

# User Interface Guidelines

## Design Guidelines

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# Background

## Project Background

The interoperability of a primary care practice's Electronic Medical Record (EMR) with the pan-Canadian Electronic Health Record (EHR) can provide many benefits, such as shared access to complete and accurate health records and improved public health surveillance. To facilitate interoperability, Canada Health Infoway has specified the use of reference terminologies, including the Systematized Nomenclature of Medicine Clinical Terms (SNOMED CT). Although it is crucial for EMR vendors to leverage standardized codes, it is also critical that EMR vendors consider usability aspects to make it easier for clinicians to adopt the coding.

Canada Health Infoway engaged Healthcare Human Factors to develop design guidelines surrounding the clinical coding of data using SNOMED CT. Prior to developing the guidelines, Healthcare Human Factors conducted an environmental scan to understand emerging trends, best practices, and challenges of coding data with SNOMED CT. The environmental scan examined both national and international efforts, but mainly focused on endeavours by the National Health Service (NHS) in the UK, who has also adopted SNOMED CT as the reference terminology for their health information systems.

As part of the environmental scan, a number of sources were consulted:

- Literature, including peer-reviewed journal articles and grey literature
- Existing guidelines, in particular, the Microsoft Health Common User Interface Guidelines (MSCUI)
- Interviews with eHealth researchers, implementers, and innovators
- Heuristic evaluations of existing coding implementations

See the environmental scan for full details of the findings.

## Purpose

This document presents a series of design guidelines for incorporating SNOMED CT into a primary care EMR. The guidelines focus on usability and safety aspects of clinician coding at the level of the user interface. Since SNOMED CT is immense, the objective is to present a manageable number of terms to the end user to ease clinical coding at the point of care.

These guidelines contain suggested best practices and are not necessarily final recommendations.

## Intended Audience

Although the guidelines stem from work from a number of medical domains and may be applicable across other domains, the intended audience for these guidelines are designers and implementers of primary care EMRs in Canada.

## Format of Guidelines

The guidelines cover five main areas:

- Context and Display (CD) – Presentation and display of concepts
- Structured Forms (SF) – Forms that contain predefined options
- Search (SR) – Input fields that allow users to search for concepts
- Elaboration (EL) – Fields that allow users to express additional attributes
- Free-text Parsing (FP) – Noting areas that allow users to type in free-text

The first section primarily covers display, while the remaining four sections cover input approaches.

Each guideline is presented in the following format:

<p><b>Guideline &lt;abbreviation&gt;&lt;#&gt;. &lt;guideline statement&gt;</b></p> <p><b>Description:</b> &lt;Information and examples on how to implement the guideline, including wireframes. The wireframes are provided for illustrative purposes only and are not meant to be implemented exactly as shown.&gt;</p> <p><b>Rationale:</b> &lt;Rationale behind the guideline, stemming from environmental scan findings and the MSCUI guidance&gt;</p> <p><b>Environmental Scan Findings:</b> &lt;List of related best practices and challenges from the environmental scan, for further reference&gt;</p> <p><b>Related NHS/MSUI Guidelines:</b> &lt;Detailed list of relevant guidelines from the MSCUI for further reference&gt;</p>
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## Limitations

Limitations of the design guidelines include:

- The design guidelines only pertain to data entry and display specifically related to SNOMED CT encoding. Detailed guidance concerning the general display of medical information and general user interface design and functionality are out of scope. Particular guidance surrounding label and button placement, fonts, images, etc. has not been provided. However, the reader is welcome to consult the MSCUI for further examples and to consult the list of additional resources at the end of this document for further guidance.
- Detailed guidance related to technical implementation (e.g., details of algorithms, installing and running terminology servers) is out of scope.
- The guidelines in this document are mostly based on existing work and findings from past implementation experience. Although the wireframes and suggestions in this document have been provided based on human factors expertise, additional user needs analysis, interactive prototype development, and usability testing were out of the current project's scope.

- Wireframe diagrams are highly based on the MSCUI guidance, with minor adjustments. Where wireframes differ significantly from the MSCUI, differences have been noted within the specific guideline.
- The MSCUI guidance's related to terminology encoding are still under development and have yet to be evaluated in actual EMR implementations. In addition, past SNOMED CT implementations have often lacked formal user acceptance and outcome evaluations.
- The NHS Connecting for Health Common User Interface team provided a draft version of a consultation document, entitled, "Suggestions for Implementing SNOMED CT into the User Interface of an Electronic Healthcare System". Although this document has been referenced herein, the full document is not currently available for further distribution.
- Decision support can further enhance clinician workflow and patient safety. However, most SNOMED CT implementations do not currently offer decision support, and this feature remains out of scope for the MSCUI guidance.
- The MSCUI did not examine Pharmaceutical/Biological Products concepts. The reason for exclusion was that further disambiguation between contexts of prescribing, administering, recording history of administration, and recording patient supplies is needed.
- Some of the guidelines are less feasible to implement than others (e.g., free-text parsing is more challenging to implement). These challenges have been noted within the affected guidelines.
- The design guidelines assume that the user is interacting with either a standalone or web application on a desktop or laptop computer using a keyboard and a mouse. Although the guidelines may also be relevant to other types of human interface devices (such as touchscreens), these other types of devices have not been specifically considered within the guidelines.

# Design Guidelines

## Context and Display

### Listing of Guidelines

- Guideline CD1. Limit the number of concepts presented to the user.
- Guideline CD2. Use plain language in the user interface.
- Guideline CD3. Use headings and avoid repetition when displaying encoded and unencoded information.
- Guideline CD4. Avoid truncation whenever possible.
- Guideline CD5. Use graphical methods to ease comprehension.

## Guideline CD1. Limit the number of concepts presented to the user.

### Description:

Whenever presenting concepts for the user to select or confirm, such as in a results list, the following should be considered:

- Only present concepts relevant to the current context or the task-at-hand by choosing appropriate concepts or using subsets. For example, when entering a health concern, the set of possible search results should be limited to just diagnoses or symptoms, and not include other items, such as medications or social behaviours. In addition to limiting the results based on the task at hand, the system could set context automatically based on the current user or their speciality.
- Only include concepts that are in English or French, as these are the official languages of Canada. Other commonly spoken languages could also be included, if necessary.
- Exclude inappropriate content that should never be selected, such as veterinary medicine related terms.
- Exclude inactive concepts.

For specific recommendations when implementing specific user interface controls for contextual limitation, refer to Guideline SF2 for structured forms, Guideline SR2 for searching, and Guideline FP6 for free-text parsing.

### Rationale:

Since SNOMED CT contains over 393,000 active concepts, it is crucial that the system limits the number of concepts to avoid overwhelming the user. In addition, limiting the number of concepts being processed at a time can improve system performance.

### Environmental Scan Findings:

- Best Design Practice #1
- Best Design Practice #3
- Design Challenge #1

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.4.1	n/a	Must filter the concepts considered during the matching process, by subsets, where such subsets are available
			Must only match concepts that are 'current' or 'pending move'.
Suggestions for Implementing into the UI of an EHS	3.1	SCT-003	Exclude inappropriate content.
		SCT-004	Exclude inactive concepts.
		SCT-005	Present only SNOMED CT concepts relevant to context.

## Guideline CD2. Use plain language in the user interface.

### Description:

Whenever presenting SNOMED CT labels or concepts to the end user, it is strongly recommended that plain language be used. The presentation of more user-friendly and meaningful terms is encouraged over the less intuitive labelling sometimes used within SNOMED CT. Specifically,

- The phrase “SNOMED CT” and concept ID numbers should not be shown to users. Also SNOMED CT jargon, such as “terminology axis”, “fully specified name”, “preferred term”, and “qualifier”, should not be shown to users.
- Interface terminologies should be used to replace less user-friendly concepts. For instance, the SNOMED CT modifier, “known absent”, could be replaced by “no” or “no history of” when inputting and displaying the absence of disorders. Similarly, “propensity to adverse drug reaction” could be replaced by “allergy”.
- Natural language reading order should always be employed, regardless of the order in which concepts are post-coordinated or combined together (e.g., “cancer – no history of” should be replaced by “no cancer”).

### Rationale:

The presentation of more meaningful and user-friendly terms improves readability, reducing user confusion and potential misinterpretation errors. Use of interface terminologies can also facilitate maintenance of cross-maps with other classification systems and ease adjustments to SNOMED CT versioning. As a result, users would always see consistent labels, regardless of changes within the terminology server.

### Environmental Scan Findings:

- Best Design Practice #7
- Design Challenge #4

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Display of Clinical Statements	Slide 8	n/a	Do not show the entire SNOMED CT expression with the term identifiers.
			Hide default values of context wrapper modifiers (e.g., “subject of record” defaults to patient).
			Do not show the phrase “SNOMED CT” on screen.
			An interface terminology is required to replace both individual and combination of clinical terms for concept modifiers.
Display of Adverse Drug Reaction Risks	3.3.2	ADR-0025	Label the causative agents ‘Drug/substance’ for example as a column header.
Terminology Display Standards	2.1.2	n/a	Should not display the SNOMED CT concept ID number in the default view of the encoded notes.
			Must render expressions that comprise post-coordinations of multiple concepts in a user-friendly and readable form.
Terminology Matching	2.3.2	n/a	Must keep SNOMED CT Concept IDs hidden from the clinician.



Document	Section #	Guideline #	Guideline Description
Suggestions for Implementing into the UI of an EHS	3.4	SCT-044	Do not display SNOMED CT codes.

**Guideline CD3.** Use headings and avoid repetition when displaying encoded and unencoded information.

### Description:

When displaying encoded and unencoded information, repetition should be avoided to improve readability. As shown below, hierarchical headings can be used to logically group similar information, and indenting statements under the headings can improve comprehension. Per the MSCUI guidance on Display of Clinical Statements, usability testing has indicated that users prefer designs with a clear hierarchy, because the designs resemble paper-based note-taking. In addition, users prefer seeing additional free-text elaboration after the encoded term and not having to click on another control to reveal free text. This layout is consistent with the guidelines suggested under Elaboration, where the elaboration fields always appear after the encoded term.

Health Concerns	
<b>Diabetes mellitus type 1</b>	Poor control
<b>Weight loss</b>	Lost 10 pounds since last month
Family History	
<b>Diabetes mellitus type 1</b>	Mother
<b>MI - myocardial infarction</b>	Father died of MI at age 60
<b>No cancer</b>	No history of cancer

*Example of hierarchical headings and indenting of statements  
(Encoded statements are in bold per Guideline SR18)*

It should be noted that existing guidance regarding display is still exploratory, and further study and evaluation is still required to make and confirm more detailed recommendations.

### Rationale:

Using clear headings and avoiding repetition improves readability of information, avoiding user confusion and potential misinterpretation errors. In addition, keeping elaborations and free-text accessible or always in view is important, as the information can be useful for subsequent interpretation of the coded concept.

### Environmental Scan Findings:

- Best Design Practice #8

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Display of Clinical Statements	Slide 16	n/a	The optimum design appears to be unified (extrapolating the encoded clinical term and indicating what was the additional free text that was not encoded, but keeping them together to form a single phrase of text that can still be read as one statement). This design was preferred over repeating the encoded term separately from the free text, or only showing the encoded terms and having a control to reveal additional free text.
	Slide 20	n/a	Any additional free text added by the clinician should be accessible – if not always immediately visible.
	Slide 48	n/a	Users want and need the interface to intelligently derive contextual labels from statement data and metadata and use this to build a

Document	Section #	Guideline #	Guideline Description
			visual information hierarchy.
			Users prefer to have any common attributes, where they exist, extracted from the individual statement and placed into the heading.
			Users find hierarchical designs with clear headings easier to read.
			Users prefer no repetition of words between the original free text and clinical terms.

**Guideline CD4.** Avoid truncation whenever possible.**Description:**

There may be cases where the user interface limits the amount of characters that can be displayed. For example, in a 32 character-wide selection list with one line per item, about 35% of the terms would need to be truncated. Truncation should be avoided whenever possible. Wrapping text onto two or more lines is recommended for fixed-width lists (see also Guideline SR6 and Guideline SR15). If truncation is required, the following precautions should be taken:

- Truncation should always be done at the end of the text, and not at the midpoint. An ellipsis (“...”) should be used to mark the truncation point.
- Whole words should be preserved, and numbers and units should be kept together.
- The full term should always be displayed to the user prior to selection (such as in a flyout dialog, as discussed under Guideline SR13) to prevent selection error.
- If there are seemingly identical truncated terms, the system should display the text without truncation or warn the user of identical terms to avoid possible selection error.

For areas that are not of fixed-width, the system should provide a control to allow users to adjust the size of the area or to expand the view to display the text without truncation.

It should be noted that existing guidance is still exploratory, and further study and evaluation is required to determine the most intuitive and effective approach.

**Rationale:**

Truncation should be avoided whenever possible, to improve readability and reduce the risk of data misinterpretation. If truncation is required, precautions should be taken to prevent misinterpretation errors.

**Environmental Scan Findings:**

- Best Design Practice #8

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Truncation of Clinical Terms	Slide 19	n/a	Use truncation as a last resort and only when truncated terms are the exception rather than the rule.
			When wrapping encoded text ensure that elements such as labels, numbers, units and separators are kept together where necessary.
	Slide 20	n/a	Do not wrap mid-word (thus creating word fragments with or without hyphens).
	Slide 30	n/a	Do not truncate clinical terms when they appear in a list of fixed width.
			Only use truncation in a selection list of clinical terms if the choice of text to truncate is informed by the data structure or a manually defined means of selecting acceptable text to truncate is available.
	Slide 52	n/a	When text is truncated at the end, display (at least) an ellipsis at the point of truncation.
	Slide 53	n/a	Do not support the use of the ellipsis as a control (such as a button) for accessing the full text of a truncated term
	Slide 59	n/a	For fixed-width lists, when a list contains identical truncated terms (and when this can be determined) display the list without truncation by default.
For fixed-width lists, when it is not possible for the system to determine whether a list contains identical truncated terms, provide a notification warning of the presence of identical			

Document	Section #	Guideline #	Guideline Description
			truncated terms
	Slide 66	n/a	If it is possible that a list may contain truncated text, allow the user to display the list without truncation.
			If it is possible that a list may contain truncated text, give the user control over the width of the list. ( <i>Note: This would not apply to fixed-width lists.</i> )
	Slide 67	n/a	Ensure that the full text of a truncated term is displayed and acknowledged before an action can be carried out on the selected term.

**Guideline CD5.** Use graphical methods to ease comprehension.**Description:**

Instead of purely text-based statements, icons and graphs can be utilized to ease comprehension. For example, instead of displaying numerical values or stating severity (e.g., mild, moderate, severe), graphs or icons could be used to display this information. In addition, graphics could be used to ease noting. For example, instead of asking users to enter or select parts of the body, the system could present an image of the body from which users could simply click on the specific part of the body.

Although general guidance on designing and presenting icons and graphs is out of the scope of the present guidance document, the MSCUI does offer detailed recommendations on Displaying Graphs and Tables and Noting using Graphics, as referenced below. However, within these MSCUI documents, terminology encoding is limited to recommendations to use SNOMED CT concepts for measurement units, axes, or titles. Thus, further study and evaluation is still needed to create and refine guidelines as they pertain to SNOMED CT.

**Rationale:**

Graphical noting can help users input information more intuitively and efficiently, and graphical forms of display can improve readability and interpretation of information. However, further study and evaluation is required to create and refine guidelines as they pertain to SNOMED CT.

**Environmental Scan Findings:**

- Best Design Practice #8

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Display of Clinical Statements	Slide 24	n/a	For examinations and findings, users find purely text-based statements too dense to read and would like to see common graphical noting used to support the text, for example, to indicate male/female, left/right.
			Graphics and icons are most effective when used as shorthand for data and not just used to indicate free-text (for example, a pencil icon), as users find this visually cluttering.
Displaying Graphs and Tables	n/a	n/a	<i>(This document recommends to use standard terms (SNOMED CT) whenever possible, including axes and labels. The document also outlines general guidance for displaying graphs and tables.)</i>
Noting with Graphics	n/a	n/a	<i>(Terminology encoding is noted as out of scope, but can still be used for general guidance.)</i>

## Structured Forms

### Listing of Guidelines

- Guideline SF1. Use structured forms when there are a limited number of possible terms (e.g., 20 or less).
- Guideline SF2. Choose appropriate options and order them intuitively.
- Guideline SF3. Use checkbox, radio button, and dropdown lists appropriately.
- Guideline SF4. Allow users to easily add and view additional attributes and free-text.

**Guideline SF1.** Use structured forms when there are a limited number of possible terms (e.g., 20 or less).

**Description:**

When a data field is limited to a small number of possible terms (e.g., 20 or less) that can be enumerated in advance, structured forms should be used. Structured forms present a series of predefined or fixed-choice options mapped to SNOMED CT concepts. Typical designs including dropdown, radio button, or checkbox lists, as shown below. Radio button and checkbox lists should contain ten or fewer items, but dropdown lists can be used if there are more than ten items. For more specific guidance on choosing the appropriate control, refer to Guideline SF3.

Site of Measurement:

*Example of dropdown list*

**Patient Education:**

- Less than high school
- High school diploma
- Undergraduate or college degree
- Graduate degree

*Example of radio button list*

**Sites Examined:**

- Skin
- Head
- Eyes
- Ears
- Neck
- Back

*Example of checkbox list*

Another alternative is to use graphical noting (see Guideline CD5), such as presenting an image of the body from which users could select anatomical sites.

**Rationale:**

Since fewer options are presented to users, the accuracy and completeness of entries can be improved. However, if the number of possible terms is quite large, search mechanisms should be considered (see Guideline SR1), to avoid overwhelming the user with too many choices.

**Environmental Scan Findings:**

- Best Design Practice #2

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	9.3.1	CNA-1880	A group of radio buttons should contain at least two items and a maximum of seven plus or minus two.
		CNA-1980	Aim to keep the number of check boxes to 10 or fewer.



## Guideline SF2. Choose appropriate options and order them intuitively.

### Description:

Structured forms should reflect workflow and appropriate options to ensure that users can complete forms with accuracy. Items should represent mutually exclusive options to reduce user confusion. The selection of items may also require validation with end users to ensure greater user acceptance. However, as there may still be cases the user cannot find an appropriate option, presenting an “Other, please specify” input field can increase flexibility, as shown below. Entries into this other field should be reviewed periodically to determine whether the displayed options are indeed appropriate.

#### Sites Examined:

Skin  
 Head  
 Eyes  
 Ears  
 Neck  
 Back  
 Other, please specify:

#### *Example of checkbox list with “Other, please specify” field*

In addition to selecting appropriate items, the items should be listed in a logical order, such as grouping highly-related options together or placing common options first. For example, as shown below, severity should be listed in the order of increasing severity. In the absence of any logical ordering, alphabetical order should be considered.

Severity:

Mild  
Moderate  
Severe

#### *Example of logical ordering in a dropdown list*

### Rationale:

Past implementation experience has indicated that users tend to abandon forms with too many detailed or inappropriate options. Adding an “Other, please specify” field can mitigate situations where the user cannot find the appropriate option, and periodic review can ensure that forms reflect relevant options. Ordering the list items in a logical manner facilitates scanning and prevents selection error.

### Environmental Scan Findings:

- Best Design Practice #2

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	9.3.1	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.

Document	Section #	Guideline #	Guideline Description
		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.

**Guideline SF3.** Use checkbox, radio button, and dropdown lists appropriately.

**Description:**

Form controls should be employed appropriately. Specifically:

- Checkbox lists should be used when multiple items need to be selected. The number of checkbox items should be limited to ten or less.
- Radio button and dropdown lists should be used when only one item needs to be selected.
- Dropdown lists are recommended over radio buttons if there are greater than ten items and there is limited space on the screen. However, dropdown lists should not be used if missing an option impacts patient safety, the list label is not understood by all users, or the list is used infrequently.

Site of Measurement:

*Example of dropdown list*

**Patient Education:**

- Less than high school
- High school diploma
- Undergraduate or college degree
- Graduate degree

*Example of radio button list*

**Sites Examined:**

- Skin
- Head
- Eyes
- Ears
- Neck
- Back

*Example of checkbox list*

**Rationale:**

Form controls should be selected such that they reflect input requirements and facilitate visibility of options to end users.

**Environmental Scan Findings:**

- Best Design Practice #2

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	9.3.1	CNA-1880	A group of radio buttons should contain at least two items and a maximum of seven plus or minus two.
		CNA-1980	Aim to keep the number of check boxes to 10 or fewer.
		CNA-2030	Do not feature a list box if: <ul style="list-style-type: none"> <li>• Missing one or more of the options in the list has important implications for patient safety</li> <li>• There are a small number of options and there is space to display them as radio buttons</li> <li>• The list label is not understood by all relevant users and the list is used infrequently</li> </ul>

**Guideline SF4.** Allow users to easily add and view additional attributes and free-text.

**Description:**

Users should be able to elaborate on a selected concept for increased flexibility. As shown below, the additional attribute or free-text fields should only appear after a concept has been selected (see Guideline EL4). After saving the additional text, the information should always be kept in view.

**Blood Pressure**

Site of Measurement:

Enter additional text

Position:

*Example of additional text field*

**Blood Pressure**

Site of Measurement:   Could not do upper arm because of pain

Position:

*Example of saved free text*

**Rationale:**

Often a single-coded expression is not adequate to describe what a clinician wishes to express. Thus, the system should provide the flexibility for users to specify additional elaboration. The elaboration should be easily accessible and always kept in view, as the information can be important for subsequent interpretation of the coded concept.

**Environmental Scan Findings:**

- Best Design Practice #2
- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	8.3.1	CNA-1680	Provide a mechanism that allows the user to add free text to a fixed choice selection
		CNA-1710	Reveal the control for activating this mechanism where any of the following situations exist: <ul style="list-style-type: none"> <li>• When the user has moved the focus to a fixed-choice data control</li> <li>• At the point that the user has selected from a fixed-choice data field</li> <li>• Upon mouse-over of the associated control or the location of the 'add free text' control</li> </ul>
		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.
		CNA-1740	Move the focus to [the text field] immediately after the user has

Document	Section #	Guideline #	Guideline Description
			selected from a list box.
		CNA-1790	Display free text immediately to the right of the associated fixed-choice control.
		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.
		CNA-1810	Do not hide the free text that the user has entered, if the associated control is in view
Display of Clinical Statements	Slide 20	n/a	Any additional free text added by the clinician should be accessible – if not always immediately visible.

## Search

### Listing of Guidelines

- Guideline SR1. Use search for entering single concepts when there are a large number of possible terms (e.g., greater than 20).
- Guideline SR2. Use contextual limitation to increase relevancy of results.
- Guideline SR3. Provide partial matching by default and highlight search tokens.
- Guideline SR4. Provide progressive matching as the user types in text (feasibility permitting).
- Guideline SR5. Indicate that search activity is occurring.
- Guideline SR6. Ensure that the search field and results list can hold sufficient characters.
- Guideline SR7. Match single or multiple search terms, regardless of word order.
- Guideline SR8. Offer flexibility during search entry, by handling synonyms, abbreviations and acronyms, upper- and lower-case, non-alphanumeric characters, and foreign characters.
- Guideline SR9. Do not search by concept ID or fully specified name — only match synonyms and preferred terms.
- Guideline SR10. Return lexically matching descriptions, but remove redundant or unused synonyms if possible.
- Guideline SR11. Prioritize commonly used terms or provide favourites.
- Guideline SR12. Order the results list in an intuitive and useful manner.
- Guideline SR13. Display additional information for each result.
- Guideline SR14. Display 10-20 results simultaneously in a scrollable list near the search entry field.
- Guideline SR15. For lengthier terms, always provide access to full text.
- Guideline SR16. Explicitly state when no results are found, and provide assistance.
- Guideline SR17. Provide word equivalence matching, and ensure that the option is visible.
- Guideline SR18. Upon selecting a term, replace the typed text and show that it has been encoded.
- Guideline SR19. Allow users to edit and delete confirmed entries before being committed to record.
- Guideline SR20. Provide browsing for refinement (necessity permitting).
- Guideline SR21. For multiple list entries, only display the next field upon confirmation of a concept.
- Guideline SR22. Allow users to easily add and view additional attributes or free-text.

**Guideline SR1.** Use search for entering single concepts when there are a large number of possible terms (e.g., greater than 20).

**Description:**

When there are many possible concepts (e.g., greater than 20), search input fields can allow users to more easily find the desired term. Browsing in general can be slow and overwhelming for users when there are thousands of concepts, and can be confusing if the user is not familiar with the organizational structure of the data (e.g., the SNOMED CT hierarchy). Search functionality offers greater flexibility than structured forms, but should not be used if the clinician is expected to enter a large, rich set of notes containing many concepts to be encoded.

Due to differences in functionality, the search field should appear distinct from non-encodable data fields. In the example shown below, the search field has an added magnifying glass icon to indicate search functionality.

Health Concern:

*Search Field (encodable)*

Value:

*Regular Field (non-encodable)*

**Rationale:**

Easing the concept selection process through searching encourages users to use encoded terms during data entry. The search or single concept matching approach has been used commonly in past clinical information system implementations with greater success than browsing.

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0010	Provide a mechanism into which the user can type in a list of clinical phrases while the system returns matched terms from the appropriate terminology.
		CNA-0020	Provide a single field into which the user can type a clinical term (search entry field).
Terminology Matching	2.1.1	n/a	The system must allow the user to search for a single concept and immediately view the possible matches ('single concept matching'). This should be available as a standalone process, or as part of matching refinement in a text parser approach.
			Do not offer the single concept matching approach if the clinician is expected to enter a large and rich set of notes.
			Do not offer the single concept matching approach if the clinician may wish to enter notes that will require post-coordinated expressions.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-008	Ensure it is clear which text entry fields are encodable.

**Guideline SR2.** Use contextual limitation to increase relevancy of results.

**Description:**

As discussed in Guideline CD1, only those concepts that are relevant to context should be presented to users. Since SNOMED CT contains over 393,000 active concepts, it is crucial that search mechanisms only work upon concepts that are relevant to the current context. Subsets should be employed so that users do not have to browse through irrelevant concepts. For example, when entering a health concern, the set of possible search results should be limited to just diagnoses or symptoms, and not include other items, such as medications or social behaviours.

In addition to limiting the results based on the task at hand, the system could set context automatically based on the current user or their specialty. There may also be value in providing specialties to primary care clinicians to help refine context. Shown below is an example of a control that could be used to select specialties.

Please select specialties:

- Primary Care/Core Specialty (mandatory)
- Cardiology
- Dermatology
- Endocrinology
- Infections
- Injuries
- Urology

[Select All](#) [Clear All](#)

*Example of control to select specialties*

Alternative wireframe examples, including a filter slider control when subsets are logically nested, and a radio button control when subsets are not nested, are also provided below. The provision of a button indicating the current filter is also helpful to increase visibility of the current filter being applied.

Current filter: Health Concerns

Health Concern:

Widen or narrow the range of matching words:

- No filter
- Primary Care Subset
- Health Concerns Subset

*Example of filter slider control used when subsets are logically nested*

Current filter: Health Concerns

Health Concern:

Change filter:

- No filter
- Health Concerns subset

*Example of radio button control used when subsets are not logically nested*



**Rationale:**

Increasing the relevancy of results can reduce the number of results presented to users, helping them to more quickly select the desired concept. Employing subsets can also improve system performance since there is a smaller dataset upon which to search. Providing a control that allows users to change the context increases flexibility and can be valuable for additional refinement or expansion of the range of results.

**Environmental Scan Findings:**

- Best Design Practice #1
- Design Challenge #1

**Related NHS/MSUI Guidelines:**

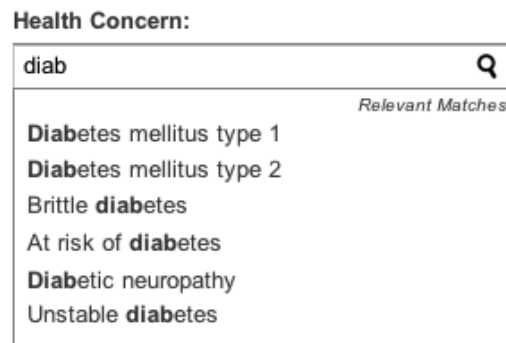
Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.4.1	n/a	Must filter the concepts considered during the matching process, by subsets, where such subsets are available.
			Must allow users to adjust the subset filters.
			Should feature a slider control if there is a linear relationship between subsets, that is, if the subsets are logically nested.
			Could refer to limiting matches by subsets such as 'Filtering'.
Suggestions for Implementing into the UI of an EHS	3.1	SCT-005	Present only SNOMED CT concepts relevant to context.
	3.5	SCT-057	Provide an option to expand beyond the default context.

### Guideline SR3. Provide partial matching by default and highlight search tokens.

#### Description:

By default, the system should automatically perform partial or prefix matching. The user should not be forced to enter a full or exact word to trigger a search or enter wildcard characters to trigger a partial word search. For example, the system should automatically handle the search string, *diab*, as *diab\**. Any exact matches could still be prioritised to the top of the results list.

When conducting partial word matching, it may be difficult for users to identify how the results relate to the entered search query. As shown below, highlighting the part of each result item that matches the search keyword can improve the visual association between the results and the search term.



*Example of highlighted tokens within results*

#### Rationale:

Partial matching can increase user efficiency, as users do not have to type all of the characters of each word or know how to use wildcard characters. Partial matching can also help address situations where users are uncertain of a word's proper spelling. Highlighting search tokens within the results can improve visibility of the relationship between the results and the search term entered.

#### Environmental Scan Findings:

- Best Design Practice #1

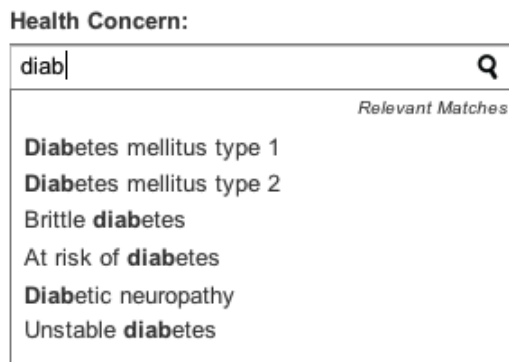
#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Should feature partial, or 'prefix', matching in the case of single concept matching and matching within the encoding dialog.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-014	Do not require the user to enter wildcard characters to enable partial matching.
	3.3	SCT-028	Perform partial matching by default.
	3.4	SCT-047	Highlight search tokens in the result.

**Guideline SR4.** Provide progressive matching as the user types in text (feasibility permitting).

**Description:**

Progressive matching extends partial matching (see Guideline SR3), in that results are automatically displayed for each successive character that is typed by the user. The user does not have to press *Enter* on the keyboard or click on the search button (or magnifying glass icon) to initiate a search, enhancing user efficiency. For maximal visibility, the results should be displayed near where the user is typing, such as below the search input field as shown below. As when conducting partial word matching, highlighting the part of each result item that matches the search keyword can improve the visual association between the results and the search term.



*Example of search results for progressive matching*

Although progressive matching can be a very powerful feature for users, performance may be an issue particularly with larger SNOMED CT datasets. Contextual limitation (see Guideline SR2) and/or prioritising common matches (see Guideline SR11) can be employed to improve performance. The MSCUI on Terminology Matching suggests that the results are updated within 200 milliseconds of the key press. Informing the user that the search is taking place (see Guideline SR5) may be necessary when searches take longer than this suggested timeframe.

**Rationale:**

Progressive matching can increase efficiency by saving typing time and suggesting matches to users when they are unsure of the exact term for which they are looking. This approach is used in a number of popular search engines, including Google, meaning greater familiarity to users. Reception of the feature has also been very positive in a number of previous SNOMED CT implementations, improving the uptake of encoded data entry.

**Environmental Scan Findings:**

- Best Design Practice #1
- Design Challenge #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0050	Progressively match terms as the user types in text.
Terminology Matching	2.3.1	n/a	Should feature progressive matching in the case of single concept matching and matching within the encoding dialog, that is, typing in a new character (or deleting a character) invokes a matching event.
			Must ensure the matching event invoked during progressive matching is sufficiently timely. Should ensure that the matching

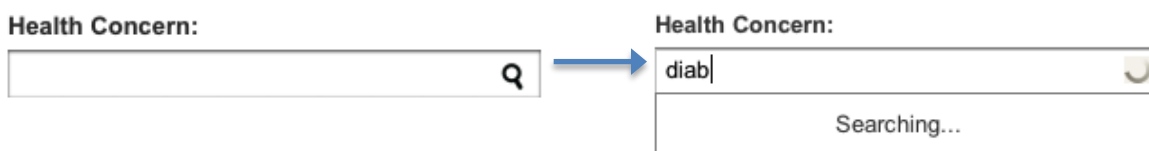
Document	Section #	Guideline #	Guideline Description
			event is invoked within 200 milliseconds of the key press.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-023	Provide progressive matching (performance permitting)

## Guideline SR5. Indicate that search activity is occurring.

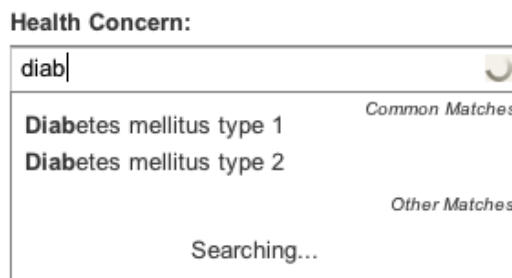
### Description:

The system should inform the user when searches are running, especially when there is a significant delay between when the user triggers the search and sees results. When performing progressive matching the MSCUI on Terminology Matching suggests refreshing the results within 200 milliseconds of each key press. If the search is triggered manually by pressing *Enter* on the keyboard or pressing the search button (or magnifying glass icon), a loading indicator should be displayed when response times are greater than 1 second.

The animated loading indicator should be prominent to users, but not visually obstruct the search dialog or other components. Examples of the loading indicator are provided in the wireframe diagrams below. The animated loading indicator replaces the magnifying glass icon, which can help prevent the user from manually triggering the search repeatedly. In addition, explanatory text (“Searching...”) is provided where the results would otherwise appear.



Example of loading indicator when searching



Example of loading indicator with prioritised common matches (see Guideline SR11)

### Rationale:

The loading indicator provides greater visual feedback of system status to users, and prevents users from trying to re-initiate the search needlessly or abandoning the search when the system does not appear to be responding.

### Environmental Scan Findings:

- Best Design Practice #1
- Design Challenge #1

### Related NHS/MSUI Guidelines:

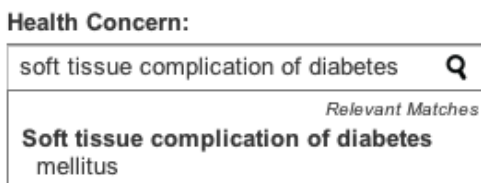
Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0090	If there is a significant delay between the user triggering the matching process and the system returning matches, provide an indication that there is search activity occurring until matches are returned. Note: Any time period longer than a second could be defined as a significant delay.
		CNA-0100	Indicate that search activity is occurring by providing an animation.

Document	Section #	Guideline #	Guideline Description
		CNA-0110	Display the activity animation in a position that is prominent, but does not visually obstruct the search facility.
Terminology Matching	2.3.1	n/a	Must ensure the matching event invoked during progressive matching is sufficiently timely. Should ensure that the matching event is invoked within 200 milliseconds of the key press.
	2.3.2	n/a	Ensure that matches are presented sufficiently promptly.
Suggestions for Implementing into the UI of an EHS	3.3	SCT-034	Inform the user that a search is taking place.

**Guideline SR6.** Ensure that the search field and results list can hold sufficient characters.

**Description:**

The search entry field should display at least 32 characters simultaneously and hold up to 255 characters in total. In addition, the results list should be fixed-width, containing 32 characters per line. Terms exceeding 32 characters should be wrapped onto a second line indented by two characters, as shown in the example below.



*Example of 32-character wide search field and results list*

For guidance concerning terms longer than two lines or greater than 62 characters, see Guideline SR15.

**Rationale:**

Ensuring that 32 characters are visible allows the full text of over 65% SNOMED CT labels (preferred terms and synonyms) to be displayed. In addition, wrapping the SNOMED CT label over two lines (62 characters plus the two-character indent) allows 95% of all labels to be displayed in full. Ensuring that the search entry field can hold a maximum of 255 characters allows users to type the full length of all SNOMED CT labels.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #8

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0190	Ensure the search entry field can display 32 characters simultaneously
Terminology Matching	2.2.2	n/a	Must provide a visible space in the input field that can accommodate a text string of 32 characters long.
			Must allow the user to type up to 255 characters in the input field.
			Should wrap labels that exceed 32 characters over two lines, with the second line indented by two characters.
	2.3.2	n/a	Must allow a width of 32 characters for the matches list.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-010	Ensure that the text entry field can hold sufficient characters.

**Guideline SR7.** Match single or multiple search terms, regardless of word order.

**Description:**

Users should be allowed to enter single (e.g., *diabetes*) or multiple (e.g., *soft tissue*) search terms that can match SNOMED CT labels that contain multiple words. In addition, the order of terms should not matter, and terms should be automatically combined using the AND operator.

**Rationale:**

The entry field should be flexible to accommodate as many terms as required and in any order. In addition, users expect that by entering additional keywords that they are refining the search and narrowing results (e.g., implying the AND operator), as opposed to widening the search (e.g., implying the OR operator).

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Must be able to match multiple words against a SNOMED CT description that contains multiple words. Must be able to match words regardless of order.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-012	Allow the entry of single or multiple search tokens.
		SCT-013	Search token order independent.
	3.3	SCT-027	Where multiple search tokens are entered, apply the AND operator.



**Guideline SR8.** Offer flexibility during search entry, by handling synonyms, abbreviations and acronyms, upper- and lower-case, non-alphanumeric characters, and foreign characters.

**Description:**

When searching, the input field should be flexible to accommodate user preferences. Specifically, the search should:

- Work on synonyms, as users may utilize different terms to describe the same concept
- Include abbreviations and acronyms, such as *MI* for *Myocardial infarction* (Note: Abbreviations and acronyms are also considered synonyms within SNOMED CT)
- Offer case-insensitivity, as it should not matter whether users type upper- or lower-case
- Handle non-alphanumeric characters (those outside the range of 0-9, A-Z, and a-z), as there are SNOMED CT terms, such as *Non-productive cough*, that contain these characters
- Handle foreign characters, as there are SNOMED CT terms, such as *Sjögren-Larsson syndrome*, which contain these characters. In addition, the input field should be able to handle whether the user chooses to type in the foreign or English characters (e.g., the search should consider *Sjö* or *Sjo* as the same search query)

**Rationale:**

Catering to user preferences and offering flexibility during search entry can help users more easily find the desired concept.

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.2.2	n/a	Must allow users to type in a full range of alphanumeric characters. Could allow users to type in punctuation and capital letters.
	2.3.1	n/a	Must match text against SNOMED CT concept 'preferred term' and 'synonym' descriptions.
	2.3.4	n/a	Must allow users to search using SNOMED CT abbreviations in the same way as for any other synonym. Should not treat abbreviations as case sensitive (that is, treat 'TATT', 'Tatt' and 'tatt' as equivalent entries).
Suggestions for Implementing into the UI of an EHS	3.2	SCT-015	Offer case-insensitivity.
		SCT-018	Handle entered foreign characters.
		SCT-019	Allow replacing of foreign characters with English ones.
		SCT-021	Handle entered non-alphanumeric characters.
		SCT-022	Handle entered abbreviations and acronyms.

**Guideline SR9.** Do not search by concept ID or fully specified name — only match synonyms and preferred terms.

**Description:**

Each SNOMED CT concept consists of a numerical identifier, fully specified name, preferred term, and one or more synonyms. Although there exists multiple ways to find a concept, the system should NOT allow users to search by SNOMED CT identifiers or fully specified name. The search should only work upon preferred terms and synonyms.

**Rationale:**

The SNOMED CT identifier is not meaningful to users, and should not be displayed to users in general (see Guideline CD2). A further risk is that clinicians, who choose to remember the numerical identifier, could mistype the number and enter the wrong concept into the patient's record.

Existing guidance suggests that searching should not include fully specified names. In many cases, the preferred term is equivalent to the fully specified name. In addition, the fully specified name includes a parent or semantic tag (e.g., the *disorder* tag within the fully specified name, *myocardial infarction (disorder)*) that should not be included during a search.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #7

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Must match text against SNOMED CT concept 'preferred term' and 'synonym' descriptions
			Do not match input text against the following SNOMED CT descriptions: Concept ID, Fully specified name.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-016	Prevent searching by SNOMED CT code.

**Guideline SR10.** Return lexically matching descriptions, but remove redundant or unused synonyms if possible.

### Description:

The search results should include SNOMED CT labels (preferred terms and synonyms, per Guideline SR9) that lexically match the entered search term. For example, if *diabetes* is entered, then all labels containing *diabetes* will be returned as a matched result. However, as each concept has multiple synonyms, the number of results from a single search query may be exceedingly large. For example, *diabetes* could return for the single concept ID 290002008:

- *Brittle type I diabetes mellitus* (preferred term)
- *Brittle type 1 diabetes mellitus* (synonym)
- *Labile type I diabetes mellitus* (synonym)
- *Unstable insulin dependent diabetes mellitus* (synonym)
- *Unstable type I diabetes mellitus* (synonym)
- *Unstable type 1 diabetes mellitus* (synonym)

Although one option is to only show the closest matching label for each unique concept, some synonyms may appear sufficiently different that multiple synonyms must still be displayed in order to accommodate flexibility for the end user (see Guideline SR8). In the example shown above, one way to reduce the number of items in the list is to remove *Brittle type 1 diabetes mellitus* and *Unstable type 1 diabetes mellitus*, since the list contains very similar terms already. If the user chooses to *type I diabetes*, the input field could handle the number 1 and the Roman numeral I as the same character. Alternatively, the synonyms including the Roman numeral I could be displayed in the results instead. There may also be other opportunities to reduce the number of synonyms in a subset based on lack of usage within an organization or region.

### Rationale:

The pattern of returning lexically matching results agrees with user expectations, since the results will contain the search terms typed by the user. Although the inclusion of synonyms within the matching process accommodates flexibility, one problem is the sheer growth of results. Past implementation experience has indicated that hiding redundant or unused synonyms can help users navigate through a more manageable number of results.

### Environmental Scan Findings:

- Best Design Practice #1

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.2	n/a	Must display the matched synonym description label if the match is with a synonym and the preferred term description label if the match is with a preferred term description.
			Must display the preferred term or the synonym term label for each suggested match.
Suggestions for Implementing into the UI of an EHS	3.3	SCT-031	Matching results: Option 1: Return all lexically matching concept descriptions Option 2: Return one item per unique concept where that concept has at least one lexically matching description

## Guideline SR11. Prioritize commonly used terms or provide favourites.

### Description:

Prioritizing frequently used terms within the search algorithm can be helpful to users, as these represent matches that would likely be chosen by the user. These results can be placed at the top of the list, separated by a subtitle or header, such as “Frequently Used Terms” or “Common Matches”, as shown in the wireframe below. The common matches list could be based on a group of users or the organization, or for maximal user accommodation, on the individual user. This list of common matches would be adaptive and would learn based on user activity.

**Health Concern:**

diabetes	Q
<b>Diabetes mellitus type 1</b>	<i>Common Matches</i>
<b>Diabetes mellitus type 2</b>	
	<i>Other Matches</i>
Brittle <b>diabetes</b>	
At risk of <b>diabetes</b>	
<b>Diabetic neuropathy</b>	

*Example showing prioritised common matches*

As shown below, another potentially useful feature is to present a list of common matches without requiring the user to enter any characters into the search input field. The list would only appear if the user had placed the cursor within the entry field, bringing the control into focus. Although not noted in the MSCUI guidance, this feature has been used in past SNOMED CT implementations.

**Health Concern:**

	Q
	<i>Common Matches</i>
Abdominal discomfort	
Diabetes mellitus type 1	
Diabetes mellitus type 2	
Food poisoning	

*Example showing common matches without the user entering a search query*

Alternatively, the system can provide or allow the user to create a predefined suggestion or favourites list for the current task. This feature is less challenging to implement than incorporating the frequently used terms within the search algorithm, but does have the disadvantage of being less dynamic based on user activity.

### Rationale:

Prioritizing or presenting commonly used terms can increase efficiency for end users. This approach can also improve system performance, as the system could process the common terms first, and then process a larger subset as needed. See Guideline SR5 for a wireframe diagram illustrating the loading status indicator.

### Environmental Scan Findings:

- Best Design Practice #1
- Design Challenge #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0210	Create a list of common matches from within the clinical terminology (SNOMED CT) against which the user can search for matches.
		CNA-0220	During the searching process, visually distinguish the common matches from remaining matches.
		CNA-0230	Display the common matches above the remaining matches.
		CNA-0240	Provide labels that distinguish common matches from the remaining matches.
Terminology Matching	2.4.1	n/a	Should provide a listing of matches from a 'common matches' subset, that is, push them to the top of the matching list. Should distinguish between 'common' and other matches in the list (where common matching applies).
Suggestions for Implementing into the UI of an EHS	3.2	SCT-026	Provide favourites.
	3.4	SCT-048	Prioritise some concepts by putting them to the top of the results list.
		SCT-049	Add appropriate headers within the results list.

## Guideline SR12. Order the results list in an intuitive and useful manner.

### Description:

Sort order is an important consideration, as it can help users find the desired concept more quickly. Using random or no sort order, or sorting by SNOMED CT hierarchy or concept ID numbers should be avoided. In addition to prioritising frequently used terms (see Guideline SR11), there are two common strategies for ordering individual results:

- Alphabetical - This type of ordering is the easiest for users to recognise, but does not give priority based on similarity to the original search query. In addition, the user has to know the characters that the SNOMED CT label starts with.
- Lexical distance from search term (strength of matching) - Although the ordering is harder to recognise, the sort order gives priority based on the original search term. This sorting method increases the likelihood that the matches near the top of the list are closer to what the user intended, improving user efficiency. For this reason, this sorting method is recommended over alphabetical sorting. The sort method may also incorporate frequency of use to further increase the likelihood that the user finds the desired term at the top of the list.

As also suggested in Guideline SR11 for common matches, the use of subtitles or headers within the results list can also help users understand sort order. As shown below, if common matches are not used, “Relevant Matches” above the results, “Exact Matches” listed above “Other Matches”, or “Nearest Matches” listed above “Other Matches”, could be provided as visual cues. Regardless of the sublist header, the order of results should be consistent across sublists. The only exception may be the “Common Matches” sublist, which may be sorted by frequency of use.

#### Health Concern:

diabetes mellitus	Q
<i>Relevant Matches</i>	
<b>Diabetes mellitus type 1</b>	
<b>Diabetes mellitus type 2</b>	
Gestational <b>diabetes mellitus</b>	
Soft tissue complication of <b>diabetes mellitus</b>	

*Example with “Relevant Matches” header*

#### Health Concern:

diabetes mellitus	Q
<i>Nearest Matches</i>	
<b>Diabetes mellitus type 1</b>	
<b>Diabetes mellitus type 2</b>	
<i>Other Matches</i>	
Gestational <b>diabetes mellitus</b>	
Soft tissue complication of <b>diabetes mellitus</b>	

*Example with “Nearest Matches” and “Other Matches” headers*

It should be noted that even though headers are being used, the results should be displayed as a flat list, regardless of the term’s place within the SNOMED CT hierarchy. Numbering should not be featured next to each list item, as it may confuse users.

### Rationale:

Although users may more easily recognize alphabetical sorting, ordering results based on lexical distance from the search term can help users more quickly find the desired concept. Displaying headers that imply the sorting method can provide additional visibility to the end user.

### Environmental Scan Findings:

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

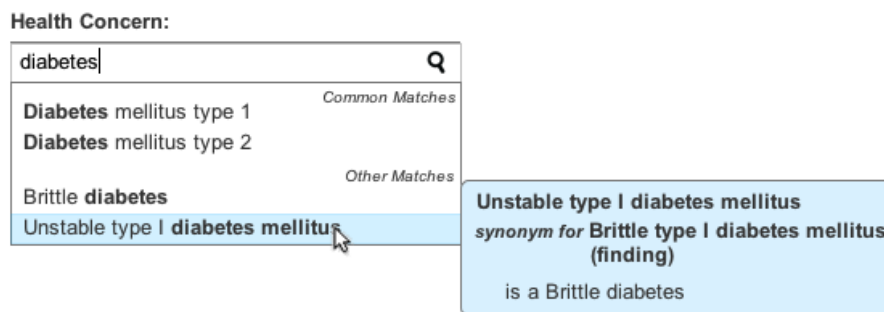
Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Should employ a statistical word matching algorithm. Should feature a vector-space matching algorithm for text that contains multiple words.
	2.3.2	n/a	Do not feature numbering next to each list item.
Suggestions for Implementing into the UI of an EHS	3.4	SCT-042	Display the results as a flat list.
		SCT-049	Add appropriate headers within the results list.
		SCT-050	Ordering the results list.

**Guideline SR13.** Display additional information for each result.

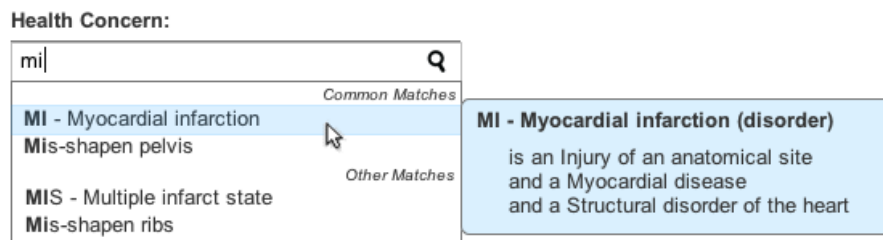
To help users select a result, the system should provide additional information about each match, including:

- the fully specified name (e.g., *Brittle type I diabetes mellitus (finding)*)
- the fully expanded abbreviation (e.g., *MI – Myocardial infarction (disorder)*)
- whether the match is a synonym (e.g., *Unstable type I diabetes mellitus synonym for Brittle type I diabetes mellitus (finding)*)
- parent concepts (e.g., *is a Brittle diabetes*), but not top-level concepts (e.g., *Clinical finding*)

This information could be included as a flyout message upon hovering the mouse pointer over a match, as shown below. Abbreviations should always be expanded in both the results list and the flyout dialog.



*Example flyout of a synonym with a single parent concept*



*Example flyout of an abbreviation with multiple parent concepts*

**Rationale:**

Providing additional information for each result helps users fully understand the selection they are making and prevent inaccurate entries. In some cases, two or more results may appear very similar or have the same spelling, and the additional information can help users distinguish between the multiple matches.

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Must communicate to the user where a match is a synonym. Should communicate to the user in a fly-out that a match is a synonym.
			Must allow the user to view the fully specified name for any concept. Should allow the user to view the fully specified name for

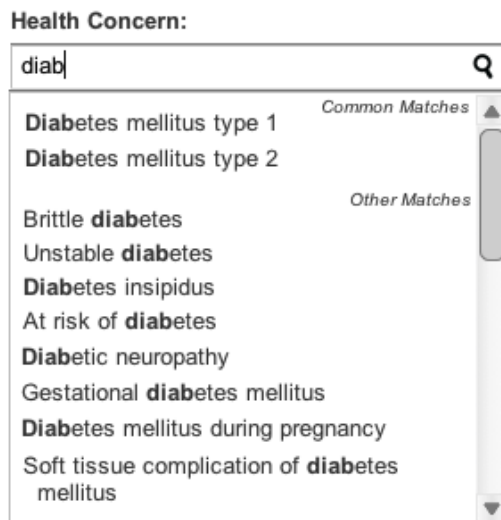


Document	Section #	Guideline #	Guideline Description
			the concept in a fly-out that appears when the user moves the mouse over the concept in a list.
	2.3.2	n/a	Should display the highlighted concept's parent concept labels. Should display the highlighted concept's parent concept labels in the fly-out. Should feature appropriate labels next to each parent concept. Should feature the labels 'Is a' for the first parent, and 'And a' for further parents.
			Do not feature the Top Level Concepts (TLCs) next to each match.
	2.3.4	n/a	Should display both the abbreviation and fully specified name in the fly-out (as with other SNOMED-CT synonyms).
			Must display a combined label of both the acronym and the fully specified name in those instances where the acronym is not combined in the synonym label.
Suggestions for Implementing into the UI of an EHS	3.4	SCT-045	Provide additional information per result.
		SCT-046	Ensure all abbreviations and acronyms include an expanded text.

**Guideline SR14.** Display 10-20 results simultaneously in a scrollable list near the search entry field.

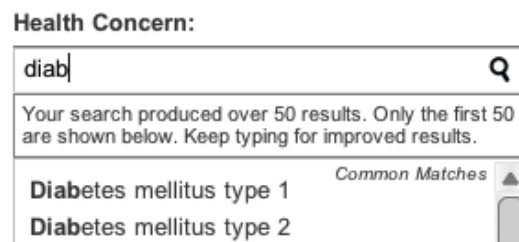
**Description:**

Results should be displayed within a scrollable listbox, with 10-20 results being presented at a time. The results list should be placed near or below the search entry field for maximal visibility of results.



*Example of scrollable results list showing 10 items simultaneously*

Although the scrollable list works well when there are a manageable total number of results (e.g., 50-100), the control becomes cumbersome with lengthier lists. The MSCUI does not deal specifically with this situation, but one solution is to only show a fixed number of results, regardless of the total number of possible results. An advisory message, such as “Your search produced over 50 results. Only the first 50 are shown. Keep typing for improved results.”, could also be displayed to provide additional guidance to the user. This message could be displayed directly below the search input field, as shown below.



*Example of message indicating additional results*

**Rationale:**

Displaying 10-20 items simultaneously allows the user to quickly scan through results and does not overwhelm the user. Placing the results within a scrollable list box below the search field also avoids the extra step of opening another dialog or navigating to another page to view and select a match. However, the scrollbar can become cumbersome to use with lengthier lists and it is unlikely that the user will continue to read through results placed lower in the list. Thus, the system should present a fixed number of total results (e.g., 50-100), and only display other, more relevant results if the user adjusts the search query. This recommendation is consistent with past SNOMED CT implementation experience.

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Must display the SNOMED CT matches close to the input field (in the case of single concept matching and matching within the encoding dialog). Should display the SNOMED CT matches below the input field.
Suggestions for Implementing into the UI of an EHS	3.4	SCT-036	Provide a scrollable results list.
		SCT-037	Display at least 10 results simultaneously.
		SCT-038	Display a maximum of 20 results simultaneously.
		SCT-041	Positioning the results list.

**Guideline SR15.** For lengthier terms, always provide access to full text.

### Description:

As suggested under Guideline SR6, each line within the fixed-width list of results should contain 32 characters. Terms exceeding 32 characters should be wrapped onto a second line and indented by two characters.

However, when a result item exceeds two lines (62 characters plus the two-character indent), there are two options:

- Wrap and indent - Wrapping concepts to three lines ensures that almost all concepts can be displayed without truncation. However, wrapping reduces the number of results that can be viewed at a time within a confined area (such as the scrollable list). Wrapping to more than three lines may also make it difficult to read through lines of results.
- Truncate at the end of the second line and add an ellipsis (“...”) - This approach has the advantage of being able to maintain a constant number of results on the screen. To prevent selection error, the full term should be displayed to the user prior to selection (such as in a flyout dialog, as discussed under Guideline SR13). Furthermore, as discussed under Guideline CD4, the text should be truncated such whole words are preserved and seemingly identical truncated terms are avoided. If there are duplicate truncated descriptions, a warning message, such as “This list contains apparent duplicates. Please enter additional terms to refine your search.” should be presented. This message could be displayed directly below the search input field (see Guideline SR14 for example placement).

As noted under Guideline CD4, existing truncation guidance is still exploratory, and additional study is needed to determine the most intuitive and effective approach.

### Rationale:

To prevent selection error, users need to see the full text of a SNOMED CT concept, whether it be shown upfront in the results list or expanded prior to selection (such as in a flyout dialog). Truncation has the added risk of apparent duplicate descriptions, so additional warning messages are necessary to mitigate this risk.

### Environmental Scan Findings:

- Best Design Practice #8

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.2	n/a	Should wrap labels that exceed 32 characters over two lines, with the second line indented by two characters.
			Should truncate labels that exceed 62 characters and feature an ellipsis to communicate the truncation.
Truncation of Clinical terms	Slide 19	n/a	Use truncation as a last resort and only when truncated terms are the exception rather than the rule.
	Slide 20	n/a	Do not wrap mid-word (thus creating word fragments with or without hyphens).
	Slide 30	n/a	Do not truncate clinical terms when they appear in a list of fixed width.
			Only use truncation in a selection list of clinical terms if the choice of text to truncate is informed by the data structure or a manually defined means of selecting acceptable text to truncate is available.
Slide 52	n/a	When text is truncated at the end, display (at least) an ellipsis at	

Document	Section #	Guideline #	Guideline Description
			the point of truncation.
	Slide 53	n/a	Do not support the use of the ellipsis as a control (such as a button) for accessing the full text of a truncated term.
	Slide 59	n/a	For fixed-width lists, when a list contains identical truncated terms (and when this can be determined) display the list without truncation by default.
			For fixed-width lists, when it is not possible for the system to determine whether a list contains identical truncated terms, provide a notification warning of the presence of identical truncated terms.
Suggestions for Implementing into the UI of an EHS	3.4	SCT-040	Displaying results longer than 2 lines.

### Guideline SR16. Explicitly state when no results are found, and provide assistance.

#### Description:

When no results are found, the system should clearly indicate this to the user, rather than not responding or displaying an empty list. In addition, the system should provide assistance to the user, such as possible causes or actions to improve the search, such as trying a more general term or expanding the current filter. The system should also provide an option to retain unencoded text, but indicate that doing so is not recommended, as shown below.

Current filter: **Health Concerns** ▼

**Health Concern:**

rare disease |

**No matches found.** Try a more general term or expanding the [current filter](#).

If you cannot find what you want, you may [save](#) this as free text (not recommended)

*Example of message indicating no matches found*

The MSCUI guidance on Terminology Matching also suggests displaying a separate 'Match Not Found' button to allow users to actively report missing concepts. In the example wireframe shown above, the 'Save' button can also serve to notify system administrators of missing concepts. Periodic review of unencoded text and missing concepts should be undertaken to ensure the system has adequate concept coverage. Whenever possible, these missing terms should be considered for inclusion within the local system's subset or subsequent releases of SNOMED CT.

To mitigate no matches found from occurring, the search scope could be automatically expanded. For example, the system could automatically expand the current context filter if no matches are found (rather than asking the user to do so, as above), or automatically add synonymous keywords to the search query (see Guideline SR17). The system should notify the user whenever these automatic actions are performed.

#### Rationale:

While the MSCUI guidance on Clinical Noting in Forms suggests providing clear feedback when no matches are found, the MSCUI guidance on Terminology Matching suggests not showing any indication, which is problematic. Clear feedback about when no results are found is critical, as otherwise the user may assume the system is not responding or functioning properly, and wait unnecessarily for a system response. Providing text assistance or expanding the search scope automatically can also prevent users from abandoning the search. Although encoded text is recommended, the system also needs to be flexible to accommodate the saving of free text. Ongoing feedback and review of missing concepts can help to address gaps in terminology and improve system quality.

#### Environmental Scan Findings:

- Best Design Practice #6

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.2	CNA-0340	Clearly indicate when no matches have been found.
		CNA-0350	Provide a control that allows the user to retain the unencoded text in the form.

Document	Section #	Guideline #	Guideline Description
		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 appropriate then they are to activate the control that retains the unencoded text.
		CNA-0370	In the message, communicate to the user that retaining the unencoded text is not recommended.
		CNA-0380	Display the message in the same location as the results would otherwise be displayed.
		CNA-0390	If the user activates the control that retains the unencoded text, display the text in normal weight.
Display of Clinical Statements	Slide 26	n/a	If no encoded terms are available, this should be flagged and not left blank.
Recording Adverse Drug Reaction Risks	3.2.5	RAD-0191	If a term has not been recognised, the system will warn the clinician that the term has not been recognised, but will allow them to enter it as free text.
Terminology Matching	2.3.2	n/a	Must provide the user with a method of reporting 'No matches found'.
Suggestions for Implementing into the UI of an EHS	3.4	SCT-054	Explicitly state when no results are found.
		SCT-055	With no results returned, offer further assistance.

### Guideline SR17. Provide word equivalence matching, and ensure that the option is visible.

#### Description:

In addition to the individual synonyms for each SNOMED CT concept, SNOMED CT includes word equivalence tables that consider semantically similar words, such as *kidney* and *renal*. The table also includes commonly used abbreviations. This feature can be very helpful to expand the search results if the user is unsure of the exact term for which they are looking.

The MSCUI Guidance on Terminology Matching suggests adding a checkbox option for searching equivalent words and automatically detecting and stating the equivalent words near the search field. Although this option would initially be unchecked, the system could automatically run the search on equivalent words if no matches are initially found. Shown below are wireframe diagrams illustrating the word equivalence option.

#### Health Concern:

Also search on: 'renal'

kidney	Q
<i>Relevant Matches</i>	
<b>Kidney</b> stone	
<b>Kidney</b> tumour	
History of <b>kidney</b> stone	

Example showing word equivalence option

#### Health Concern:

Also search on: 'renal'

kidney	Q
<i>Relevant Matches</i>	
<b>Kidney</b> stone	
<b>Renal</b> stone	
<b>Kidney</b> tumour	
History of <b>kidney</b> stone	

Example showing word equivalence enabled

#### Health Concern:

Also search on: 'renal'

kidney	Q
No matches found for 'kidney'. Automatically searched on equivalent words.	
<i>Relevant Matches</i>	
<b>Renal</b> stone	

Example showing word equivalence automatically enabled when no matches are initially found

#### Rationale:

Word equivalence is especially helpful when users are unsure of the exact terminology or when no matches are found on the initial search term. As word equivalence matching can appear to break the rules of lexical matching (where part of the search query is always contained within the results), ensuring that the option is visible is paramount. Since the inclusion of equivalent words does increase the number of results, allowing the user to manually enable or disable the option is also critical.

#### Environmental Scan Findings:

- Best Design Practice #1

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.3.1	n/a	Should match text against equivalent SNOMED CT concepts, as defined in the equivalence table(s) in the latest SNOMED CT



Document	Section #	Guideline #	Guideline Description
			release data.
			Must provide two matching states for equivalence matching: 'on' and off'. Must provide a control to allow the user to choose whether equivalence matching is switched on or off.
			Must ensure that the equivalence matching is switched off by default in those situations where the matching is done progressively as the user types. Could ensure that equivalence matching is switched on by default in those situations where matching is not done progressively.
			Must clearly indicate where equivalence matching is switched on, that is, where the system has attempted to match on equivalent words. Should communicate this in a location close to the match results list.
			Must communicate which equivalent words the system is searching. Should display these equivalent words adjacent to the input field.
			Do not switch on word equivalence matching automatically if some matches have been returned.
Suggestions for Implementing into the UI of an EHS	3.3	SCT-032	Provide word equivalence matching.
		SCT-033	Ensure user is aware that word equivalence matching is being done.

**Guideline SR18.** Upon selecting a term, replace the typed text and show that it has been encoded.

#### Description:

Once the user has selected a concept from the results list, the system should replace the user typed original text with the SNOMED CT concept. In addition, the encoded term should be bolded (unencoded terms should remain in normal weight). As shown below, the text field could also be styled differently or removed, with the option to edit the confirmed text as necessary (see Guideline SR19).

Health Concern:

**Diabetes mellitus type 1**

*Example of encoded text*

Health Concern:

diabetes

*Example of unencoded text*

#### Rationale:

Replacing the original text with the encoded label prevents confusion that can arise with multiple statements referring to the encoded concept. Bolding distinguishes encoded text from unencoded text and clarifies to users which text has been encoded.

#### Environmental Scan Findings:

- Best Design Practice #1
- Best Design Practice #8

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0300	After the user has selected a matched term, display the term in bold text.
	3.3.2	CNA-0390	If the user activates the control that retains the unencoded text, display the text in normal weight.
Recording Adverse Drug Reaction Risks	3.2.5	RAD-0170	Display encoded causative agent text in bold.
Terminology Display Standards	2.2.1	n/a	Must replace the typed text with the matched SNOMED CT label once the user confirms the match.
Terminology Matching	2.3.3	n/a	Should replace the original text in the text input area with the relevant SNOMED CT concept label (which will be either a 'preferred term' label or 'synonym' label) upon confirmation.
Suggestions for Implementing into the UI of an EHS	3.6	SCT-060	Display the selected concept as the encoded concept.
		SCT-061	Show in the text entry field that a concept has been encoded.

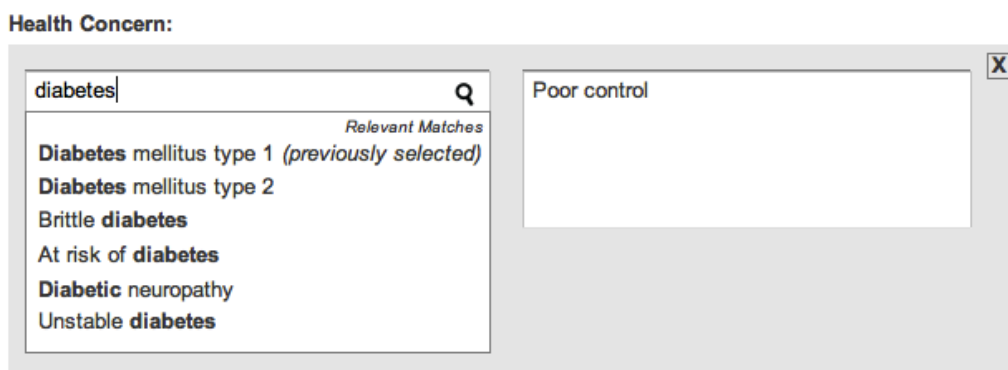
**Guideline SR19.** Allow users to edit and delete confirmed entries before being committed to record.

### Description:

Once an entry has been confirmed, the system should provide the user with the flexibility to edit and delete entries. Refer to the wireframes below. When editing an entry, the main concept should appear visibly clickable (such as displaying a triangle icon and changing colour upon mouse-over). Once the user clicks on the area, the original search query and list of results should be displayed. In addition, the user should be able to edit the main concept independently from the additional details (see Guideline EL6). If the user chooses to delete the entry (e.g., by clicking on the “X” icon in the top right corner of the box), the system should provide adequate warning to the user to prevent inadvertent deletions.



*Example showing the change in colour when hovering over the entry*



*Example showing the original text and original list of results*

These guidelines are only applicable prior to information being committed to the patient's record. Different requirements and user privileges may exist once information has already been committed, which may reduce access to edits or deletions.

### Rationale:

Edit and delete functionalities allow users to go back to fix a selection that could have been made in error. By showing the original search text and original search list, users do not have to rely upon their memory and can efficiently make another selection.

### Environmental Scan Findings:

- Best Design Practice #1

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.4	CNA-0720	Allow the user to edit the main concept, the associated additional details or both, if the entry has not already been saved.
		CNA-0730	Ensure that the user can edit the main concept and the associated additional details independently of each other.

Document	Section #	Guideline #	Guideline Description
		CNA-0740	If the user hovers the mouse pointer over the main concept, visually indicate it can be clicked (for example, shade the area with a yellow gradient upon hover-over).
		CNA-0760	If the user clicks on the main concept, open up the list of results for the text that had originally been input.
		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 user interface should treat this action as an intended deletion and should behave correspondingly.
		CNA-0790	Provide a control for deleting an entry.
		CNA-0810	When the user clicks the 'delete' button, provide an appropriate confirmation message and options to either continue with or cancel the delete.
Display of Clinical Statements	Slide 69	n/a	Users need to be able to edit both encoding and free text, and want to see how they can adjust or remove their changes during editing.
Suggestions for Implementing into the UI of an EHS	3.6	SCT-062	Re-selecting a result.

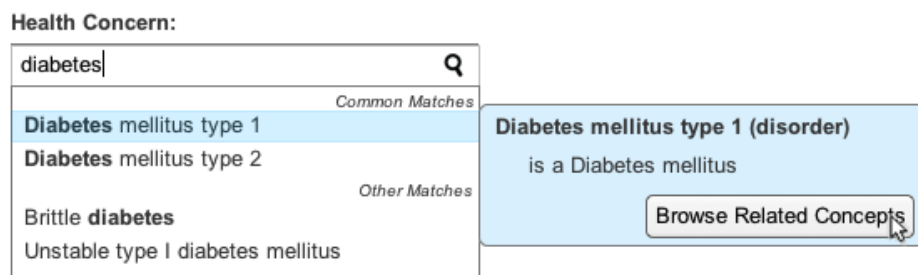
**Guideline SR20.** Provide browsing for refinement (necessity permitting).

**Description:**

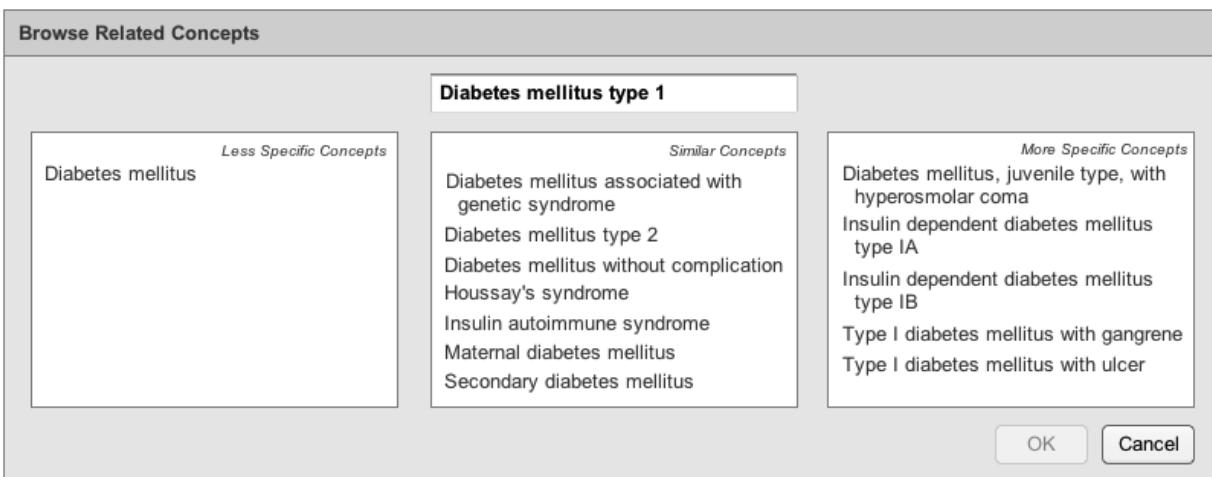
The system could allow users to browse for related terms to precisely express their notes. The related concepts could include the following:

- Parents of the selected concept
- Children of the selected concept
- Siblings of the selected concept (children of the selected concept's parents)

To avoid overwhelming the user, users would only be exposed to the browsing mechanism as a secondary feature after searching. The wireframe diagrams below illustrate how the user could access a 'Browse Related Concepts' button within a flyout dialog after searching for a concept. Once the user presses the button, the user can browse for related concepts within a dialog containing the three columns of *Less Specific Concepts* (parents), *Similar Concepts* (siblings), and *More Specific Concepts* (children).



*Example of browse concepts button within flyout*



*Example of browsing dialog*

It should be noted that browsing mechanisms might not be useful for all types of users. In some cases, searching may be sufficient, and further evaluation may be required to determine whether browsing is a necessary feature.

**Rationale:**

The browsing mechanism can be helpful if users are unsure of the exact term and would like to add further precision. Past implementation experience and usability evaluations have indicated that the hierarchical tree design is confusing and cumbersome to navigate. The MSCUI guidance on Terminology Matching suggests that the three-column approach is more intuitive and easier to use. However, the

browsing mechanism may not be used often and may not necessarily need to be included within implementations. In past implementation experience, users have found that the search mechanism is often sufficient.

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.5.1	n/a	Must allow the user to navigate parts of the SNOMED CT hierarchy.
			Should only allow the user to access the SNOMED CT hierarchy at the point of having selected a concept.
			Must distinguish between the parents, siblings and children of a selected concept. Should feature a 'three list box' solution: a list of parents, a list of the siblings for all parents, and a list of the children.
Suggestions for Implementing SNOMED CT into the UI of an EHS	3.6	SCT-058	Provide hierarchical browsing for refinement.

**Guideline SR21.** For multiple list entries, only display the next field upon confirmation of a concept.

**Description:**

For data entry areas that require multiple list entries, the system should provide the ability to add multiple selections. As shown below, another search input field would be presented and brought into focus upon confirmation of the first concept. This pattern would continue until the user had finished all of their entries.

Health Concerns:

Diabetes mellitus type 1 ▼

|  Q

*Example of presenting next field*

**Rationale:**

The system needs to provide clinicians with the flexibility to enter as many items as they need. The automatic display of the next field minimizes the number of key presses and maintains visual focus so that clinicians can intuitively attend to data entry. This design approach is recommended over initially presenting multiple data entry fields to the user, which can introduce visual clutter.

**Environmental Scan Findings:**

- Best Design Practice #1

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	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.
		CNA-0290	After the user has selected a matched term, automatically move the focus to the next field in the tab order.
		CNA-0320	Just after the user has selected a matched term, automatically display a new field for entering the next list entry.
		CNA-0330	Next entries will be displayed directly below the preceding entry.
Recording Adverse Drug Reaction Risks		RAD-0200	Provide one or more text entry fields for entering or selecting reaction keywords or key phrases that summarise the past reactions to the causative agent.
		RAD-0220	Allow for multiple reaction keywords or key phrases to be entered for a single drug.

**Guideline SR22.** Allow users to easily add and view additional attributes or free-text.

**Description:**

Users should be able to elaborate on a single concept for increased flexibility. As shown below, the additional attribute or free-text fields should only appear after a concept has been selected (see Guideline EL4). After saving the additional text, the information should always be kept in view. The wireframe diagrams also include a new search field appearing below, as discussed under Guideline SR21.

**Health Concerns:**

Diabetes mellitus type 1 ▼

Enter additional text

X

Q

*Example of additional text field*

**Health Concerns:**

Diabetes mellitus type 1 ▼
Poor control
X

Q

*Example of saved free text*

**Rationale:**

A single-coded concept is often not adequate to describe what a clinician wishes to express. Thus the system should provide the flexibility for users to specify additional elaboration. In addition, once the information is saved, the user should not have to click on another button to view the additional information. The elaboration should be easily accessible and always kept in view, as the information can be important for subsequent interpretation of the coded concept.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0040	Do not display associated fields, such as an 'Additional text' field, until the user has searched for and selected a clinical term.
	3.3.3	CNA-0400	Provide a mechanism which allows the user to type in attribute data associated with the clinical phrases which they are entering.
		CNA-0410	As soon as the user has selected a suitable matched term, automatically display the associated attribute fields.
		CNA-0420	Upon the user selecting the matched term, display corresponding attributes fields plus a field for entering additional text.
		CNA-0650	Provide a field into which the user can enter additional free text.
Display of Clinical Statements	Slide 20	n/a	Any additional free text added by the clinician should be accessible – if not always immediately visible.



Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.2.3	n/a	Must allow the user to type in 'additional' text that is associated with a selected concept

## Elaboration

### Listing of Guidelines

- Guideline EL1. Allow users to specify additional attributes for coded concepts when using Structured Forms, Search, and Free-text Parsing.
- Guideline EL2. If attributes or qualifiers are mandatory, use dropdown lists.
- Guideline EL3. Provide an additional free-text field for only the Structured Forms and Search approaches.
- Guideline EL4. Only show elaboration fields once a concept is confirmed.
- Guideline EL5. Alert users if concepts are detected within the additional free-text field.
- Guideline EL6. Allow users to edit elaborations prior to being committed to record.
- Guideline EL7. Post-coordinate elaborations with the main concept (feasibility permitting).

**Guideline EL1.** Allow users to specify additional attributes for coded concepts when using Structured Forms, Search, and Free-text Parsing.

**Description:**

The system should allow users to specify additional attributes for single concepts for increased flexibility. There are a number of approaches to provide this functionality. As shown below, once a concept has been confirmed, additional attribute fields appear, including a date and/or duration field and an additional text field (see Guideline EL3). A similar design could also apply to structured forms (the fixed-choice field would replace the search field). Although these additional attributes do not necessarily have to be coded, they should be coded whenever possible, facilitating post-coordination (see Guideline EL7).

*Example of dates/durations appearing to the right of the matched concept (Search approach)*

In the free-text parsing approach, elaboration can also be conducted on the main concept. Whenever possible, the system should prompt for values that are associated with or required for the matched concept (see Guideline FP16). In the examples below, the system has detected that *Body temperature* should have an associated temperature value. In addition to the input fields for temperature value, the user can opt to type in temperatures within the noting area (not shown, see Guideline FP16).

*Example of clickable alert message in suggested match area (Free-text Parsing Approach)*

*Example of fields appearing within suggested match area (Free-text Parsing Approach)*

When matched concepts require larger sets of values, templates containing a series of values can also be triggered for more complete documentation. Although work is still exploratory, the MSCUI Design Groundwork Exploration on Noting Using Templates suggests being able to offer more than one template per triggered term.

Once information is saved, the elaboration should be easily accessible and always kept in view. The user should not have to click on another button to view the additional information.

#### Rationale:

Design guidance and past implementation experience have indicated that a single-coded concept is often not adequate to describe what a clinician wishes to express. Thus the system should provide the flexibility for users to specify additional elaboration. Prompting for associated or required information can improve the completeness of documentation. The elaboration should be easily accessible and always kept in view, as the information can be important for subsequent interpretation of the coded concept.

#### Environmental Scan Findings:

- Best Design Practice #4

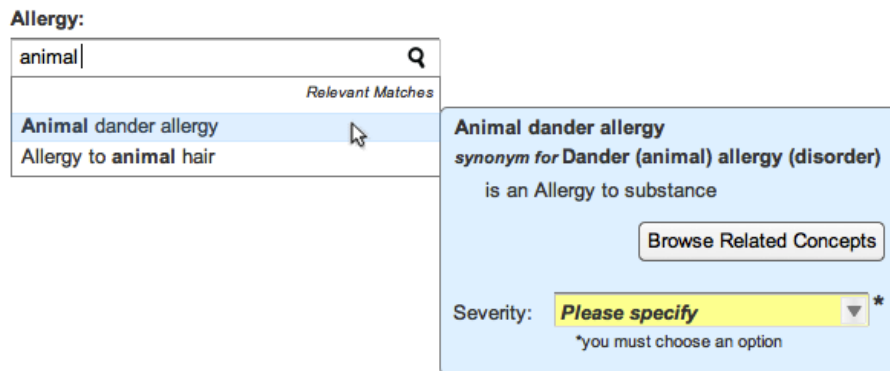
#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.3	CNA-0400	Provide a mechanism which allows the user to type in attribute data associated with the clinical phrases which they are entering.
		CNA-0460	Present important structured data fields before the additional text field in the tabbing order.
		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.
		CNA-0700	Where clinically appropriate, provide fields to select other associated attributes (for example, 'Current active problem', 'Laterality').
Noting using Templates	5.2	n/a	The user interface offers templates related to a recently encoded term.
			It automatically 'pushes' template options, in addition to allowing the user to request them ('pull').
			It can offer more than one template for a single term.
			Templates are filtered according to context.
			The user interface visually links templates to trigger words.
	Templates can be opened by default if there is only a single template available, if it is assumed that the user will need to complete it, and the user can then 'opt out' rather than 'opt in'.		
6.2	n/a	The user interface allows the user to trigger templates from free text. The user interface proactively offers certain template matches from within free text.	
Terminology Elaboration	2.3.2	n/a	Should identify where matched concepts are associated with or require values. Offer default units, but do not offer default values.
		n/a	Should encourage users to enter values where appropriate.

**Guideline EL2.** If attributes or qualifiers are mandatory, use dropdown lists.

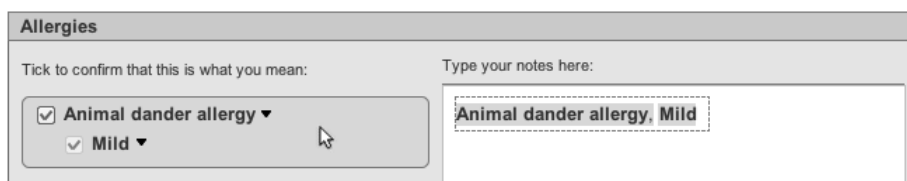
**Description:**

Whenever attributes or qualifiers (e.g., severity or laterality) are mandatory, the user interface should present a dropdown field, such as shown below. The user cannot confirm the concept until a qualifier is selected. For additional guidance on using dropdown lists, see Guideline SF2 and Guideline SF3.



*Example of mandatory dropdown list*

In the free-text parsing approach, the user can select a qualifier using a fly-out dialog as above (also see Guideline FP17). However, once the qualifier is confirmed, the checkbox relating to the mandatory qualifier is disabled. The user cannot deselect the qualifier independently from the main concept, as shown below.



*Example of disabled checkbox for severity qualifier (Free-text Parsing approach)*

**Rationale:**

Encouraging users to specify a qualifier can ensure complete documentation. The suggested designs prevent users from confirming a concept without selecting a qualifier.

**Environmental Scan Findings:**

- Best Design Practice #3
- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Elaboration	2.2.3	n/a	Must disable the control for confirming a match (text parser matching control) or the control for saving the note (single concept matching approach) if there is a mandatory qualifier that remains unresolved. Do not allow users to encode a term without selecting all of its mandatory fields.
			Must provide a control for selecting the mandatory qualifier. Could feature a drop-down list box. Should associate the control with the individual match. Should feature the control in the match's flyout.
			Must not allow the user to unconfirm the mandatory qualifier value independently from the base concept.

**Guideline EL3.** Provide an additional free-text field for only the Structured Forms and Search approaches.

**Description:**

Additional text fields are necessary to allow users to adequately describe what they wish to express. The field should be provided for the structured form and search approaches. The diagram below illustrates an additional text field placed next to the confirmed concept (see Guideline SR22). A similar design could be used for fixed-choice fields within structured forms (see Guideline SF4).

*Example of additional text field*

However, owing to the purpose of the additional text field, this field should not be provided in the free-text parsing approach (see section on Free-text Parsing). Instead, users should type all of their notes within the designated noting area, as shown below.

*Example of free-text parsing user interface, with noting area on right side*

**Rationale:**

An additional text field is necessary when users are limited to choosing one option at a time. The field allows users to type their observations and notes freely. However, since the noting area within the free-text parsing approach also allows users to type their notes freely, an additional text field is not necessary and may only serve to confuse users.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #2
- Best Design Practice #3
- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.3	CNA-0420	Upon the user selecting the matched term, display corresponding attributes fields plus a field for entering additional text.
		CNA-0460	Present important structured data fields before the additional text field in the tabbing order.
		CAN-0650	Provide a field into which the user can enter additional free text.
	8.3.1	CNA-1680	Provide a mechanism that allows the user to add free text to a fixed choice selection

Document	Section #	Guideline #	Guideline Description
		CNA-1710	Reveal the control for activating this mechanism where any of the following situations exist: <ul style="list-style-type: none"> <li>When the user has moved the focus to a fixed-choice data control</li> <li>At the point that the user has selected from a fixed-choice data field</li> <li>Upon mouse-over of the associated control or the location of the 'add free text' control</li> </ul>
		CNA-1790	Display free text immediately to the right of the associated fixed-choice control.
		CNA-1810	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.
Display of Clinical Statements	Slide 20	n/a	Any additional free text added by the clinician should be accessible – if not always immediately visible.
Recording Adverse Drug Reaction Risks	3.2.7	RAD-0340	Allow the user to add additional free text that elaborates on the reaction keywords.
		RAD-0350	Enable the free text elaboration to be strongly visually associated with a specific reaction keyword
Terminology Elaboration	2.1.1	n/a	Must allow the user to add free, unstructured text to a SNOMED CT match selection.
			Do not locate the additional text field in the flyout area.
			Do not provide an additional text field for the 'text parser' approach to encoding.
	2.2.3	n/a	Must allow the user to type in 'additional text' that is associated with a selected concept.

**Guideline EL4.** Only show elaboration fields once a concept is confirmed.

**Description:**

As shown below, additional elaboration upon an encoded concept should only appear after a concept is confirmed.

Health Concerns:

Diabetes mellitus type 1
Enter dates and/or duration
X

Enter another concern
Q

*Example of elaboration only appearing once a concept is confirmed*

**Rationale:**

The appearance of additional options only after the initial concept has been selected improves readability of the user interface and avoids overwhelming the user with irrelevant options.

**Environmental Scan Findings:**

- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0040	Do not display associated fields, such as an 'Additional text' field, until the user has searched for and selected a clinical term.
	3.3.3	CNA-0410	As soon as the user has selected a suitable matched term, automatically display the associated attribute fields.
		CNA-0420	Upon the user selecting the matched term, display corresponding attributes fields plus a field for entering additional text.
	8.3.1	CNA-1680	Provide a mechanism that allows the user to add free text to a fixed choice selection.
		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.



**Guideline EL5.** Alert users if concepts are detected within the additional free-text field.

**Description:**

Users should be encouraged whenever possible to enter coded data, including prompts when SNOMED CT concepts are detected within additional free text. Alternatively, the system can highlight encodable text within the free-text entry field (see Guideline FP9). Matches would be detected based on the allowable attributes of the selected main concept. The user can then decide to confirm the coded concept using the checkbox control, as shown below.

**Health Concerns:**

Asthma ▼

Severe X

Severe attacks

Q

*Example of detected concept within additional text field*

The MSCUI guidance on Recording Adverse Drug Reaction Risks also suggests warning users if there is any text that fundamentally changes the meaning of the main concept. For example, if “family history of asthma” was entered in the text field, the system should prompt the user to ensure that the main concept of *Asthma* indeed applies to the current patient. Other ‘dangerous’ words include expressions of negation (e.g., “no asthma present”) or expressions of reduction (“lack of asthma”).

It should be noted that this guideline might be more feasible when implemented in conjunction with the general free-text parsing approach.

**Rationale:**

Although users should be provided with the flexibility to enter additional free-text, detecting concepts within free-text can be advantageous, facilitating post-coordination (see Guideline EL7). Warning users if there are terms that fundamentally change the meaning of the main concept can prevent data entry errors. Re-using aspects of the free-text parsing approach also promotes consistency across the SNOMED CT application.

**Environmental Scan Findings:**

- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

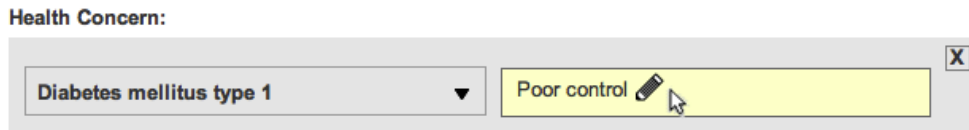
Document	Section #	Guideline #	Guideline Description
Recording Adverse Drug Reaction Risks	3.2.6	RAD-0260	If the system identifies any words which fundamentally change the meaning of the keyword or key phrase, the system should warn the user. These ‘dangerous’ words may include expressions of negation, expressions of reduction, or references to family history or other patients.
	3.2.8	RAD-0410	The user interface should identify any reaction keywords or key phrases that are typed into the justification field.
		RAD-0410.3	The user interface should not highlight any reaction words that have already been matched in the ‘Type(s) of reactions experienced’ section.

Document	Section #	Guideline #	Guideline Description
Terminology Elaboration	2.2.1	n/a	Must allow the user to type in notes that the system can match against SNOMED CT matches that have attribute relationships with the selected SNOMED CT concept, which are defined by the Concept Model (which specifies allowable relationships, including those in the Context Model) or an external information model.
			Should re-use the mechanisms for matching the text parser, namely: highlighting, bolding, featuring a confirmation check box, and featuring a control for viewing alternative matches.
	2.2.2	n/a	Must attempt to identify axis modifiers, such as negation, in the additional text notes and present them for confirmation in the same way as for qualifier values.
			Must warn the user if they try to save the note without confirming the axis modifier. Clearly outline the problem and the way in which the user may resolve the problem.

**Guideline EL6.** Allow users to edit elaborations prior to being committed to record.

**Description:**

Once an entry has been confirmed, the system should provide the user with the flexibility to edit and delete entries. Refer to the wireframes below. When editing an entry, the elaboration should appear visibly clickable (such as displaying a pencil icon and changing colour upon mouse-over). Once the user clicks on the area, the text entry field or other attribute fields should be displayed. In addition, the user should be able to edit the main concept independently from the additional details (see also Guideline SR19). If the user chooses to delete the entry (e.g., by clicking on the “X” icon in the top right corner of the box), the system should provide adequate warning to the user to prevent inadvertent deletions.



*Example of hovering over an elaboration*



*Example of editing an elaboration*

These guidelines are only applicable prior to information being committed to the patient’s record. Different requirements and user privileges may exist once information has already been committed, which may reduce access to edits or deletions.

**Rationale:**

Edit and delete functionalities allow users to go back to correct or add more information, improving quality of data entries.

**Environmental Scan Findings:**

- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.3	CNA-0480	Upon hiding the associated attribute fields, display the data in these fields entered to the right of the main concept.
	3.3.4	CNA-0730	Ensure that the user can edit the main concept and the associated additional details independently of each other.
		CNA-0760	If the user hovers the mouse pointer over the summarised associated additional details, visually indicate the area can be clicked (for example, shade the area with a yellow gradient upon hover-over).
		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.

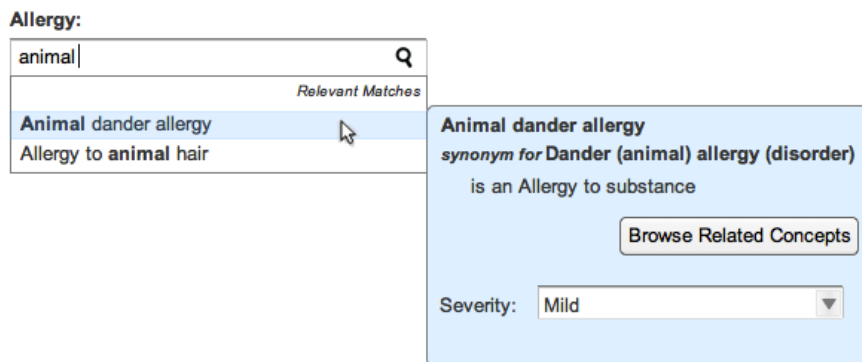
**Guideline EL7.** Post-coordinate elaborations with the main concept (feasibility permitting).

SNOMED CT offers the ability to post-coordinate concepts to describe more complex circumstances. Concepts can be post-coordinated with their context header. For example, if the concepts *Allergy* and *Animal* existed within SNOMED CT, but the concept *Allergy to animal* did not exist, the two concepts could be post-coordinated automatically, if the user simply entered “animal” within an Allergies form.

Concepts can also be post-coordinated with elaborations. For example, an allergy concept could be post-coordinated with its severity through a drop-down list or an additional free-text field, as shown in the wireframes below.

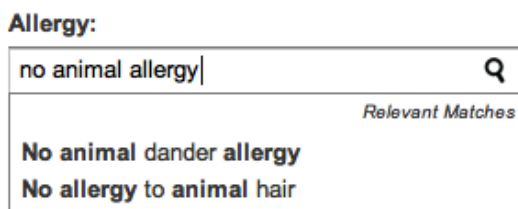


Example of detected concept that could be post-coordinated (see Guideline EL5)

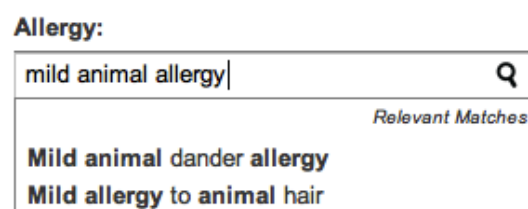


Example of selected value from dropdown list that could be post-coordinated (see Guideline EL2)

An additional approach is to simply allow the user to indicate the absence or severity of the allergy directly in the search field.



Example of negation within search field



Example of qualification within search field

Post-coordination can also be conducted in the free-text parsing approach (see Guideline FP18).

This guidance is still preliminary, as there has been limited uptake in clinical settings. Past research has indicated that dropdown lists are a suboptimal approach in comparison to free-text entry for post-coordination. In addition, post-coordination must be studied on a case-by-case basis, as rules may differ based on the types of concepts being post-coordinated. At this time, there only exists guidance pertaining to disorders, and these guidelines may not be suitable for other types of SNOMED CT concepts. Thus, further study is required to evaluate feasibility as SNOMED CT implementations progress.

#### Rationale:

Post-coordination is tremendously valuable in refining concepts and improves semantic interoperability between systems. One of the main hurdles of post-coordination is seamless integration within the user interface. The suggestions provided above do not add extra steps for the user over what would have been originally performed during elaboration. However, further study is still required in this area.

#### Environmental Scan Findings:

- Best Design Practice #4
- Best Design Practice #5

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.3	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').
		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).
Noting using Templates	5.2	n/a	The template matching accounts for post-coordination (for example, contextual wrappers).
Recording Adverse Drug Reaction Risks	3.2.6	RAD-0290	Allow the entry of negation with the reaction keywords. This will post-coordinate the reaction term with 'known absent'.
		RAD-0300	Allow the entry of severity qualifiers with the reaction keywords. This will post-coordinate the reaction keyword or key phrase.
	3.2.7	RAD-0370	Words corresponding to severity or certainty (and that are recognised SNOMED CT qualifiers) that are entered as free text should be highlighted and offered to the user for encoding. This guideline is only recommended for applications with the technological sophistication to handle text parsing of free text.
Terminology Matching	2.4.1	n/a	Must appropriately post-coordinate those concepts which derive part of their meaning from the heading under which they are written.
Terminology Post-Coordination	n/a	n/a	<i>(This document focuses more on the free-text parsing approach, but can be used for additional guidance.)</i>

## Free-text Parsing

### Listing of Guidelines

- Guideline FP1. When tasks require the flexibility to enter a passage of notes, use free-text parsing (feasibility permitting).
- Guideline FP2. Display matched concepts separately from the free-text field.
- Guideline FP3. Require user to confirm matched concepts prior to encoding.
- Guideline FP4. Show top matches, but allow users to choose other results.
- Guideline FP5. Reuse guidelines from Search.
- Guideline FP6. Use contextual limitation to increase relevancy of results.
- Guideline FP7. Provide progressive matching as the user types in text (feasibility permitting).
- Guideline FP8. Indicate the association between the text expression and the suggested match.
- Guideline FP9. Distinguish between potentially encodable text and unencodable text.
- Guideline FP10. Block additional formatting by the user.
- Guideline FP11. Visually indicate expression boundaries within the noting area.
- Guideline FP12. Explicitly state when no results are found, and provide assistance.
- Guideline FP13. Upon confirming a match, replace the typed text and show that it has been encoded.
- Guideline FP14. Allow users to edit and undo the confirmation of matches before the note is committed to record.
- Guideline FP15. Detect elaborations associated with the base concept.
- Guideline FP16. Prompt for values associated with a concept.
- Guideline FP17. Only allow users to confirm a base concept if its mandatory attributes have been completed.
- Guideline FP18. Post-coordinate elaborations with the main concept during free-text entry (feasibility permitting).

**Guideline FP1.** When tasks require the flexibility to enter a passage of notes, use free-text parsing (feasibility permitting).

**Description:**

When tasks require the flexibility to enter a passage of notes, free-text parsing is the recommended approach. The wireframe diagram below presents a free-text field on the right. As the user is typing, suggested SNOMED CT matches are presented on the left for the user to confirm. This general user interface design will be used throughout the free-text parsing guidelines.

The wireframe shows a window titled "Allergies". On the left, under the heading "Tick to confirm that this is what you mean:", there is a list of suggestions: "Animal dander allergy", "Sneezing", and "Often". The "Sneezing" and "Often" items are highlighted in yellow. On the right, under the heading "Type your notes here:", there is a text input field containing "Animal dander allergy; sneezing often". The words "sneezing often" are highlighted in yellow and enclosed in a dashed box. At the bottom right of the window are "OK" and "Cancel" buttons.

*Example of user interface for free-text parsing*

Natural language processing that can identify complex and semantic relationships between concepts is the ideal textual processing approach. However, comprehensive designs for intelligent natural language processing is currently outside the scope of these guidelines and the existing MSCUI guidance. Instead, the guidelines will focus on aspects of SNOMED CT, including matching single and combined or post-coordinated concepts within a passage of text.

Although free-text parsing is the preferred data entry approach, it is also more difficult to implement. When implementing SNOMED CT applications, it may be worthwhile for developers to consider implementing the search approach first, and then reusing search features for free-text parsing (see Guideline FP5). In general, there is less experience in the implementation of free-text parsing within health information systems. Further study and evaluation is necessary to refine and validate design guidelines.

**Rationale:**

Free-text entry allows users to main the narrative structure of medical entries and is the preferred data entry method for clinicians. Allowing users to type without constraint provides the user with greater flexibility and efficiency. However, the approach may be less feasible to implement, and further study and evaluation is required to refine and validate design guidelines.

**Environmental Scan Findings:**

- Best Design Practice #3

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.1.1	n/a	Do not offer the single concept matching approach if the clinician is expected to enter a large and rich set of notes.
			Do not offer the single concept matching approach if the clinician may wish to enter notes that will require post-coordinated expressions.
	2.1.2	n/a	Must allow the user to type in free-text notes without requiring any further actions until the time they decide to save the record.
			Must suggest possible SNOMED CT matches based upon the free-text notes the user has typed.
			Allow users to type their notes without constraint.



## Guideline FP2. Display matched concepts separately from the free-text field.

### Description:

To allow users to type notes without constraint, the user interface should display matched concepts separately from the free-text field. The wireframe diagram below presents a free-text field on the right. As the user is typing, suggested SNOMED CT matches are presented on the left for the user to confirm. In the list of matches, each suggested match is bounded visually, and related concepts are indented below the main concept. If the matches exceed the space available, a vertical scrollbar should appear.

Example showing separate free-text field and suggested matches area

### Rationale:

Users should not be interrupted while typing notes. The appearance of suggested matches on the left is not obtrusive, as the user does not have to review or immediately confirm matches.

### Environmental Scan Findings:

- Best Design Practice #3

### Related NHS/MSUI Guidelines:

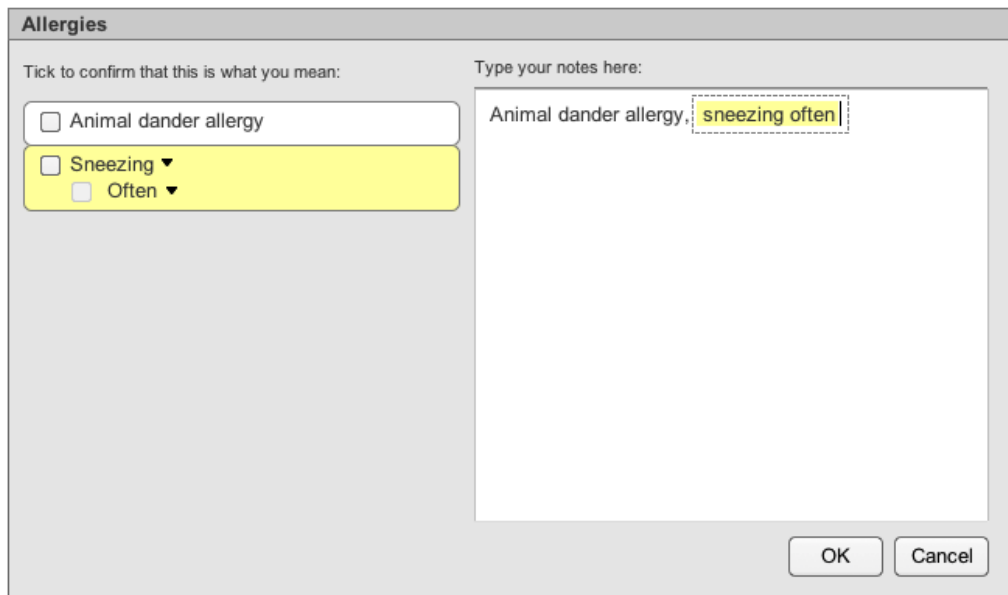
Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.1.1	n/a	Should ensure that while typing, all text is clearly visible.
	2.1.2	n/a	Must display the suggested matches in an area that can be viewed at the same time as the area in which user types the notes.
	2.2.1	n/a	Must provide a clearly-defined area into which the user may type in text. Must ensure that this area is separate from the area in which the system presents suggested SNOMED CT matches.
			Must feature a distinct label for the matching area. Could feature a label that reads 'Tick to confirm that this is what you mean:'.
2.3.1	n/a	Should display the suggested matches in an area adjacent to the text parser input field (in the text parser matching approach). Should locate the suggested match area immediately to the left of the text parser field.	

Document	Section #	Guideline #	Guideline Description
	2.3.2	n/a	Must display top matches to the user while the user is typing their notes.
			Should stack the suggested matches vertically.
			Should bound each suggested match visually (for example, in a rectangular or lozenge-shaped perimeter).
			Must provide an automatic scroll bar in the suggested matches area, if the matches exceed the space available.

**Guideline FP3.** Require user to confirm matched concepts prior to encoding.

**Description:**

Since free-text parsing may be imperfect, it is necessary to ask users to confirm concepts prior to encoding. In the wireframe diagram below, checkboxes are provided for each individual match. Checkboxes for related concepts are disabled until the user has confirmed the main concept (Guideline FP15). If the user chooses to save the entry and close the dialog (e.g., by pressing the “OK” button), the system should provide a warning that there are unconfirmed matches.



*Example showing checkboxes next to suggested matches*

**Rationale:**

As text-processing algorithms may be imperfect, user confirmation can ensure data accuracy. In addition, the warning of unconfirmed matches encourages users to confirm entries at the point of entry, further ensuring accuracy and timeliness of encoding.

**Environmental Scan Findings:**

- Best Design Practice #3

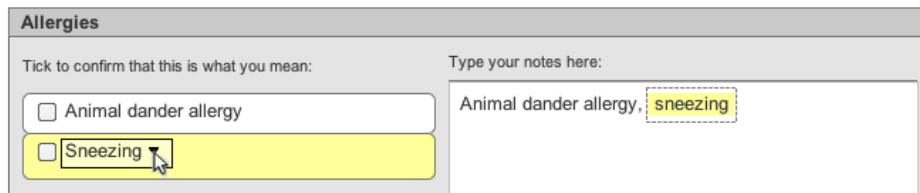
**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.2	n/a	Must display a confirm chick box control at the far left of the suggested match area. Should display the suggested match label immediately to the right of the confirm check box.
Terminology Matching	2.1.2	n/a	Do not automatically save the SNOMED CT concepts to the record without the user's confirmation.
	2.2.1	n/a	Must feature a distinct label for the matching area. Could feature a label that reads 'Tick to confirm that this is what you mean:'.
	2.3.3	n/a	Must allow the user to confirm, or not confirm suggested matches Should provide the user with a clear confirmation control for each suggested match. Should feature a check box to enact confirmation.

#### Guideline FP4. Show top matches, but allow users to choose other results.

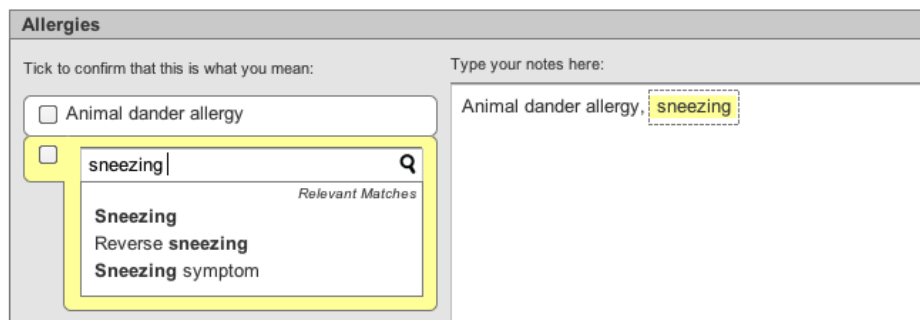
##### Description:

As the user is typing in the free-text field, suggested SNOMED CT matches are presented on the left for the user to confirm. The list of suggested matches only shows the top result that most closely matches the text within the text field. However, the user should also have the flexibility to choose another match. When the user hovers over the match, the area should appear clickable. In the example wireframe below, the area becomes outlined, and a triangle icon appears to signify to the user that additional action is possible.



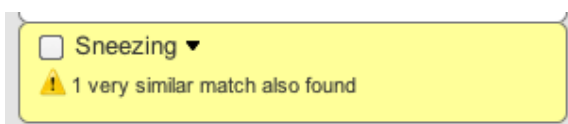
*Example of hovering over a suggested match*

Once the user clicks on the match, the list of alternative matches is shown, including the top match. The original text from the noting area is shown within the search input field, and if the user chooses to type within the search input field, the corresponding text in the noting area will also be updated. The interaction with the list of results is the same as when searching for single concepts (see Guideline FP5). Once the user selects a concept, the match is automatically confirmed, and the text in the noting area is replaced with the chosen concept (see Guideline FP13).

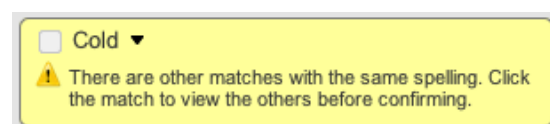


*Example of listing of alternative matches*

The suggested match area should also warn users when there are similar matches, more specific matches (such as children concepts), and matches with the same spelling. Example wireframes are shown below. In the scenario with matches of the same spelling, the confirmation checkbox should be disabled until the user views the list of matches to ensure the encoded concept is accurate.



*Example of similar match warning*



*Example of same spelling warning*

##### Rationale:

Presenting users with the option of choosing another match not only provides flexibility but also can improve precision and accuracy of entries. Warning users when there are similar matches, more specific matches, or matches with the same spelling can also improve accuracy of encoded entries.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #3

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.2	n/a	Could change the surface of the suggested match area so that it becomes embossed and clickable on mouse-over.
			Must display a message to communicate to the user when (i) there are close alternative matches or (ii) when there are more specific alternative matches (that is, children of the top match).
Terminology Matching	2.3.2	n/a	Must warn the user if there are very similar alternative matches or matches which constitute a 'child' (in terms of the SNOMED CT hierarchy). Should communicate to the user that they can access these alternative matches by clicking on the suggested match area.
	2.3.3	n/a	Must allow the user to view the full list of matches for each suggested match.
			Should disable the confirmation control if there is an alternative match that has the same spelling as the top match. The user must view the expanded list of matches prior to confirmation.

**Guideline FP5.** Reuse guidelines from Search.**Description:**

In principle, the free-text parsing approach matches SNOMED CT concepts. Thus, many of the guidelines proposed under the section of Search are also directly applicable.

- Guideline SR3. Provide partial matching by default and highlight search tokens. (Note: Only highlight tokens within the search results list and not in the suggested matches.)
- Guideline SR5. Indicate that search activity is occurring.
- Guideline SR6. Ensure that the search field and results list can hold sufficient characters.
- Guideline SR7. Match single or multiple search terms, regardless of word order.
- Guideline SR8. Offer flexibility during search entry, by handling synonyms, abbreviations and acronyms, upper- and lower-case, non-alphanumeric characters, and foreign characters.
- Guideline SR9. Do not search by concept ID or fully specified name — only match synonyms and preferred terms.
- Guideline SR10. Return lexically matching descriptions, but remove redundant or unused synonyms if possible.
- Guideline SR11. Prioritize commonly used terms or provide favourites.
- Guideline SR12. Order the results list in an intuitive and useful manner.
- Guideline SR13. Display additional information for each result.
- Guideline SR14. Display 10-20 results simultaneously in a scrollable list near the search entry field.
- Guideline SR15. For lengthier terms, always provide access to full text.
- Guideline SR17. Provide word equivalence matching, and ensure that the option is visible.
- Guideline SR20. Provide browsing for refinement (necessity permitting).

Other Search guidelines, such as Guideline SR4 for progressive matching, also apply to free-text parsing, but these will be discussed in separate guidelines tailored to free-text parsing.

**Rationale:**

Since the principles of matching concepts when searching for single concepts and free-text parsing are similar, Search guidelines are also relevant. When implementing SNOMED CT applications, it may be worthwhile for developers to consider implementing the search approach first, and then reusing features for free-text parsing. Consistent user interface controls also help users understand how to use system features more quickly and easily.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #3

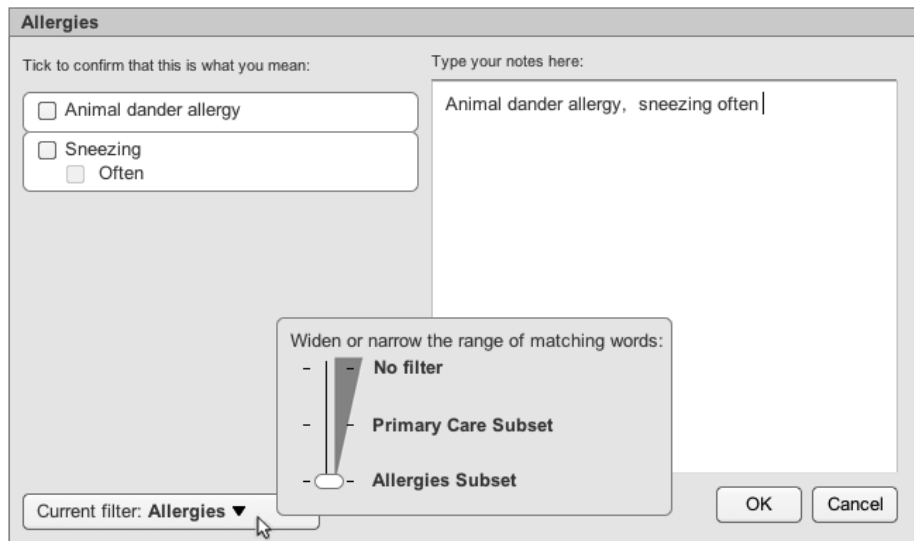
**Related NHS/MSUI Guidelines:** n/a

**Guideline FP6.** Use contextual limitation to increase relevancy of results.

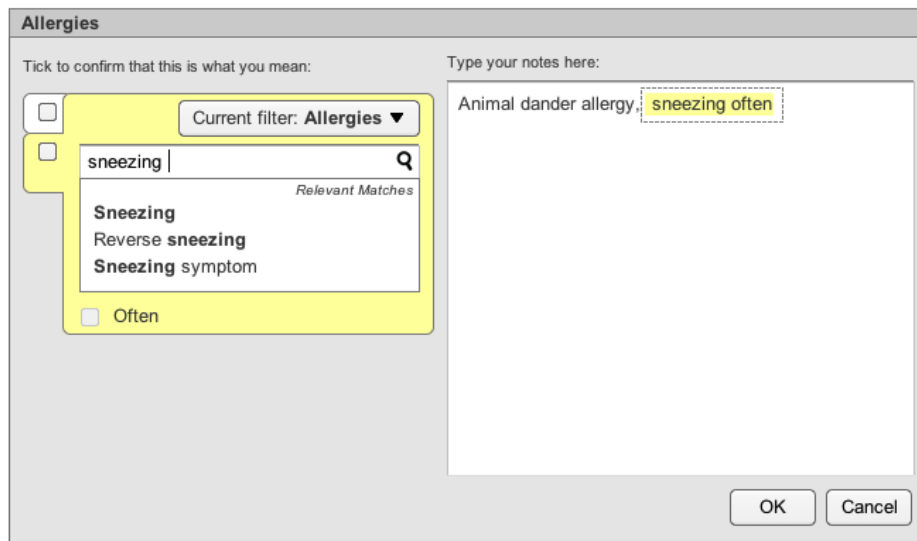
**Description:**

As discussed in Guideline CD1 only those concepts that are relevant to context should be presented to users. Since SNOMED CT contains over 393,000 active concepts, it is crucial that matching mechanisms only work upon concepts that are relevant to the current context. Subsets should be employed so that users do not have to read through irrelevant concepts. For example, when entering an allergy, the suggested matches should be limited to just allergies, and not include other items, such as social behaviours.

The system can also provide users with the ability to change the context filter. The filter buttons could be placed in two locations (within the note taking dialog and the search dialog), as shown below.



*Example of filter slider control used when subsets are logically nested*



*Example of filter button within search dialog*

Refer to Guideline SR2 for other types of possible filter controls, including checkbox and radio button controls.

**Rationale:**

Increasing the relevancy of results can reduce the number of results presented to users, helping them to more quickly select the desired concept. Employing subsets can also improve system performance since there is a smaller dataset upon which to search. Providing a control that allows users to change the context increases flexibility and can be valuable for additional refinement or expansion of the range of results.

**Environmental Scan Findings:**

- Best Design Practice #1
- Best Design Practice #3
- Design Challenge #1

**Related NHS/MSUI Guidelines:**

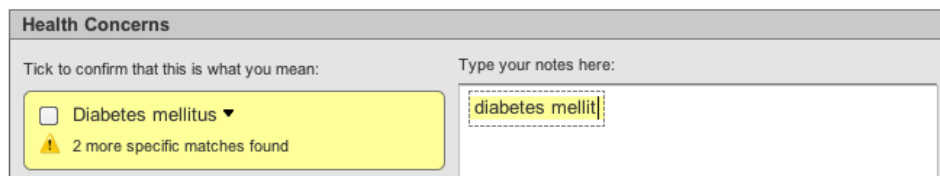
Document	Section #	Guideline #	Guideline Description
Terminology Matching	2.4.1	n/a	Must filter the concepts considered during the matching process, by subsets, where such subsets are available.
			Must allow users to adjust the subset filters.
			Should feature a slider control if there is a linear relationship between subsets, that is, if the subsets are logically nested.
			Could refer to limiting matches by subsets such as 'Filtering'.
Suggestions for Implementing into the UI of an EHS	3.1	SCT-005	Present only SNOMED CT concepts relevant to context.
	3.5	SCT-057	Provide an option to expand beyond the default context.



## Guideline FP7. Provide progressive matching as the user types in text (feasibility permitting).

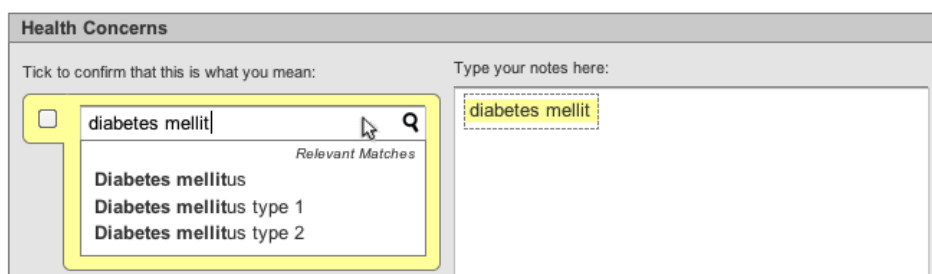
### Description:

As discussed under Guideline SR4, progressive matching results in the automatic display of results as users are typing. In the free-text parsing approach, the top match would be updated with each successive character the user has typed, as shown below. The wireframe below also indicates that there are more specific matches, as per Guideline FP4.



*Example of display of top match as user is typing*

If the user clicks to view the alternative matches, the search dialog also featuring progressive matching is presented. The user can also choose to modify the text within the search input field, automatically updating the results list.



*Example of progressive matching within search dialog (see Guideline SR4).*

Although progressive matching can be a very powerful feature for users, performance may be an issue particularly with larger SNOMED CT datasets. Contextual limitation (see Guideline FP6) and/or prioritising common matches (see Guideline SR11) can be employed to improve performance. The MSCUI on Terminology Matching suggests that the results should be updated within 200 milliseconds of the key press.

If progressive matching is not possible, other alternatives to consider include matching upon completion of the sentence, full-word matching, line-by-line matching, time-based matching (periodical triggering), and user-triggered matching (such as by pressing an “Auto-Analyze” button).

### Rationale:

Progressive matching can increase efficiency by saving typing time and suggesting matches to users when they are unsure of the exact term for which they are looking. This approach is used in a number of popular search engines, including Google, meaning greater familiarity to users. Reception of the feature has also been very positive in a number of previous SNOMED CT implementations, improving the uptake of encoded data entry. User-triggered matching (by pushing a button) has also been used in past implementations with some success in user adoption.

### Environmental Scan Findings:

- Best Design Practice #1
- Best Design Practice #3

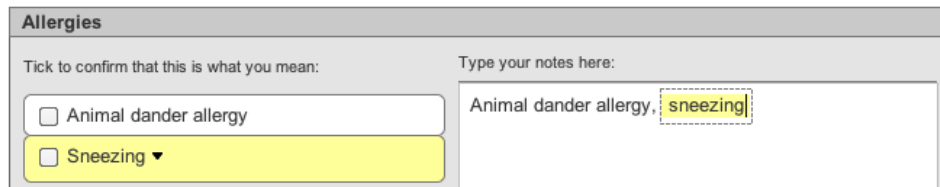
**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0050	Progressively match terms as the user types in text.
Terminology Matching	2.3.1	n/a	Should feature progressive matching in the case of single concept matching and matching within the encoding dialog, that is, typing in a new character (or deleting a character) invokes a matching event.
			Must ensure the matching event invoked during progressive matching is sufficiently timely. Should ensure that the matching event is invoked within 200 milliseconds of the key press.
Suggestions for Implementing into the UI of an EHS	3.2	SCT-023	Provide progressive matching (performance permitting)

**Guideline FP8.** Indicate the association between the text expression and the suggested match.

**Description:**

To improve visibility, the linkage between the expression within the noting area and the suggested match should be highlighted to the user. In the example below, the expression in the noting area is highlighted in yellow and surrounded by a dotted marquee. The corresponding suggested match is also highlighted in yellow, and a triangle icon appears next to the match’s label to not only provide visual distinction, but also make the area appear clickable. Conversely, if the user hovers the mouse pointer over another item in the suggested match list (e.g., *Animal dander allergy*), then the corresponding text in the noting area should be highlighted.



*Example highlighting linkage between text expression and suggested match*

In addition to highlighting the pairing of text and the suggested match, the ordering of items within the suggested match area should correspond to the order within the noting area.

**Rationale:**

Visually indicating the association and maintaining the order between the suggested match and the expression within the passage of notes helps users understand the linkage between the two areas. In past implementation experience, there has been greater user adoption of free-text parsing when highlighting was added.

**Environmental Scan Findings:**

- Best Design Practice #3

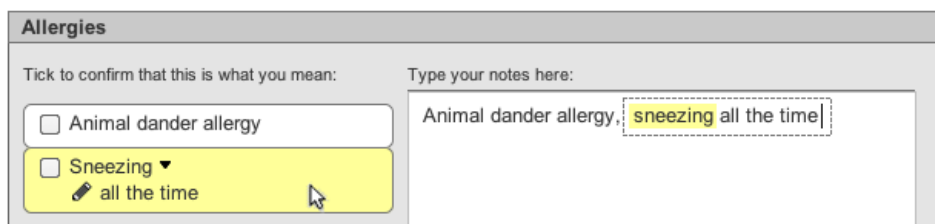
**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.2	n/a	Should display the suggested matches stacked vertically. Should display the suggested matches in the same order in which the related text appears in the input field.
			Should feature the suggested SNOMED CT matches in the same colour as the encoded highlight. Could feature a yellow or orange colour for the suggested SNOMED CT match above which the mouse is hovering.
Terminology Matching	2.3.3	n/a	Should ensure that the highlight in the left hand ‘suggested matches’ area is reflected by the focus in the text input area. Clicking on a suggested match highlights that area and also moves the focus to the corresponding text in the text input area.

### Guideline FP9. Distinguish between potentially encodable text and unencodable text.

#### Description:

During clinical noting, some of the text in the noting area may not be encodable as SNOMED CT concepts. For clear differentiation, only the potentially encodable text should be highlighted within the noting area, as shown below. In addition, within the suggested matches area, the unencodable text elaboration should still be listed below the related concept, but a different icon (e.g., a pencil icon) should be shown instead of a confirmation checkbox (see Guideline FP15).



*Example of unencodable text in noting area*

The MSCUI guidances on Terminology Display Standards and Terminology Elaboration suggest highlighting all potentially encodable text in light blue, regardless of whether the expression is in focus. Thus, the MSCUI would have highlighted both “Animal dander allergy” and “sneezing”. However, the solution presented above where only the expression in focus contains the highlighting can be less visually distracting, and still indicates to the user which text is potentially encodable. Further evaluation may be necessary to determine the effectiveness and usability of these alternative approaches.

#### Rationale:

Highlighting only potentially encodable text helps users recognize which words within an expression can be encoded. Within the suggested matches area, a confirmation checkbox is not required as the user does not need to confirm unstructured text. A special icon (e.g., pencil icon) provides further visual differentiation within the suggested matches area.

#### Environmental Scan Findings:

- Best Design Practice #3

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.1	n/a	Must visibly display, from the text typed by the user, which words or phrases have been recognised by the system to be potentially encodable as SNOMED CT concepts.
			Should ensure that the visible elements for communicating encodable words or phrases must be strongly visually associated with the text typed by the user.
			Should ensure that any communication where text can be encoded does not hinder the legibility of the text itself.
			Should communicate that a word or phrase is encodable by highlighting it.
			Should emphasise the boundaries between encodable concepts, for example, by showing clear gaps in the highlight between separate encodable concepts.
	2.1.4	n/a	Must visually distinguish the unstructured free text from the structured SNOMED CT and non-SNOMED CT terms. Should feature a special icon for the unstructured text. Must not feature a

Document	Section #	Guideline #	Guideline Description
			confirm check box control for the unstructured free text.
	2.1.5	n/a	<p>Must communicate how potentially encodable text is grouped with potential elaboration text, and distinguish this from text that will not be encoded.</p> <p>Should ensure that any visual communication of grouping does not significantly reduce the legibility of text. Should ensure that any visual communication of grouping does not interfere with other visual communication elements associated with the text (for example, encodable text highlights). Could display marquees around words to visually communicate they are grouped together.</p>
	2.2.2	n/a	Must visually link the unstructured notes with the confirmed concept match with which they are associated. Should visually link the unstructured notes with the associated confirmed concept match by a marquee.
Terminology Elaboration	2.1.2	n/a	<p>Must allow the user to associate free text with SNOMED CT expressions in the text parser approach to matching</p> <p>Should display the free text in the same area as the suggested match in the left-hand confirmation pane. Must distinguish the free text from the matched text. Could feature an icon to communicate that it is free text, rather than matched text. Could indent the free text and display it below the matched text, to show that the free text 'belongs' to the matched expression.</p>

**Guideline FP10.** Block additional formatting by the user.**Description:**

Within the noting area, additional formatting, including highlights, text colour changes, and underlines, should be blocked.

**Rationale:**

Highlighting and bolding serve as visual indicators within the noting area for other design guidelines (Guideline FP8, Guideline FP9, and Guideline FP13). If the user has the ability to change formatting, the meanings behind the formatting are lost, and the interpretation of information can become confusing.

**Environmental Scan Findings:**

- Best Design Practice #3

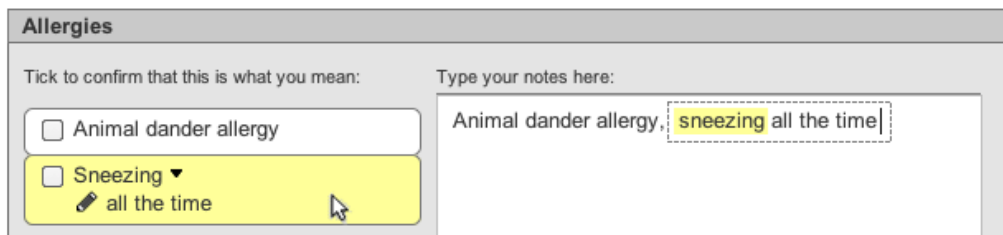
**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.1	n/a	Should block additional formatting by the user, including highlights, text colour changes and underlines.
Terminology Matching	2.2.1	n/a	Should NOT allow users to format the text (e.g., bold, underline, highlight).

### Guideline FP11. Visually indicate expression boundaries within the noting area.

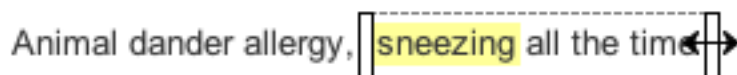
#### Description:

During clinical noting, the system could detect an expression such as after a full stop or carriage return. To clearly distinguish the multiple expressions from one another, visual indications can be used, such as a dotted marquee, as shown below. Only potentially encodable text is highlighted per Guideline FP9.



*Example of marquee used to group text in noting area*

Although the system would automatically detect expression boundaries by default, the system could also allow users to change the expression boundaries. As shown below, the dotted marquee box could be redesigned to include two 'handles', as shown below. Upon hovering over a handle, the cursor would change to a double-sided arrow icon, a conventional design used for resizing objects in many software packages. The user could drag the handle to either remove or add words to the expression. However, as the MSCUI has only evaluated this feature using wireframes, further evaluation may be necessary in health information system implementations.



*Example of resizable expression boundary with resize cursor*

#### Rationale:

The expression boundary provides greater visibility to users about the grouping of text, especially when multiple concepts are detected within the noting area. The boundary also serves to highlight the association between the text within the noting area and the suggested match (see Guideline FP8). Allowing users to manipulate the expression boundaries provides greater flexibility, and can enhance accuracy of encoded entries, but the user interface control may require further evaluation.

#### Environmental Scan Findings:

- Best Design Practice #3

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.1	n/a	Should emphasise the boundaries between encodable concepts, for example, by showing clear gaps in the highlight between separate encodable concepts.
	2.1.5	n/a	Should ensure that any visual communication of grouping does not significantly reduce the legibility of text. Should ensure that any visual communication of grouping does not interfere with other visual communication elements associated with the text (for example, encodable text highlights). Could display marquees around words to visually communicate they are grouped together.
	2.2.2	n/a	Must visually link the unstructured notes with the confirmed concept match with which they are associated. Should visually link

Document	Section #	Guideline #	Guideline Description
			the unstructured notes with the associated confirmed concept match by a marquee.
Terminology Elaboration	2.1.2	n/a	Must allow the user to 'un-associate' the free text from the matched expression. Should allow the user to delete the free text. Should allow the user to manipulate the expression envelope boundaries, in order to move the free text outside of the expression envelope, and thus disassociate it from the matched expression. Should conversely, allow the user to associate free text with a matched expression by manipulating the marquee boundaries.



## Guideline FP12. Explicitly state when no results are found, and provide assistance.

### Description:

When no results are found, the system should clearly indicate this to the user, rather than not responding. In addition, the system should provide assistance to the user, such as possible causes or actions to improve the search, such as trying a more general term or expanding the current filter. In the free-text parsing approach, this warning could be displayed within the suggested match area, as shown below. Instead of a confirmation checkbox, a special icon (e.g., pencil icon) could be shown to indicate unencoded text. Once the user clicks on the area, a search dialog could appear (see Guideline FP4), with the warning still shown (see Guideline SR16). The user then has the opportunity to change the text. Alternatively, the user could modify the text within the noting area.

The screenshot shows a form titled "Allergies" with two sections: "Tick to confirm that this is what you mean:" and "Type your notes here:". In the first section, there is a yellow box containing a pencil icon, the text "rare allergy", a warning icon, and the message: "No matches found. Try searching for a more general term or expanding the current filter." In the second section, the text "rare allergy" is entered in a text box.

*Example of message indicating no matches found*

This warning should only be shown when no matches are found for the main concept. If the main concept is encodable, a warning does not need to be displayed for additional text elaboration, as shown below.

The screenshot shows the same "Allergies" form. In the "Tick to confirm that this is what you mean:" section, there are two items: "Animal dander allergy" and "Sneezing" (with a pencil icon and "all the time" below it). The "Sneezing" item is highlighted in yellow. In the "Type your notes here:" section, the text "Animal dander allergy, sneezing all the time" is entered, with "sneezing all the time" highlighted in yellow.

*Example of no warning message for additional text elaboration*

Refer to Guideline SR16 for additional guidance for reporting no matches found, ongoing feedback and review of unencoded text, and mitigating no matches found.

### Rationale:

The MSCUI guidance on Terminology Matching does suggest an alternative approach where no indications would be provided within the suggested match area. However, the problem with this approach is that users may assume the system is not responding or functioning properly. Indicating to users when the main concept cannot be encoded encourages users to encode their notes.

### Environmental Scan Findings:

- Best Design Practice #6

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.2	CNA-0340	Clearly indicate when no matches have been found.
		CNA-0350	Provide a control that allows the user to retain the unencoded text in the form.

Document	Section #	Guideline #	Guideline Description
		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 appropriate then they are to activate the control that retains the unencoded text.
		CNA-0380	Display the message in the same location as the results would otherwise be displayed.
		CNA-0390	If the user activates the control that retains the unencoded text, display the text in normal weight.
Display of Clinical Statements	Slide 26	n/a	If no encoded terms are available, this should be flagged and not left blank.
Recording Adverse Drug Reaction Risks	3.2.5	RAD-0191	If a term has not been recognised, the system will warn the clinician that the term has not been recognised, but will allow them to enter it as free text.
Terminology Elaboration	2.1.2	n/a	Must allow the user to associate free text with SNOMED CT expressions in the text parser approach to matching.
Terminology Matching	2.3.2	n/a	Must provide the user with a method of reporting 'No matches found'.
Suggestions for Implementing into the UI of an EHS	3.4	SCT-054	Explicitly state when no results are found.
		SCT-055	With no results returned, offer further assistance.

**Guideline FP13.** Upon confirming a match, replace the typed text and show that it has been encoded.

#### Description:

Once the user has confirmed a concept within the suggested matches area, the system should replace the user-typed text with the SNOMED CT concept. In addition, the encoded term should be bolded (unencoded terms should remain in normal weight), as shown below. The highlight colour could be changed to gray to provide further visual indication that the text has been encoded.

*Example showing bolded encoded text and gray highlighting*

#### Rationale:

Replacing the original text with the encoded label prevents confusion that can arise with multiple statements referring to the encoded concept. Bolding distinguishes encoded text from unencoded text and clarifies to users which text has been encoded.

#### Environmental Scan Findings:

- Best Design Practice #3
- Best Design Practice #8

#### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Clinical Noting in Forms	3.3.1	CNA-0300	After the user has selected a matched term, display the term in bold text.
	3.3.2	CNA-0390	If the user activates the control that retains the unencoded text, display the text in normal weight.
Terminology Display Standards	2.1.4	n/a	Must visually distinguish the unstructured free text from the structured SNOMED CT and non-SNOMED CT terms. Should feature a special icon for the unstructured text. Must not feature a confirm check box control for the unstructured free text.
	2.2.1	n/a	Must visually distinguish confirmed from unconfirmed or unstructured text. Could feature a grey background/highlight for matches that have been confirmed. Should feature the label text for all confirmed matches in bold text style. Should ensure that all unstructured text remains in a normal text style. Must replace the typed text with the matched SNOMED CT label once the user confirms the match.
Terminology Elaboration	2.1.2	n/a	Must allow the user to associate free text with SNOMED CT expressions in the text parser approach to matching
			Should display the free text in the same area as the suggested match in the left-hand confirmation pane. Must distinguish the free text from the matched text. Could feature an icon to communicate that it is free text, rather than matched text. Could indent the free text and display it below the matched text, to show that the free text 'belongs' to the matched expression.
Terminology Matching	2.3.3	n/a	Should replace the original text in the text input area with the relevant SNOMED CT concept label (which will be either a 'preferred term' label or 'synonym' label upon confirmation).

**Guideline FP14.** Allow users to edit and undo the confirmation of matches before the note is committed to record.

**Description:**

Once an entry has been confirmed, the system should provide the user with the flexibility to edit and undo the confirmation of matches. As shown below, the user can simply uncheck the confirmation checkbox to revert the text back to the originally entered form.

The screenshot shows a form titled 'Allergies'. On the left, under 'Tick to confirm that this is what you mean:', there are two options: 'Animal dander allergy' (unchecked) and 'Sneezing' (checked). On the right, under 'Type your notes here:', the text 'Animal dander allergy, Sneezing' is displayed. The word 'Sneezing' is enclosed in a dashed rectangular border, indicating it is confirmed.

*Example of confirmed match*

The screenshot shows the same 'Allergies' form. The 'Sneezing' option is now unchecked. In the notes area, the text 'Animal dander allergy, sneezing' is displayed. The word 'sneezing' is enclosed in a dashed rectangular border, indicating it is unconfirmed.

*Example of unconfirmed match and reverted text*

If the user decides to hover over the confirmed match, the area would still appear clickable, as shown below. Clicking on the area would unconfirm the match and result in the list of alternative matches appearing, with the original input text (as seen in Guideline FP4). To inform the user of the automatic unconfirmation and to prevent the user from inadvertently unconfirming the match, the system should display a warning message prior to opening the list of alternative matches.

The screenshot shows the 'Allergies' form with the 'Sneezing' option checked. The text 'Sneezing' in the notes area is highlighted with a dashed border. A mouse cursor is hovering over the 'Sneezing' option in the list, indicating it is still clickable.

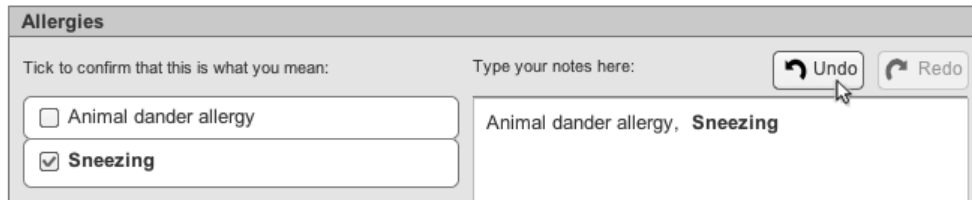
*Example of clickable area while hovering over confirmed match*

If the user decides to edit the encoded text within the noting area, they should be provided the freedom to do so, as shown below. However, again to avoid inadvertently unconfirming the match, the system should display a warning message prior to allowing the user to edit the text.

The screenshot shows the 'Allergies' form with the 'Sneezing' option unchecked. The text 'Animal dander allergy, Sneezin|' is displayed in the notes area. The word 'Sneezin|' is enclosed in a dashed rectangular border, indicating it is unconfirmed and being edited.

*Example of edited text that was previously confirmed and encoded*

As shown below, the system can also provide undo and redo functionalities, to allow users to easily recover from mistakes while confirming, unconfirming, or editing matches.



*Example of undo and redo buttons*

It should be noted that these guidelines are only applicable prior to information being committed to the patient's record. Different requirements and user privileges may exist once information has already been committed, which may reduce access to data modification.

**Rationale:**

Allowing users to edit and unconfirm matches enables users to fix a confirmed match that could have been made in error. Providing explicit undo and redo functionalities allows users to more easily recover from mistakes while confirming, unconfirming, or editing matches.

**Environmental Scan Findings:**

- Best Design Practice #3

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Display of Clinical Statements	Slide 69	n/a	Users need to be able to edit both encoding and free text, and want to see how they can adjust or remove their changes during editing.
Terminology Matching	2.3.5	n/a	Must allow users to undo the confirmation of a matched expression. Should allow the user to undo a confirmed match by deselecting the appropriate check box. Should allow the user to undo a confirmed match by clicking on the appropriate text in the text input area.
			Must return the text to its original form upon unconfirming a matched expression
			Must provide an 'undo' and 'redo' function which undoes the effects of the last send matching request. The controls should be visible from the main window.

## Guideline FP15. Detect elaborations associated with the base concept.

### Description:

As users are typing text within the noting area, a base concept should be detected, as well as additional elaborations or attributes. If the attribute is encodable, it should be listed and indented below the main concept, as shown below.

The screenshot shows a form titled 'Allergies' with two sections: 'Tick to confirm that this is what you mean:' and 'Type your notes here:'. In the first section, there are two checkboxes: 'Animal dander allergy' (unchecked) and 'Mild' (unchecked). In the second section, the text 'Animal dander allergy, mild' is entered and highlighted with a dashed border.

*Example showing detected attributes*

The confirmation checkbox for the attribute should only be enabled once the base concept has been confirmed, as shown below.

The screenshot shows the same 'Allergies' form. Now, the 'Animal dander allergy' checkbox is checked and has a grey background, indicating it is enabled. The 'Mild' checkbox is also checked and enabled. The notes field still contains 'Animal dander allergy, mild'.

*Example showing enabled checkbox for attribute*

Once the user confirms both concepts, both checkboxes would be checked and still enabled, as shown below. The user can decide to uncheck the attribute checkbox on its own to unconfirm the attribute. However if the user clicks on the base concept, the attribute should also become unchecked. If the attribute or qualifier is mandatory, the attribute checkbox should be disabled to prevent users from saving base concepts without mandatory attributes (see Guideline FP17 for wireframe diagram).

The screenshot shows the 'Allergies' form with both 'Animal dander allergy' and 'Mild' checkboxes checked and enabled. The notes field now contains 'Animal dander allergy, Mild'.

*Example showing confirmed base concept and attribute*

If the additional elaboration cannot be encoded, a special icon (e.g., pencil icon) instead of a confirmation checkbox would be displayed, as per Guideline FP9 and as shown below.

The screenshot shows the 'Allergies' form. 'Animal dander allergy' is unchecked. 'Sneezing' is checked and has a pencil icon next to it, indicating it is an unencoded elaboration. The notes field contains 'Animal dander allergy, sneezing all the time'.

*Example of pencil icon for unencoded elaboration*

### Rationale:

Design guidance and past implementation experience have indicated that a single-coded concept is often not adequate to describe what a clinician wishes to express. Thus the system should provide the flexibility

for users to specify additional elaboration. Indenting the additional elaboration below the base concept provides a clear visual association with the base concept.

**Environmental Scan Findings:**

- Best Design Practice #3
- Best Design Practice #5

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Display Standards	2.1.3	n/a	Must display the attribute concepts that it has identified as part of the top matched SNOMED CT expression solution within a single boundary. Must display a confirm checkbox for each of the attributes.
			Must communicate that the attribute concepts are further descriptions that belong to the base concept. Should indent each attribute concept in relation to its base concept.
			Should only display the attribute value label (such as 'Mild'), and not the attribute name (such as 'Severity').

## Guideline FP16. Prompt for values associated with a concept.

### Description:

Whenever possible, the system should prompt for values that are associated with or required for the matched concept. In the examples below, the system has detected that *Body temperature* should have an associated temperature value and has suggested a default measurement unit (degrees Celsius).

The screenshot shows a 'New Encounter' form with two sections: 'Tick to confirm that this is what you mean:' and 'Type your notes here:'. In the first section, there is a yellow highlighted area containing a checkbox for 'Body temperature' and a blue alert message with a warning icon that says 'You should enter values'. A mouse cursor is pointing at the alert message. In the second section, the text 'Body temperature' is entered and highlighted with a dashed border.

*Example of clickable alert message in suggested match area*

The screenshot shows the same 'New Encounter' form. In the yellow highlighted area, there is now an input field for 'Temperature value' and a dropdown menu for the unit, currently set to '°C'. A mouse cursor is pointing at the unit dropdown. The text 'Body temperature' remains in the notes area, highlighted with a dashed border.

*Example of fields appearing within suggested match area*

In addition to the input fields for temperature value, the user can opt to type in temperatures within the noting area. This value should be automatically detected and shown within the suggested matches area, as shown below.

The screenshot shows the 'New Encounter' form with the 'Temperature value' input field now containing the number '39.8'. The unit dropdown is still set to '°C'. The text in the notes area has been updated to 'Body temperature 39.8' and is highlighted with a dashed border.

*Example of detected values from the noting area*

When matched concepts require larger sets of values, templates containing a series of input fields can be triggered for more complete documentation. Although work is still exploratory, the MSCUI Design Groundwork Exploration on Noting Using Templates suggests being able to offer more than one template per triggered term.

### Rationale:

Prompting for associated or required information can improve the completeness of documentation. Placing the additional value fields directly within the suggested match area allows users to quickly enter in values. The MSCUI guidance on Terminology Elaboration does suggest alternative placements of the additional value fields, such as after clicking on the main concept and opening the search dialog, or right-clicking on the text within the noting area, but these routes may not be as obvious to users.

### Environmental Scan Findings:

- Best Design Practice #3
- Best Design Practice #4



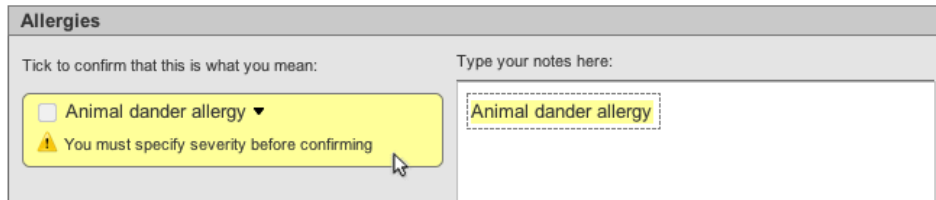
**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Noting using Templates	5.2	n/a	The user interface offers templates related to a recently encoded term.
			It automatically 'pushes' template options, in addition to allowing the user to request them ('pull').
			It can offer more than one template for a single term.
			Templates are filtered according to context.
			The user interface visually links templates to trigger words.
	Templates can be opened by default if there is only a single template available, if it is assumed that the user will need to complete it, and the user can then 'opt out' rather than 'opt in'.		
6.2	n/a	The user interface allows the user to trigger templates from free text. The user interface proactively offers certain template matches from within free text.	
		The user interface matches terms without requiring active (user) encoding [during entry of free text]".	
Terminology Elaboration	2.3.1	n/a	Must identify values and units from within the notes. Do NOT interpret a full stop character as a full stop if it has digits immediately on both sides of it.
			Should suggest default units for measurement values.
			Must display the values and units it has identified back to the user for the user's confirmation.
	2.3.2	n/a	Should allow the user to adjust the values and units in the expanded encoding dialog.
			Should identify where matched concepts are associated with or require values. Offer default units, but do not offer default values.
	n/a	Should encourage users to enter values where appropriate.	

**Guideline FP17.** Only allow users to confirm a base concept if its mandatory attributes have been completed.

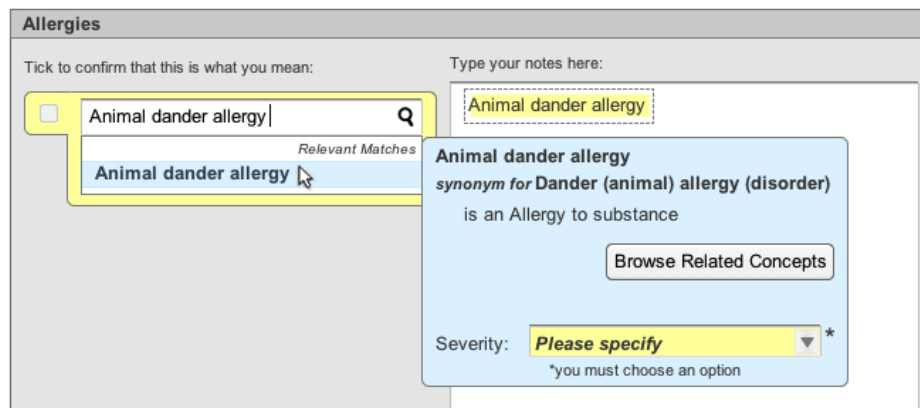
**Description:**

Whenever a base concept has mandatory attributes or qualifiers, the system should alert the user and prevent the user from confirming the base concept until the mandatory attributes have been completed. Shown below is an example of a warning message indicating that severity must be specified before confirming. The confirmation checkbox is also disabled.



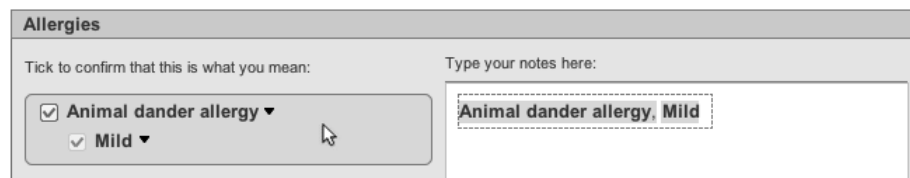
*Example of alert message indicating to specify severity before confirming.*

The user could simply enter the attribute within the noting area (per Guideline FP15). Alternatively, if the user clicks on the suggested match area, they can hover over the item to display a fly-out dialog containing a dropdown field (as per Guideline EL2).



*Example of selecting severity within the fly-out dialog*

Once the attribute value is chosen, both the base concept and attribute value are automatically confirmed. The checkbox for the attribute is also disabled, to prevent the user from deselecting the attribute value independently from the main concept.



*Example of disabled checkbox for severity qualifier*

**Rationale:**

Encouraging users to specify a qualifier can ensure complete documentation. The suggested design prevents users from confirming a concept without selecting a qualifier.

**Environmental Scan Findings:**

- Best Design Practice #3
- Best Design Practice #4

**Related NHS/MSUI Guidelines:**

Document	Section #	Guideline #	Guideline Description
Terminology Elaboration	2.2.3	n/a	Must disable the control for confirming a match (text parser matching control) or the control for saving the note (single concept matching approach) if there is a mandatory qualifier that remains unresolved. Do not allow users to encode a term without selecting all of its mandatory fields.
			Must provide a control for selecting the mandatory qualifier. Could feature a drop-down list box. Should associate the control with the individual match. Should feature the control in the match's flyout.
			Must not allow the user to unconfirm the mandatory qualifier value independently from the base concept.
Terminology Matching	2.3.3	n/a	Should only enable the confirmation control if there are no unselected mandatory elaboration fields associated with the match.

**Guideline FP18.** Post-coordinate elaborations with the main concept during free-text entry (feasibility permitting).

**Description:**

SNOMED CT offers the ability to post-coordinate concepts to describe more complex circumstances. Concepts can be post-coordinated with their context header. For example, if the concepts *Allergy* and *Animal* existed within SNOMED CT, but the concept *Allergy to animal* did not exist, the two concepts could be post-coordinated automatically, if the user simply entered “animal” within an Allergies form.

Concepts can also be post-coordinated with attributes during free-text entry, as shown below. (See Guideline FP15, Guideline FP16, and Guideline FP17 regarding the entry of attributes.)

The screenshot shows a form titled "Allergies". On the left, under "Tick to confirm that this is what you mean:", there are two checked items: "Animal dander allergy" and "Mild". On the right, under "Type your notes here:", the text "Animal dander allergy, Mild" is entered in a dashed box.

*Example showing confirmed base concept and attribute that could be post-coordinated*

Alternatively, the system could allow users to type the qualifier or attribute in *front* of the main concept to reflect natural language reading order, as shown below.

The screenshot shows a form titled "Allergies". On the left, under "Tick to confirm that this is what you mean:", there is one checked item: "Mild animal dander allergy". On the right, under "Type your notes here:", the text "Mild animal dander allergy" is entered in a dashed box.

*Example of qualification with natural language reading order*

The system could also allow users to express the absence of the allergy directly within the noting area, as shown below. Rather than asking users to type “animal dander allergy, absent”, the system could detect the absence of the allergy if the user simply typed “no animal dander allergy”. For visual clarity, only the negation keyword would be bolded within the suggested matches area regardless of confirmation status.

The screenshot shows a form titled "Allergies". On the left, under "Tick to confirm that this is what you mean:", there is one unchecked item: "No animal dander allergy". On the right, under "Type your notes here:", the text "no animal dander allergy" is entered in a dashed box.

*Example of negation with natural language reading order*

For possible allergies or disorders possessed by the patient, the MSCUI guidance on Terminology Post-coordination suggests using a question mark (“?”) in front of the disorder. However, this notation may not be conventional to users and requires further evaluation.

If the user elected to click on the item within the suggested match area, the qualifier or negation keyword would also be displayed within the search field (see Guideline EL7).

Past research has indicated that free-text entry is easier and more effective than selecting attributes from dropdown lists. However, in general, the guidance surrounding post-coordination is still preliminary, as there has been limited uptake in clinical settings. In addition, post-coordination must be studied on a case-by-case basis, as rules may differ based on the types of concepts being post-coordinated. At this time, there only exists guidance pertaining to disorders, and these guidelines may not be suitable for other types of SNOMED CT concepts. Thus, further study is required to evaluate feasibility as SNOMED

CT implementations progress.

### Rationale:

Post-coordination is tremendously valuable in refining concepts and improves semantic interoperability between systems. One of the main hurdles of post-coordination is seamless integration within the user interface. The suggestions provided above do not add extra steps for the user over what would have been originally performed during free-text entry. However, further study is still required in this area.

### Environmental Scan Findings:

- Best Design Practice #3
- Best Design Practice #5

### Related NHS/MSUI Guidelines:

Document	Section #	Guideline #	Guideline Description
Terminology Post-coordination	2.1.1	n/a	Must be able to match expressions that contain SNOMED CT concepts that are linked by attribute relationships outlined in the Concept Model.
			Must ensure that there is at least one base concept (that is, a Clinical finding, Procedure, Observable entity or Situation with explicitly context concept) in each expression.
			Wait until the system has identified an expression boundary (such as a full stop or carriage return) until running the post-coordination matching process.
	2.1.2	n/a	Must confirm the whole post-coordinated simple negation expression by selection of a single check box.
			Must confirm the whole post-coordinated queried expression by selection of a single check box.
			Should support the negation of the form 'Known absent' for disorder concepts by: <ul style="list-style-type: none"> <li>• Identifying the key word 'No' at the start of an expression (with a space character after the letters) in the user's typed input</li> <li>• Running a parallel matching process for disorders against the subsequent text typed in by the user</li> <li>• Displaying the word 'No' in front of the matched disorder concepts</li> <li>• Merging the returned results from both matching processes, and order them according to statistic word matching</li> <li>• Post-coordinating the chosen match with the Finding context attribute (ConceptID 408729009) with the qualifier value 'Known absent' (ConceptID 410590002)</li> </ul>
			Should post-coordinate expressions of uncertainty ('?', meaning 'Known possible') for disorder concepts by: <ul style="list-style-type: none"> <li>• Identifying the key word '?' at the start of an expression in the user's typed input</li> <li>• Running a matching process for disorders against the subsequent text typed in by the use</li> <li>• Displaying the word '?' in front of the matched disorder concepts Post-coordinating the chosen match with the Finding context attribute with the qualifier value 'Known possible'</li> </ul>
Must only provide this simple method of negation and uncertainty post-coordination for concepts within the 'Disorder' hierarchy.			
Display the negation or uncertainty words in bold, regardless of confirmation status.			
2.1.4	n/a	Must allow user to confirm concepts individually within a post-	

Document	Section #	Guideline #	Guideline Description
			coordinated expression (that is, independently from the others in the expression), but only if the user has confirmed the base concept.

# Additional Online Resources

## General

- Microsoft Health Common User Interface Guidelines  
<http://www.mscai.net>
- Windows User Experience Interaction Guidelines  
<http://msdn.microsoft.com/en-us/library/windows/desktop/aa511258.aspx>
- Mac OS X Human Interface Guidelines  
<http://developer.apple.com/library/mac/#documentation/UserExperience/Conceptual/AppleHIGuidelines/Intro/Intro.html>
- useit.com: Jakob Nielsen on Usability and Web Design  
<http://www.useit.com>
- Usability.gov: Research-based Web Design and Usability Guidelines  
<http://www.usability.gov/guidelines/>

## Forms

- Forms that work: Designing for Usability  
<http://www.formsthatwork.com/>
- An Extensive Guide to Web Form Usability  
<http://uxdesign.smashingmagazine.com/2011/11/08/extensive-guide-web-form-usability/>
- Web Application Form Design  
[http://www.lukew.com/resources/articles/web\\_forms.html](http://www.lukew.com/resources/articles/web_forms.html)

## Search

- useit.com: Search: Visible and Simple  
<http://www.useit.com/alertbox/20010513.html>
- User Focus: 20 search usability guidelines  
<http://www.userfocus.co.uk/resources/searchchecklist.html>
- Usability.gov: Search  
<http://www.usability.gov/pdfs/chapter17.pdf>