroll bar	Recommended	High
Displaying Free Text			
CNA-1790	Display free text immediately to the right of the associated fixed-choice control	Recommended	Medium
CNA-1800	If there is insufficient space immediately to the right of the associated fixed-choice control, display the free text immediately below the fixed-choice control	Recommended	Medium

CNA-1810	Do not hide the free text that the user has entered, if the associated control is in view	Mandatory	High
CNA-1820	Feature the free text within a faint marquee that also surrounds the associated fixed-choice control	Recommended	Medium

Usage Examples

	Example of a text field appearing when data has been selected and the field is in focus (CNA-1680, CNA-1710, CNA-1740)
	
	Example of a text field opening and the user typing in text (CNA-1740, CNA-1700, CNA-1760)
	

Breathing <p>Breathing description: wheeze Rhythm: Character: Sign of increased effort: Chest wall: Chest expansion: Chest expansion (symmetry): Trachea position:</p>	Example of free text being displayed next to the field (CNA-1750, CNA-1790) 
Oximetry <p>Oxygen support: Room air Oxygen saturation: % Inspired oxygen (FiO₂): % Inspired oxygen: Site of measurement:</p> Breathing <p>Breathing description: Rhythm: Character: Sign of increased effort: Chest wall: Chest expansion: Chest expansion (symmetry): Trachea position:</p>	Example of free text fields being displayed always (CNA-1690) 
Breathing <p>Breathing description: wheeze Rhythm: Character: Sign of increased effort: Chest wall: Chest expansion: Chest expansion (symmetry):</p>	Alternative implementation of guidance: the text entry field appears next to the entry field rather than as a pop-up. If the user tabs away from the field, the text remains as read-only text 
 Breathing <p>Breathing description: wheeze Rhythm: Character: Sign of increased effort: Chest wall: Chest expansion: Chest expansion (symmetry):</p>	

Rationale

Design Analysis:

The design provides a solution where the text fields are sufficiently hidden so that the clinician is not overwhelmed by a cluttered screen design, but which are sufficiently prominent so that the clinician knows how to enter the text. This solution provides a control which is close to the data entry field to which it applies.

The guidance allows for both a pop-up design and a design in which a field appears in the form. The latter approach requires less keystrokes or mouse-clicks, but could require a dynamic form in which entry fields move down to accommodate the field as it is revealed.

User Research:

Research (see APPENDIX B) showed that clinicians understood this solution and indicated that they would be able to easily use it, although some had an initial problem with seeing the control for adding the text.

Hazard Risk Analysis Summary:

Potential Hazards:

- If the clinician enters information for which a specific data entry field exists into the free-text field, valuable information that could be encoded may be omitted

Mitigations:

- Where appropriate, position free text fields after the fixed-choice fields or the search entry field to encourage the user to enter the fixed-choice data first

8.3.2 Edit Free Text

After clinicians have added some free text to a fixed-choice data field, they must be allowed to go back and change that text before they save the form to the patient record. It could be that they have made a mistake, or that they have discovered some new information from the patient. It could be that they are new to the form and have typed some free text which is better recorded as a fixed-choice data item later in the form. Whatever the reason, the clinician must be able to quickly and easily edit this data.

The approach adopted by the current guidance combines the control for editing the free text with the field for displaying the free text, in order to make the action of editing intuitive to the clinician.

ID	Guideline	Conformance	Evidence Rating
CNA-1830	Allow the user to edit free text that they have entered, as long as this is done before the data has been submitted to the patient record	Mandatory	High
CNA-1840	Allow the user to edit the free text by clicking on it, which reopens the entry control	Recommended	High
CNA-1850	Highlight the free text area upon mouse-over (for example, in yellow)	Recommended	High

Usage Examples

Breathing

Breathing description: wheeze

Rhythm:

Character:

Sign of increased effort:

Chest wall:

Chest expansion:

Chest expansion (symmetry):

Trachea position:

Example of free text being edited
(CNA-1830, CNA-1840,
CNA-1850)

Breathing

Breathing description: wheeze

Rhythm:

Character:

Sign of increased effort:

Chest wall:

Chest expansion:

Chest expansion (symmetry):

Trachea position:

Close-up view of the text entry
field (CNA-1830)

Additional text

expiratory, polyphonic |

Clear OK Cancel

Rationale

Design Analysis:

The editing mechanism reuses the entry mechanism and does not require any further buttons. Clicking on the displayed text to edit it is an intuitive action.

Desk Research:

The action of hovering over or moving the mouse onto the displayed text to reveal a button is one used elsewhere in the Microsoft Health CUI designs (for example, see *Design Guidance – Terminology – Matching* {R13}) and which is also used in the Microsoft Office System 2007.

The guidance suggests that the free text area should be highlighted upon mouse-over to indicate that it can be clicked (to edit it). This is supported by relevant international standards documentation, which states that “consistent feedback should be provided to the user to identify the selected option”, including “highlighting” the “selected or active option” (see *Menu dialogues* {R5}).

User Research:

User research (see APPENDIX B) showed that clinicians understood that they could edit free text by clicking on it.

8.3.3 Required or Recommended Free Text Field

If the clinician is required to add some free text or, at least, is encouraged to do so, the free text field should be made immediately visible to the clinician. That is to say, in those situations where it is recommended that the clinician should type in some free text, do not require the clinician to perform an action for it to appear.

ID	Guideline	Conformance	Evidence Rating
CNA-1860	Where free text is required or recommended, provide a free text field in the form	Recommended	High
CNA-1870	Where free text is required or recommended, but is contingent upon the user making a specific data selection, reveal a free text field in the form (for example, when the user makes an 'other, please specify' selection)	Recommended	Medium
Usage Examples			
<input checked="" type="checkbox"/> Further details: Heart sounds Added Sounds: Please Select Murmur: Please Select Description:  Site: Please Select			Example of a recommended text fields which is immediately visible (CNA-1860)
Rationale			
Design Analysis: Consistent with other guidelines in this document, required fields should not be initially hidden (see section 5.3.1) Desk Research: A brief check of best practice shows that this is a conventional way of displaying text fields. User Research: Clinicians understood (see APPENDIX B) this design and had no problems entering data into such fields.			

9 GENERAL FORM DESIGNS

9.1 Introduction

In this section, the guidelines presented are based upon standard UI practice and should be followed by developers who are planning to employ standard data entry fields in their application. These guidelines are not exclusive to the healthcare informatics industry but have been chosen because they are applicable to healthcare applications.

9.2 Principles

The following key principles inform the guidance in this section:

- Consistency
- Minimal design

9.3 Guidelines

In this section, the guidelines focus upon:

- How to use standard fields, such as check boxes and radio buttons
- How to provide labels and prompts

9.3.1 Use of Standard Fields

These guidelines address how standard fields, including radio buttons, check boxes and drop-down list boxes should be implemented in a form.

ID	Guideline	Conformance	Evidence Rating
Radio Buttons			
CNA-1880	A group of radio buttons should contain at least two items and a maximum of seven plus or minus two	Recommended	High
CNA-1890	List radio button options in a logical order, such as grouping highly-related options together or placing most common options first. In the absence of any common or logical ordering, consider alphabetical order	Mandatory	High
CNA-1900	Ensure that within radio button sets which feature the same options, feature the options in a consistent order	Recommended	High
CNA-1910	Where possible, align radio buttons vertically, not horizontally	Recommended	High
CNA-1920	If radio buttons are used to dynamically display other controls related to the selected control, provide additional accessibility mitigation to indicate that further fields have appeared	Mandatory	High
CNA-1930	Make the first option in a group of radio buttons the default option	Recommended	High
CNA-1940	Avoid nesting radio buttons with other radio buttons or check boxes	Recommended	Medium

Check Boxes			
CNA-1950	For check boxes, the meaning of the cleared state must be the unambiguous opposite of the selected state (for example, 'on' or 'off')	Mandatory	High
CNA-1960	Only use check boxes to toggle an option 'on' or 'off' or to select or deselect an item	Recommended	High
CNA-1970	In a group of check boxes, each check box should be independent of all the others, unless interdependency is clearly indicated	Mandatory	High
CNA-1980	Aim to keep the number of check boxes to 10 or fewer	Recommended	High
CNA-1990	List check box options in a logical order, such as grouping highly-related options together or placing most common options first. In the absence of any common or logical ordering, consider alphabetical order	Mandatory	High
CNA-2000	Where possible, align check boxes vertically, not horizontally	Recommended	High
CNA-2010	If check boxes are used to dynamically display other controls related to the selected control, provide additional accessibility mitigation to indicate that further fields have appeared	Mandatory	High
CNA-2020	Label every check box	Mandatory	High
Drop-Down Lists			
CNA-2030	Do not feature a list box if:	Mandatory	High
	<ul style="list-style-type: none"> ■ Missing one or more of the options in the list has important implications for patient safety ■ There are a small number of options and there is space to display them as radio buttons ■ The list label is not understood by all relevant users and the list is used infrequently 		
CNA-2040	Arrange list items in a logical order, such as grouping highly-related options together or placing most common options first. In the absence of any common or logical ordering, consider alphabetical order	Mandatory	High
CNA-2050	Place options that represent either 'none' or 'all' at the beginning of the list, regardless of the sort order of the remaining items	Recommended	High
Usage Examples			
<p>CVS normal on examination</p> <p><input checked="" type="radio"/> Not known <input type="radio"/> Yes <input type="radio"/> No</p>			Example of a set of radio buttons (CNA-1880, CNA-1890, CNA-1910, CNA-1930)
<p><input checked="" type="checkbox"/> Patient declined examination</p>			Example of a check box (CNA-1950, CNA-1960)
<p>Site of measurement</p> <p>Radial artery</p>			Example of a drop-down list box (CNA-2030)
<p>Severity</p> <p>Mild to moderate Mild Moderate to severe Moderate Severe</p>			In this example, the ordering should be clinically logical (that is, in order of severity), but instead it is in alphabetical order (CNA-2040)

Observations and findings: Cardiovascular system

General

CVS normal on examination Not known
 Yes
 No

Observations and findings: Respiratory system

General

Respiratory system normal on examination Yes
 Not known
 No

Observations and findings: Abdomen

General

Abdomen normal on examination Yes
 No
 Not known

Observations and findings: Genito-urinary system

General

Genito-urinary system normal on examination Not known
 Yes
 No

Urethral discharge  

In this example, the various sets of radio buttons feature different ordering (CNA-1900)

Rationale

Desk Research:

These designs are supported by key style guides in the software industry (for example, see *Windows User Experience Interaction Guidelines* {R21} and *Apple Human Interface Guidelines, User Experience* {R22}).

Some style guides indicate that it is possible to have a ‘mixed choice’ selection option in check boxes whereby, in addition to the selected and cleared states, a ‘mixed’ state indicates that the option is set for some, but not all objects. However, in an area of technology where ambiguity is to be avoided, such as healthcare IT, such a mixed state is to be avoided.

Relevant international guidance supports these guidelines, including:

- “If the user must select a small number of values” then “screen buttons should be considered” {R6}
- “If a conventional ordering (that is, in general usage) for options is possible, options should be placed in that order.” {R6}
- “If the frequency cannot be determined or the groups are large and users know the name of the desired option, options should be placed in alphabetical order.” {R6}

User Research:

In user research (see APPENDIX B), all clinicians understood how to use these controls.

In this case, radio buttons would be more appropriate (CNA-2030)

9.3.2 Labels and Prompts

These guidelines address how labels and text prompts should be implemented in a standard form.

ID	Guideline	Conformance	Evidence Rating
CNA-2060	Unless there is reason not to do so, use sentence-style capitalisation, that is to begin the sentence with a capital and then use lower case text unless there is cause to do otherwise	Recommended	Medium
CNA-2070	For a group of check boxes, aim to keep the label length about the same for all labels	Recommended	Medium
CNA-2080	Use positive phrasing	Recommended	Medium
CNA-2090	Where necessary, provide text prompts in order to instruct users as to the type of data they should enter in a field	Recommended	High
CNA-2100	Write the prompt in italic grey text	Recommended	High
CNA-2110	Prompt text should not be editable	Mandatory	High
CNA-2120	If there is sufficient space, feature the text prompt immediately below or to the right of the field	Recommended	Medium
CNA-2130	If space is limited, feature an in-field text prompt	Recommended	High
CNA-2140	Allow the in-field text prompt to remain upon the focus moving to the field	Recommended	Medium
CNA-2150	Remove the in-field text prompt upon data being entered into or selected in the field	Recommended	High
CNA-2160	Do not feature examples in the in-field prompt text	Recommended	High

Usage Examples

	If space is limited, feature an in-field text prompt (CNA-2130)
	Distinguish the input text from the prompt text (CNA-2100)
	Do not feature the prompt the same weight as the input text (CNA-2100)
	Remove the in-field text prompt upon data being entered into the field (CNA-2150)
	Do not feature examples in the in-field prompt text (CNA-2160)

Rationale

Desk Research:

This guidance is supported by key style guides in the software industry (for example, see *Windows User Experience Interaction Guidelines* {R21} and *Apple Human Interface Guidelines, User Experience* {R22}).

The notion of providing prompts which “indicate implicitly” or “explicitly” the “types of input that will be accepted by the dialogue” is outlined in the relevant international standards documentation {R9}. The use of positive phrasing is supported by the relevant international standard which states that such prompts “should be worded as positive statements to emphasize ‘what to do’ rather than ‘what to avoid’. However, negating statements should be used for denoting exceptions to rules or to emphasize a point” {R9}. The standards go on to emphasise the importance of providing specific prompts under certain conditions, such as where users “are unfamiliar with the system and will need information on how to proceed” and where the task requirements are such that the “user inputs should be guided”, such as where the “task requires sequenced steps”, where the task is “complicated” or where there is a “need to minimize errors” {R9}.

Regarding the use of capital letters, the standards documentation states that “to facilitate readability, text field labels should begin with an upper-case letter. The rest of the label should contain lower-case (small) letters, except for cases where the label is a logo, an acronym, or where language convention requires each word in the label to begin with a capital letter” {R6}.

10 DOCUMENT INFORMATION

10.1 Terms and Abbreviations

Abbreviation	Definition
BMI	Body Mass Index
CUI	Common User Interface
CVS	Cardiovascular System
HIU	Health Informatics Unit
ISMP	Institute for Safe Medication Practices
NHS	National Health Service
NHS CFH	NHS Connecting for Health
NPSA	National Patient Safety Agency
PMH	Past Medical History
RCP	Royal College of Physicians
RITE	Rapid Iterative Testing Evaluation
SNOMED CT	Systematized Nomenclature of Medicine Clinical Terms
UI	User Interface
WHO	World Health Organization

Table 7: Terms and Abbreviations

10.2 Definitions

Term	Definition
Conformance	In the guidance tables, indicates the extent to which you should follow the guideline when defining your UI implementation. There are two levels: <ul style="list-style-type: none"> ■ 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.
Entry field	Type of field in which data is entered. Entry fields may be optional fields or required fields.

Term	Definition
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): <ul style="list-style-type: none"> ■ Low: <ul style="list-style-type: none"> ■ 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: <ul style="list-style-type: none"> ■ Mitigates specific patient safety hazards ■ User research findings clear but with few participants ■ References old authoritative guidance (for example, from the UK-based 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: <ul style="list-style-type: none"> ■ 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
Field	Area on a screen display in which data is entered or presented.
Form	Structured display with labelled fields that the user reads, fills in, selects entries for (for example, through choice buttons or radio buttons) or modifies.
Label	Short descriptive title for an entry or read-only field, table, control or object.
Navigation	Ability to move from field to field within a form, to proceed forward and backward through a form and move from form to form.
Optional field	Field that not necessarily needs to be filled in or modified by the user.
Read-only field	Field that contains data that cannot be modified by the user.
Required field	Field that must be completed by the user if it does not already have a value.

Table 8: Definitions

10.3 Nomenclature

This section shows how to interpret the different styles used in this document to denote various types of information.

10.3.1 Body Text

Text	Style
Code	Monospace
Script	
Other markup languages	
Interface dialog names	Bold
Field names	
Controls	

Text	Style
Folder names	Title Case
File names	

Table 9: Body Text Styles

10.3.2 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 10: Cross Reference Styles

10.4 References

Reference	Document	Version
R1.	Royal College of Physicians (Health Informatics Unit): A Clinician's Guide to Record Standards – Part 2: Standards for the structure and content of medical records and communications when patients are admitted to hospital, October 2008	2008
R2.	Royal College of Physicians (Health Informatics Unit): Hospital Admission Pro-forma Headings and Definitions, April 2008	1.0
R3.	Design Guidance – Accessibility Principles	1.0.0.0
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R9.	British Standards Institute, BS EN ISO 9241-13: 1999 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 13: User guidance	1999
R10.	British Standards Institute, BS 7581:1992 Guide to Presentation of tables and graphs	1992
R11.	Design Guidance – Date Display	2.0.0.0
R12.	Design Guidance – Date and Time Input	2.0.0.0
R13.	Design Guidance – Terminology – Matching	1.0.0.0
R14.	Design Guidance – Terminology – Elaboration	1.0.0.0
R15.	Design Guidance – Terminology – Display Standards for Coded Information	1.0.0.0

Reference	Document	Version
R16.	Design Guidance – Recording Adverse Drug Reaction Risks	1.0.0.0
R17.	Design Guidance – Displaying Adverse Drug Reaction Risks	1.0.0.0
R18.	Nielsen, J: Usability Engineering, 1993	1993
R19.	Shneiderman, B: Designing the User Interface – Strategies for Effective Human-Computer Interaction, 1998	Third Edition
R20.	Galitz, W.O: Essential guide to user interface design. An introduction to GUI design principles and techniques, 1997	1997
R21.	Windows User Experience Interaction Guidelines	2008
R22.	Apple Human Interface Guidelines: User Experience	2008
R23.	Jarrett, Caroline: Forms that work	2009

Table 11: 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* {R18} 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* {R19} 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: Characteristics of Presented Information

See *Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 10: Dialogues principles* {R8} 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 34: 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 the clinical noting required for hospital admissions clerking.

Purpose:

To hone a set of designs in terms of their usability that would then form the basis for user interface design guidelines for admissions clerking. Over the series of iterations, the Design Team aimed to reduce the number of errors being made by the clinical participants and to improve the designs' ease of, and suitability for, use in a clinical environment.

Method:

Over a series of five stages of usability testing, the Design Team iteratively tested the prototypes, quickly analysed the data and updated the designs in response to the findings.

Key Results:

Key findings included:

- The need for progressive matching of clinical concepts
- The need to capture durations in a colloquial format
- The need for common matches to be distinguished when searching for clinical concepts

B.2 Research Objectives

The objectives of the research were to test a set of design features based on the following areas:

- General form design (standard controls)
- Entering summary lists
- Required fields
- Durations
- Displaying calculated values
- Displaying previous values
- Adding free text

The research was intended to result in a final set of designs plus a list of any outstanding issues that could not be resolved during the test period.

B.3 Research Design

Rapid Iterative Testing and Evaluation (RITE) testing: 13 sessions (15 participants), plus pilot testing, with Health Care Professionals (HCPs) working within the UK National Health Service (NHS). Prototypes embodying the potential guidelines were constructed in a range of media:

- Microsoft® Silverlight™
- Microsoft® Expression Blend™
- Microsoft® Office PowerPoint® slides featuring static designs created in Microsoft® Office Visio® with some animation

The test sessions were grouped into five sequential stages. Largely, participant allocation to each stage was determined by the location of the testing; for example, all the participants tested in Birmingham City Hospital were part of Stage Three. Before each stage in the testing, the prototypes were updated (if necessary), based upon the findings of the previous stage.

Participants were tested individually, with the exception of two sessions where participants doubled up and addressed the component tasks in turn.

In each test session, the participant was given a set of typical clinical noting tasks to perform using the various prototypes, with one prototype per task:

- Where the prototype was interactive, the participant was asked to perform the task by using the keyboard and/or the mouse.
- Where the prototype was not interactive, the researcher presented it screen-by-screen and asked the participant what they understood and what they would do next at each stage in the screen flow.

The tasks were presented in the form of brief written scenarios that set the scene and gave the participant goals to achieve with the prototype. After each task, the participant would be asked questions about their experience of the prototype, including how suitable they thought the design would be in a real clinical situation.

Following each stage in the testing, the researcher collaborated with the Design Team in analysing the findings and planning updates to be implemented before the next testing stage. In this way, the prototypes were incrementally improved over the five stages, with these changes being tested at each subsequent stage.

In the case of the ‘entry of summary list’ design, alternative designs were presented to the participant as part of the post-task discussion. However, this was the only exception: in all other cases, alternative designs were not tested or discussed.

If a prototype was deemed sufficiently capable of enabling the participant to perform the task easily and without error, it was dropped from the testing. This was because of time constraints: stopping tests on a successful prototype released time for tests on a previously untested prototype.

B.4 Results

B.4.1 Participant Description

15 participants took part in the user research, although in two cases participants ‘doubled up’, taking it in turns to perform user tasks (marked as 7a/7b and 12a/12b in Table 12). In total, testing took part in six different hospitals throughout London, the South East and the West Midlands. The participants had varying levels of IT experience, although everyone had a basic level of computer proficiency, and all used computers to varying degrees in a clinical context.

Each participant had either volunteered through the NHS CFH Events Management System (EMS) signup or had been recruited by an HCP who had volunteered. None of the respondents had previously taken part in CUI clinical engagement for other work areas

Table 12 shows a summary of the participants' profiles:

#	Job Role	Specialty	Level	Site	Computer Experience
1	Doctor	Plastic surgery	Y4 Registrar	Royal Free Hospital	High: HTML, ASP, SQL, developed in-house mini-EPR
2	Health Care Assistant	MAU	Band 2	Basingstoke and North Hampshire Hospital	Low: Sage, Email, Internet (four hours a week)
3	Nurse	MAU	RGN	Basingstoke and North Hampshire Hospital	Low: Pathology results, Internet shopping, ECDL
4	Nurse Practitioner	Pain	Band 7	Basingstoke and North Hampshire Hospital	Medium: Email, recording statistics for clinics, booking, National Audit database, Hospital PMS
5	Doctor	Medicine	FY2	Basingstoke and North Hampshire Hospital	Unknown
6	Nurse (Pain Sister)	Pain	Band 6	Basingstoke and North Hampshire Hospital	Medium: Hospital intranet, Microsoft® Office Outlook®, blood results, PMS system, Google™, Microsoft® Office Excel®, record data for audits
7a	Ward Manager	Surgical Assessment Unit	Band 7	Birmingham City Hospital	Medium: iSoft® Lorenzo® RCM (transferring patients, scanning notes). Microsoft® Office Word, Excel, PowerPoint, Internet
7b	Nurse	Surgical Assessment Unit	Band 6	Birmingham City Hospital	Medium: Lorenzo RCM (transferring patients, scanning notes). Word, Excel, Microsoft® Office PowerPoint®, Internet
8	Nurse	Medicine MSSU	Band 7	Birmingham City Hospital	Medium: ICM – patient finder, results, discharge, the Microsoft® Office System
9	Doctor	Poisons	FY2	Birmingham City Hospital	High: In-house ICM, Web client (clinical data archive), x-rays. previous professional IT experience
10	Nurse	A&E	Band 7	Birmingham City Hospital	Low: IPM Lorenzo PAS, x-rays
11	Doctor	Rotating: Cardiology, Neurology, Breast Surgery (current)	FY1	Whipps Cross	Medium: In-house blood system, PACS (Agfa®), PAS, Excel, GraphPad Prism®, email, Microsoft Office
12a	Doctor	Rotating: Diabetes, General Medicine, Elderly, Cardiovascular	FY1	Royal London Hospital	Medium: CRS, EPR, PACS, Word, PPT, Internet, email
12b	Doctor	Rotating: General Medicine, Endocrinology	FY1	Royal London Hospital	Medium: CRS, EPR, PACS, Word, PPT, Internet, email
13	Doctor	ICU	FY1	Homerton	n/a

Table 12: Testing Participants

B.4.2 Key Findings

- Clinicians understood how to enter observation data into a form using standard controls, such as drop-downs and radio buttons
- However, clinicians felt that it would be too time-consuming to enter data in this way
- Clinicians understood how to reveal hidden fields with the check box control and/or by selecting a data item, as long as there is sufficient labelling and prompts
- Clinicians may try to enter too much information into a search field (such as for Past Medical History (PMH)) unless there is progressive matching
- Clinicians do not want to navigate to a tab in order to enter a duration or date
- Clinicians quickly learn how to type in data into the ‘natural language’ ‘duration/date(s)’ field
- Clinicians find it unclear and time-consuming to search a long list of search results for a fairly common clinical concept
- Some clinicians find a ‘Current problem’ field ambiguous and unclear, whereas others find it easy to understand
- If the ‘Current problem’ field is located immediately below the additional text field, the clinician may not notice it
- Clinicians want to be able to reorder a summary list (such as a PMH)
- Faced with a ‘search’ or ‘drop-down’ button alongside a search entry field (or combo box), some clinicians may click the button without entering any text.
- Clinicians understand red asterisks mean that a field is required
- Clinicians understand the usefulness of providing a right-hand panel that indicates missed fields, but some clinicians do not notice it: clinicians find it easier to notice in-line indications, such as yellow shading in the missed fields
- Clinicians expected in-line indications for the data that contributed to a calculated value, where appropriate (in this case, where the values are ‘out-of-range’)
- Clinicians need the label to be visually distinct in order to know that they can click on it to find further information about the calculation. However, after they realise that further information about the calculation may be available, they indicate that clicking on the label is intuitive
- Clinicians expect the same ‘auto-complete’ mechanism in a date dialog as is employed in the summary list entry control, which allows the entry of words such as ‘past’
- Clinicians found the button for adding free text to be insufficiently prominent
- Clinicians expect to be able to access a graphical representation of previous values

B.4.3 Conclusions

- Although the guidance should clearly show how standard controls should be used in electronic forms, further work should be done to make the process more intuitive and less time-consuming
- In order to simply reveal fields on a form, provide a check box control in addition to providing a mechanism that automatically reveals fields when a certain data item is selected
- Provide progressive matching where technology supports it
- In the control for entering summary lists, do not hide fields behind a tab

- Provide a ‘natural language’ entry field which matches duration and date phrases and numbers as they are entered, and provide a ‘play back’ of what they have entered in a more formal structure
- Distinguish common matches in the search results
- If a ‘Current problem’ field is to be featured, locate it next to the ‘duration/date(s)’ field
- Provide a feature to reorder the summary list
- Do not feature a search button if the matching is done progressively. Feature a search icon where appropriate
- Do not feature a drop-down button in the ‘duration/date(s)’ entry field
- Feature red asterisks next to the labels of required fields
- Shade required fields in yellow where they have been missed by the clinician (that is, where the clinician has moved the focus to a field that is after the required field in the tabbing order)
- Provide a right-hand panel that lists missed fields in addition to in-line indications of missed fields
- Where appropriate, feature in-line indications of values that contribute to a calculated score
- Ensure that the label of the calculated score visually communicates that it can be clicked
- Ensure that the button for adding free text is sufficiently prominent
- In a previous values dialog, provide access to a graphical representation of previous values

B.5 Design Iterations: Findings and Design Updates

Table 13 to Table 19 describe the design iterations in each area of testing, including the findings and changes made in each case. The left-hand columns indicate the number of design iterations performed.

Table 13 describes the design iterations for entering summary lists:

Iteration	Headline Findings and Comments	Changes
1	Too time consuming Don't always want to add a date Wants to write everything in 'additional text' Wants to be able to add natural terms that are how he would write them Clinician does not like systems that require codes or exact text	Remove 'attribute' tabs: feature 'duration/dates' and 'current problem' fields in the same area as the additional text field Provide 'natural' date input
2	Clinicians tried to enter everything in the first field Clinicians tried to type all information in the 'additional text' field Too many search results returned Time consuming/too much detail required/over-complicated It is strange separating the concept from its details, but it does make sense More emphasis on date rather than details 'Current problem' is ambiguous Want to be able to sort by date Depending upon the situation, either the 'natural language' or the calculated date would be most appropriate in the final display	Improve visual appearance, including removing fields from around the calculated date

Iteration	Headline Findings and Comments	Changes
3	<p>Need to indicate that dates are approximate</p> <p>Clinician tries to select from date drop-down without typing</p> <p>Clinician finds it hard to find the 'next' entry field</p> <p>Clinician cannot find items at the top of the list</p> <p>Must be able to use familiar nomenclature</p> <p>Not hard, but long-winded</p> <p>SNOMED CT limitations – "gangrenous toes"</p> <p>Did not notice 'Current problem' check box</p>	<p>Remove date drop-down button</p> <p>Remove frames</p>
4	<p>Entered 'ketacidosis' as part of the 'diabetes' entry</p> <p>Too many results returned</p> <p>Would expect a shortlist of common matches</p> <p>Typed in the duration/date(s), but did not select it</p> <p>Did not understand the 'Current problem' field</p>	<p>Provide 'progressive' matching</p> <p>Provide a common matches 'shortlist'</p>
5	<p>Clinician confused as to whether to type into the search field or click on the button</p> <p>Missed the 'Current problem' field</p> <p>Would like to enter a problem and then, below it, list the associated complications</p> <p>Clinicians claimed that the data entry process seemed 'time consuming', although they did complete the tasks quickly and without major problems</p> <p>Types in date, but does not select it</p> <p>Colours and alignment are not good</p> <p>Wants to be able to change the order (for example, by 'drag and drop')</p> <p>Some shorthand not recognised in the SNOMED CT search</p>	<p>Replace the 'Search' button with a non-clickable icon</p> <p>Remove the 'Current problem' field</p> <p>Improved alignment and slightly indented the attribute fields.</p>

Table 13: Entering Summary Lists

Table 14 describes the design iterations for required fields:

Iteration	Headline Findings and Comments	Changes
1	<p>Red asterisks are very clear and understandable</p> <p>Indifferent to the side panel</p> <p>Expect such validation upon clicking the final 'Submit'</p>	
2	Red asterisks are very clear and understandable	
3	Did not notice the right-hand side panel	<p>Replace right-hand panel with in-line indication of having missed a field: yellow shading in the field</p>
4	Did not notice the red asterisks	Reintroduced the right-hand panel

Table 14: Required Fields

Table 15 describes the design iterations for displaying automatic calculations:

Iteration	Headline Findings and Comments	Changes
1	Expected visual cues for 'out-of-range' values Label/value do not seem 'clickable'	
2	Expected visual cue for 'out-of-range' values Over-complicated Alerts are not sufficiently obvious	Added visual cues for 'out-of-range' values
3	Lots of comments relating to EWS alerts rather than calculated values Some clinicians needed prompting to click on the label to find more information Generally participants had no problems with understanding what was calculated and what had been entered, and found it intuitive to click on an item to find further information	Replaced the 'calculated' icon with an underline for the label
4	Clinician would expect a standard action plan to appear if they click on the 'details of scoring' button	

Table 15: Displaying Automatic Calculations

Table 16 describes the design iterations for entering durations:

Iteration	Headline Findings and Comments	Changes
1	Limited applicability Concerns over spurious accuracy Would like 'asap' option	
2	Would expect to use shorthand Would like auto-complete Concerns over spurious accuracy Expects to be able to enter 'past 22 years' Limited in expression, in that you cannot express frequency	Provide auto-complete Allow the entry of words such as 'past'
3	Limited applicability: this concept "falls between two stools"	

Table 16: Entering Durations

Table 17 describes the design iterations for general form design (including revealing fields):

Iteration	Headline Findings and Comments	Changes
1	Would expect to type a single line, for example 'HS 1+2+0=Clear, Otherwise normal' Does not think 'Not examined' is a good default Wants progressive disclosure of fields	Implemented the progressive disclosure
2	Free text would easier than making selections Might not know that there are fields for further details Negative statements are useful	

Iteration	Headline Findings and Comments	Changes
3	Free text would be easier than making selections Want drawings/annotations Clinician does not realise they should click 'No' for further details Buttons are too small Must be able to use familiar nomenclature	
4	Need the ability to add free text Text is too small Laborious: would prefer tick boxes	

Table 17: General Form Design

Table 18 describes the design iteration for adding free text:

Iteration	Headline Findings and Comments	Changes
1	Clinician expected to be able to find what they wanted to enter as fixed choice widgets Button was not sufficiently prominent	

Table 18: Adding Free Text

Table 19 describes the design iteration for displaying previous values:

Iteration	Headline Findings and Comments	Changes
1	Clinicians liked this feature and would find it useful Seeing a graph would be more useful	

Table 19: Displaying Previous Values