Integrating the Healthcare Enterprise

IHE Radiology (RAD)
White Paper

Management of Radiology Report Templates

Revision 1.0

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Foreword

This is a white paper to explore the use cases for the Radiology Report Templates and to describe a template model that will serve as a format for how templates can be transported
30 between systems.

This white paper is intended to inform about the creation of a Management of Radiology Report Templates (MRRT) Profile and support work being done in DICOM Working Group 8.

35 General information about IHE can be found at: www.ihe.net

Information about the IHE Radiology domain can be found at: http://www.ihe.net/Domains/index.cfm

Information about the structure of IHE Technical Frameworks and Supplements can be found at: http://www.ihe.net/About/process.cfm and http://www.ihe.net/profiles/index.cfm

40 The current version of the IHE Radiology Technical Framework can be found at: http://www.ihe.net/Technical_Framework/index.cfm

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Introduction

This white paper, developed by the IHE Radiology Technical Committee, describes the Management of Radiology Report Templates (MRRT).

Open Issues and Questions

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- How to harmonize this framework with DICOM-SR framework?

- How to adapt content of existing RSNA RelaxNG templates into fields and annotated text in this conception of report templates?

- What is the scope for field identifiers under which they must be unique? They could be scoped within the template in which they appear. But then how do we handle reports in which more than one template has been invoked?

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- Is there a better way to manage issues of associated text, which when edited, called into question associated coded entries?

- What is the semantics of inheritance among templates?

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- Examples are needed of both in line markup and markup in a separate section for coded entries, which are linked back to text segments with an identifier.

- How should applications deal with numeric range violations?

- How should merge content be retrieved? Should retrieval methods use data other than the coded content associated with a field? Should the merge content initially be restricted to atomic/scalar value?

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- How to specify merge fields that are not related to controlled terminology, such as <current time>?

- Should templates be used to validate report instances? Are there any compelling use cases?

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- Should more flexibility be offered for the representation of coded content in Term Sets?

Closed Issues

- Template inheritance: child template should only further specialize by restriction, including specification and requiring of content optional in parent- cf. inheritance rules for CDA templates [HS]. Probably will not satisfy use case. Some specialized templates need added content in the children; some require deleted content in the children.

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- Use identifier mechanism from DICOM SR to handle Merge fields [HS]. Yes, will work well for Merge fields drawing data from DICOM objects.

- What are CDA limits on section recursion? None.

- Is a "Report Element" concept needed, or can will Sections, Text, and Fields be sufficient? <text> and <entry> blocks will be used.

- <<Need to address the report authors inside report instances>> WG-8

- <<Review RFD and/or XForms as possible source of mechanisms?>> No.

- How to handle hyperlinking. Should URLs be explicitly specified in Fields, Items, etc., or should we just allow HTML markup anywhere we allow text? Yes—HTML markup is allowed anywhere within a <text> block.

- Can options in a picklist be other templates (select a template to insert here). Yes, one attribute of a selection list item is the name of the template that should be executed if the item is selected.

- Do we need certain required sections in a top level template? Yes. At least Impression/Conclusion should be required.

- Should Term Sets be implemented as Shared Value Sets, which would enable central/automatic updates? [KO] Term sets are dynamic parts of a template and should not be encoded as part of a standard.

- Avoiding having some of these attributes edited without modifying other corresponding attributes is part of why we might need a dedicated tool for authoring/editing. This is handled by markup and coded entries.

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1   Reporting Process

This document concerns the use of report templates to create diagnostic imaging reports. We
will begin with a description of the reporting process to provide a clear context for the templates
described and to introduce some relevant terms.

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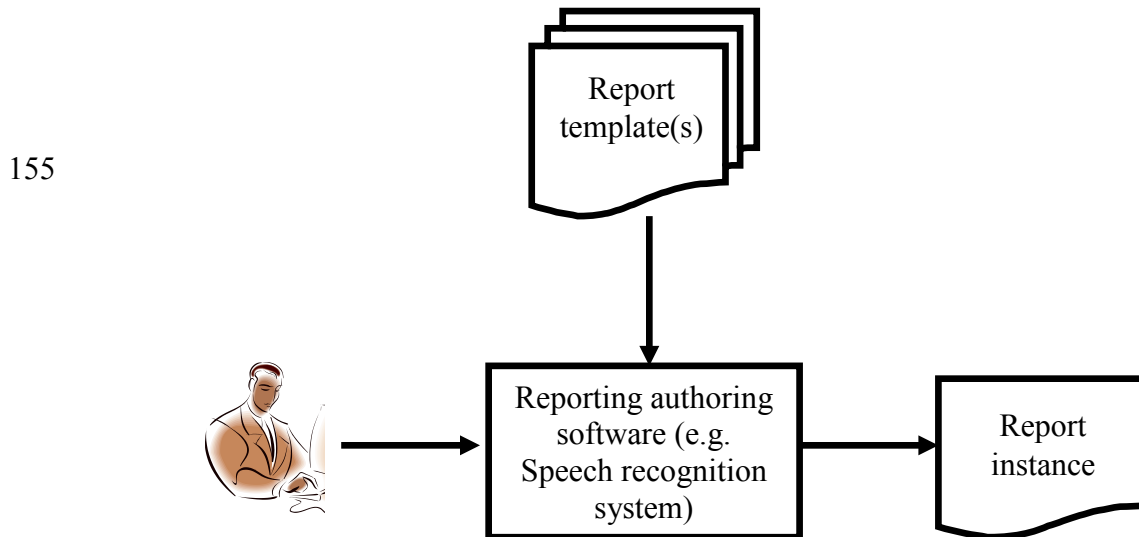
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**Figure 1-1: A schematic representation of the clinical reporting process. The user of
reporting software applies one or more report templates in the production of clinical
documentation.**

A report is *created* by a user of a *reporting system*, typically a *provider* such as a radiologist. A
reporting template may be *applied* by the user to assist in the creation of the *report*. Figure 1-1
shows the reporting process schematically. For example, a radiologist in the reading room may
use a speech recognition system to create a narrative report describing the interpretation of a
diagnostic imaging study. The speech recognition system assists the radiologist in applying
templates during the reporting process. The radiologist also may edit the text of report using that
system.

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Although many radiology practices use automated systems to create their reports, the process of
radiology reporting has changed very little in the past 100 years. The report still is distributed
almost exclusively as a free-text narrative, modeled after a consultation letter between clinical
colleagues. Although some reporting systems have sophisticated template functions, the overall
metaphor for interaction with the report authoring system is that of a text editor with an insertion
point. Although the provider may apply templates at any point in the process, he or she retains
ultimate control over the appearance of the document and may add or delete text at any point,
whether through speech recognition, typing at the keyboard, or the application of a template.

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1.1 Reporting Modes

180 Radiologists who use automated systems to assist in the creation of their reports typically use one of 4 modes.

1. Text mode: In a purely text mode, the radiologist begins with a blank page, and creates the text of the report through automated speech recognition, or by typing and formatting the report narrative manually.

185 2. Fill in the blanks: Many radiologists start by applying a template that contains the overall structure of the entire report (e.g., by speaking "macro CT Abdomen normal"). Blanks within that template can be filled with customized text related to the study at hand. Because a template is used, the resulting report has a consistent ordering of report content.

190 3. Serial assembly. Some radiologists use a large set of small templates, each containing only a small phrase or sentence related to the report (e.g., "macro atelectasis", "macro heart normal", "macro central line"). These small templates generally do not contain blanks that need to be filled in, and are assembled in series to create an entire report.

4. Nested or hybrid assembly. Radiologists who are "power users" of reporting systems
195 often assemble their reports using a combination of fill-in-the-blanks and serial assembly. For example, they may begin with an overal template containing blanks. Then each blank is filled in using serial assembly of smaller templates.

Which reporting mode is the most useful depends on the type of study being reported. For example, serial assembly is often used to report ICU chest radiographs, where there are a large
200 number of brief elements (e.g., the position of tubes and lines) that must be assembled in multiple combinations. Creating a template for each combination would create a combinatoric explosion. Fill-in-the-blanks mode works well for radiologists who are not sophisticated users, but nevertheless want consistent ordering of content, and are willing to fill in each section using speech recognition. Hybrid assembly works well for sophisticated users who report complex
205 studies, and are willing to give substantial advanced consideration to the design of their templates and how they will be used in combination.

1.2 Using a Template in Report Creation

1.2.1 Template Selection

Regardless of the reporting mode used by a provider, there are several common elements of the
210 process. The first is the selection of the template, which can be done manually or using a speech trigger according to the needs of the current reporting task. Alternatively, some reporting systems select an initial template automatically or offer a short list to the provider based on attributes of the exam code such as the imaging modality and/or body part being imaged.

Once a template is selected, it is typically presented to the user in the form of a text document,
215 often containing blanks or *fields*, using a text-editor metaphor. Many systems enable the user to navigate between fields using the rewind and fast forward buttons on the microphone. Thus the

provider can use that template to guide its interaction with the reporting system to create a report. Below are listed some abstract examples of how that interaction can occur.

1.2.2 Verbatim Mode

220 For common normal reports, templates are often constructed to fully specify the complete report. In that case, the provider can accept the template and its default values "as is" with one click.

1.2.3 Text Unchanged Mode

When most studies are nearly normal, and tend to vary from normal in consistent patterns, the provider often will design a template that encodes those common variations as fields that can be
225 filled to describe the variation. When a report is completed in that manner, the fields are modified, but often not the text.

1.2.4 Revision Mode

When there is increasing variation of the report from the normal and near-normal, the provider still may invoke a common template, but may significantly modify the template. For example
230 the provider may add or delete text, template fields, or other portions of the template, including entire sections. Or, the provider might violate the typical format, such as by inserting text in a field rather than choosing from items in the provided pick list.

1.2.5 Template Deletion

In this mode, the physician completely deletes all or nearly all template elements and dictates the
235 report from mostly from scratch. This is similar to reporting in text mode without a template, but the need to report in this manner may occur to the provider only after attempting to fit the report content into an existing template.

1.3 The Benefits of Radiology Report Templates

Regardless of the reporting mode used, research shows that radiologists who use templates are
240 more efficient than those reporting in a free text mode. Because templates contain pre-authored text, there is less conceptual work required to design the report and create the text de novo. And less proof reading of the resulting text is required.

Reporting from templates also can improve the resulting reports by making them more complete, with a consistent ordering that makes it easier for report recipients to find information. Because
245 templates can be constructed with pre-associated coded concepts, terms, and metadata, they can more easily be parsed, searched, and retrieved by a computer. The use of templates can also encourage and/or enforce compliance with local or national guidelines, such as the critical test result reporting requirements of the Joint Commission, or the report content measures of the CMS Physician Quality Reporting System (PQRS).

1.4 IHE Scope and Responsibilities

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This document is part of an IHE process to create methods for the exchange of templates between reporting systems, and between template libraries and reporting systems. The methods described here are agnostic to how the templates may be selected for exchange (e.g., shopping cart from a web site, or comprehensive data migration from one vendor system to another). The purpose of this document is to describe the minimum elements that will be required for template exchange via a file. We will focus this work on the file format for template exchange, and will coordinate our work with DICOM Working Group 8 (Structured Reporting) as they do interdependent work on the compatible version of the report instances that will be created.

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In defining requirements for template exchange, we are necessarily anticipating the needs of the report creator (e.g., radiologist), proposing the features that can be made available to the user during the reporting process, and constraining the format of the radiology report that is created. Different reporting vendors may make widely varying decisions about how to use these template features to optimize the efficiency of the reporting provider. We view such diversity as an important benefit to potential users, who can select a reporting vendor that offers a feature set best suited to their reporting situation.

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There is an inherent tension between the rigor of coded data, which is machine readable and can later be mined for a variety of important and productive purposes, and the freedom of the text editor metaphor, which enables the human user to arbitrarily modify the report as they see fit. The development of transport methods for radiology report templates must manage the tension between these two imperatives because both are necessary to maintain and improve the quality of care.

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2   A Report Template Model

As shown in Figure 1-1, a report is *created* by a user of a *reporting system*, typically by a *provider* such as a radiologist. A *reporting template* may be *applied* by the user to assist in the creation of the *report*. This section describes an information model for how a report template (and, by inference, a report instance created from that template) can be structured. This model will affect how templates are encoded and will implicitly define certain required behaviors of reporting systems.

2.1   Template Structure

2.1.1   Template Attributes

The following attributes can be associated with each report template:

- Template UI (REQUIRED): A unique alphanumeric identifier (e.g., URI) that should be included in any report instance generated using the template

- Template Name:

- Template Attributes:

    - Template exam characteristics: A list of characteristics which enable matching of the template to the imaging exams to which it might apply, for example:

        - Exam code(s), using the standard term triplet used by DICOM: code meaning, code value, coding scheme designator. (E.g., [CT ABDOMEN WITHOUT IV CONTRAST, RPID3, RADLEX] from the RadLex Playbook)

        - Modality, e.g., [RID10321, computed tomography, RADLEX]

        - Body site, e.g., [RID56, abdomen, RADLEX]

        - Subspecialty

        - IV_Contrast

        - Gender

        - Indication

        - Patient life stage, e.g., a subclass of [RID5639, human life stage, RADLEX]

        - Provider group

    - Owner(s) (REQUIRED): The individual(s) responsible for maintaining the template

    - Contributors: A list of individuals who contributed to the template

    - Parent template: A template from which this template may inherit characteristics

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- Sanctioning body(ies): The organizations who have sanctioned the use of this template (e.g., RSNA, the local site)

- Language: The language in which the template is written (e.g., English)

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- Top level (REQUIRED): Binary attribute that indicates when the template cannot be a subsection of another template

- Creation date (REQUIRED)

- Revision number

- Retired flag: Marks templates that can no longer be used for creating reports

310 ### 2.1.2 Relationships Among Templates

Templates may have a hierarchical relationship with one another, encoded using the "Parent template" attribute. For example, it might be desirable to create a "CT Abdomen" template, with children "CT Abdomen with IV contrast" and "CT Abdomen without, then with, IV contrast". Each of these children might inherit many of the attributes and features of the parent template,
315 but modify and specialize other attributes. The semantics of this inheritance have not yet been worked out and are currently left to the application.

Templates are not inherently nested. However, a user of a reporting system could invoke one template to fill in a blank of another template, creating a nesting effect. We described this hybrid reporting method above. Also, we describe below how the invocation of an item from a
320 selection list could automatically invoke another template.

2.2 Report and Template Sections

A template may contain Sections. These sections are intended to create corresponding sections in the resulting report.

2.2.1 Section Attributes

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- Section name: Every section must have a heading. Sections are identified by coded terms from LOINC (with RadLex mappings).

- Required: Binary variable indicating whether this "section" can be deleted from the report after the template is invoked by the report author.

- Level: Indicates whether this section is a top level section (level=1), a sub-section
330 (level=2), a sub-sub-section (level=3), etc.

2.3 Section Body

The body of a template section can be structured like an HL7 CDA document, with a <text> block that contains the narrative that is authenticated, and an <entry> block that contains

machine-readable coded entries, such as controlled terminology, hyperlinks, and fields.
335 Alternatively, narrative text could be marked up in line with coded entries.

2.3.1 Text

Most current radiology report templates consist primarily of narrative text. For that reason, most reporting systems and template editing tools should handle text much like a text editor would, allowing the user to select, delete, edit, or add text at an insertion point. However, reports are
340 moving toward an itemized rendering, so some systems may begin to restrict the editing of certain aspects of radiology reports. (This model is already used in cardiology, and in many electronic medical record systems.)

This white paper will assume the user has complete flexibility to edit any narrative portion of the report, since only that model is currently adopted by radiologists.

345 ### 2.3.2 Coded Entries

Text may be "marked up" by hyperlinks to external web resources using HTML syntax, or by Term Sets, which are structured groups of terms from a controlled vocabulary that explicitly represent the semantics of the text. (See below.)

The text and associated machine-readable content are semantically linked by using the "ID"
350 attribute in the narrative text. Elements within an <entry> will be linked to the text using a URI reference with the same attribute as the fragment identifier.

For example, consider the following report fragment: "the heart size is [_____]", where "the heart size" is text and the field in brackets specifies the heart size from a pick list. The field might be filled with the text "normal" or the text "enlarged", each of which is associated with a
355 coded concept.

The following example shows how the semantic unit discussed in the previous paragraph might be represented in XML:

```
     <section_body>
360      <text>
             <content ID="a6">The heart  size is normal</content>.
         </text>
         <entry>
             <reference value='#a6'/>
365          <template_field>
                 <field_type>selection_list_field</field_type>
                 <field_name>heart size</field_name>
                 <field_verbal_trigger>heart</field_verbal_trigger>
                 <field_default_value>normal</field_default_value>
370              <field_term_set>
                     <term_set>
                         Coded with RadLex terms for "heart" and "size" (details omitted for brevity)
                     </term_set>
                 </field_term_set>
```

```
375                 <field_merge_flag>N</field_merge_flag>
                    <field_select_option>single</field_select_option>
                    <selection_items>
                        <item><!--normal-->
                            Coded item for "normal" (details omitted for brevity)
380                     </item>
                        <item><!--enlarged-->
                            Coded item for "enlarged" (details omitted for brevity)
                        </item>
                    </selection_items>
385             </template_field>
            </entry>
        </section_body>
```

Report creation tools typically provide a text editor metaphor, allowing the user to select, delete, edit, or add text at an insertion point. If an element like the one above is edited by the user, the
390 coded entries underlying the text may no longer be valid. (For example, in the worst case, the user might type the word "not" after the word "is".) How reporting systems handle these dependencies will be left to each system implementation.

In summary, content references link text in the report with the associated machine-readable content.   These linkages enable reporting systems and template editing tools to manage the text
395 and associated coded content, and to assure that the underlying semantic information is removed when it may be invalid.

2.3.3 Template Fields

Many current reporting systems support the concept of fields, typically rendered as delimited by square brackets. Fields serve many purposes. Fields can:

400 • Emphasize a part of the report that frequently should be modified by the provider (e.g., left/right information).   Default text may be provided, even where there is an expectation that it will be replaced or modified.

  • Enable rapid navigation among parts of the report that are frequently modified (e.g, using rewind and fast-forward buttons to move between fields).

405 • Provide a visual cue for more complex user interface behavior (e.g, verbal triggers, pick lists, and other field types).

  • Represent a field that must be accepted or edited before the report can be accepted/signed.

2.3.3.1 Field types

410 While many current radiology reporting systems support only the notion of a text field, we intend to expand the concept of a field to include more complex elements that support the creation of structured reports.

  • **Text field:** These fields may contain narrative text that is editable by the user. The main function of text fields is to delimit a part of the report for rapid navigation and possible

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415   modification. Text fields are currently in wide use by radiology speech recognition systems.

- **Integer Field:** Integer fields contain a string-coded integer with associated optional range and optional units.

- **Real Field:** Real number fields contain a real number with an optional range and optional
420   units.

- **Date/Time:** Date fields accept calendar date and/or clock time information.

- **Selection list:** Selection list fields can take on a value selected by the user from a list of items. Each item on the list must be associated with text that should be displayed in the report if that item is selected, and may also be associated with additional report content,
425   such as terms from a controlled vocabulary. Selection lists may have a default value, which is displayed in the field when the template is applied. A user choice among the list items may be required or optional. A single selection may be required, or multiple selected elements may be allowed. Only the attributes of items selected by the user are associated with the report that is generated.

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- **Merge field:** A merge field accepts information from other sources, such as patient information from an HL7 order, measurements from an ultrasound device, or a region of interest (ROI) calculation from a PACS workstation.   These fields represent a significant advantage over templates because they can substantially increase the efficiency of the provider and the accuracy of the report by reducing the need to re-dictate or re-enter these
435   data.

2.3.3.2 Field Attributes

Each field may have the following attributes:

- Field name: (REQUIRED) A unique alphanumeric identifier for this field, scoped within this template.

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- Field type: (OPTIONAL) Values drawn from the list in the previous section. Defaults to Text if not specified.

- Merge flag (OPTIONAL): Indicates whether content from an outside source can be accepted as the value of this field. If this attribute is absent, the assumed value is 'N'.

- Verbal trigger (OPTIONAL): A word or phrase to enable rapid navigation to the field
445   with a voice command. If no verbal trigger is specified, the Field name serves as the default verbal trigger.

- Default value: (OPTIONAL) The value of the field if the user does not modify it. This value is displayed when the report template is initially applied. Default values should be used with care, particularly when incorrectly leaving the default as-is would be risky for
450   the patient.

- Term Set (OPTIONAL): One or more terms from a controlled vocabulary that represent the semantics of this field.

- Completion requirement (OPTIONAL):

  - Unrestricted: the user may modify the field in any way, including deletion, with no restriction on completing the report. If no completion requirement is provided, this value is assumed.

  - Alert: if the field is blank or missing, provide an alert at completion time. Alert fields may be deleted by the user, but such a deletion will cause an alert at completion time.

  - Prohibit: A value must be supplied for this field prior to report completion. Deletion is not allowed. If the field is blank, do not allow the report to be completed.

- Hint: (OPTIONAL) A comment or instruction on how to complete the field.

- Required format (OPTIONAL): Value of this attribute can force the value of a field to be formatted in a particular way (e.g., ALL CAPS).

- For INTEGER or REAL fields only:

  - Minimum (OPTIONAL): A minimum can be specified for numeric fields.

  - Maxiumum (OPTIONAL): A maximum can be specified for numeric fields. When a range is specified, a reporting system could check whether a report instance is "compliant" with the original template by determining whether a range has been violated. How range violations are handled is up to the application designer.

  - Units (OPTIONAL): The unit of measure for the number.

- For SELECTION LIST fields only:

  - Select option (REQUIRED):

    - Single: Only one choice can be selected from the list of items, typically implemented as a menu or as radio buttons.

    - Multiple: More than one choice can be selected from the list of items, typically implemented as multiple check boxes or as a multi-select menu.

- For MERGE fields only:

  - Merge source (REQUIRED): The source of the content that can be accepted into this field.

  - Merge retrieval method (REQUIRED): The method by which the content should be retrieved from the source. The method of locating the merge content should be based on the coded content for this field (Term Set) when possible.

Other forms of field consistency checking other than range checking and signature latitude, such as logical contraints among fields, are currently out of scope.

485 2.3.3.3 Selection Item Attributes

For those fields that have type "Selection list", each selection item in the list may have the following attributes:

- Item name (REQUIRED): A unique alphanumeric identifier of this item within the scope of this report.

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- Value text (OPTIONAL): The text that should be displayed and incorporated into the report when this item is selected. If absent, the item name is used.

- Template name (OPTIONAL): The name of a template that should be inserted into this field when this item is selected.

- Rank (OPTIONAL): A number specifying the order in which this item should appear
495   relative to other items.

- Hint: (OPTIONAL) A comment or instruction on the meaning of this item.

- Verbal trigger (OPTIONAL): A word or phrase to enable rapid selection of this item using speech recognition. If absent, defaults to Item name.

- Term Set (OPTIONAL): One or more terms from a controlled vocabulary that represent
500   the meaning of this item.

- Default (OPTIONAL): Binary variable indicating whether this item should be used as the default value for this field.

2.4 Proposed Term Set

A linear list of terms is insufficient to represent even simple semantic information. For example,
505   it is impossible to represent pain in the left upper quadrant and the right lower quadrant with an unstructured list of terms. Therefore, whenever terms are associated with concepts in a template, the notion of a Term Set is used to provide structure for grouping of terms and specifying the relationships among them. A term set grammar is defined as follows:

- Term = Code value + Coding Scheme Designator + Code Meaning

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- Term Set = one or more Term, OR Linking Term Set

- Subject Term Set = Term Set

- Verb Term Set = Term Set

- Object Term Set = Term Set

- Linking Term Set = Subject Term Set + Verb Term Set + Object Term Set

515   For the statement "suboptimal inspiration causes basilar atelectasis", "decreased inspiration" is the subject, "causes" is the verb, and "basilar atelectasis" is the object.

2.4.1 Linking Term Set Example

Below is an XML rendering of a Linking Term Set to encode the structured content underlying the following sentence: "There is some basilar atelectasis bilaterally, related to a suboptimal inspiration."

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```
< linking_term_set>
    <verb_term_set>
        <term>
525         <code_meaning>causes</code_meaning>
            <code_value>RIDxxxxx</code_value><!--needs a RadLex code-->
            <coding_scheme_designator>2.16.840.1.113883.6.256</coding_scheme_designator
        </term>
    </verb_term_set>
530 <subject_term_set>
        <term>
            <code_meaning>decreased</code_meaning>
            <code_value>RID36044</code_value>
            <coding_scheme_designator>2.16.840.1.113883.6.256</coding_scheme_designator>
535     </term>
        <term>
            <code_meaning>inspiration</code_meaning>
            <code_value>RID10468</code_value>
            <coding_scheme_designator>2.16.840.1.113883.6.256</coding_scheme_designator>
540     </term>
    </subject_term_set>
    <object_term_set>
        <term>
            <code_meaning>atelectasis</code_meaning>
545         <code_value>RID28493</code_value>
            <coding_scheme_designator>2.16.840.1.113883.6.256</coding_scheme_designator>
        </term>
        <term>
            <code_meaning>basilar</code_meaning>
550         <code_value>RID5834</code_value>
            <coding_scheme_designator>2.16.840.1.113883.6.256</coding_scheme_designator>
        </term>
        <term>
            <code_meaning>bilateral</code_meaning>
555         <code_value>RID5771</code_value>
            <coding_scheme_designator>2.16.840.1.113883.6.256</coding_scheme_designator>
        </term>
    </object_term_set>
</linking_term_set>
```

2.5 Merging Data into Report Templates

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Data can be merged into a field of a report template from another source (e.g., DICOM-SR object, AIM object, RIS exam information) by matching the Coded Values of the field with the controlled terms associated with data elements from the other source. The template user is

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permitted to delete or modify merged information. The method for obtaining merge data for a given field is specified by the Merge Source and the Merge Retrieval Method.

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2.5.1 Merge Sources

There are many possible sources for which there might be a need to merge information into a report:

- The HL7 order for this study

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- The DICOM image header for this study

- Previous reports for the same patient

- The electronic patient record

- Annotation and imaging markup (AIM) objects transmitted to the reporting system

- The DICOM structured report for this study

575 ### 2.5.2 Retrieval Methods

A retrieval method must be specified to retrieve the data from the Merge Source. The reporting system should use selection information from the merge field within the template, which is then "sent to the source". The source uses the retrieval method and the selection information to return a value, which populates the merge field of the template. In some cases this process might be as

580 simple as a retrieving a value from the source based on the name of the merge field. In a more complex merge, there may be a need to specify the desired information by a Term Set, or by specifying a "path" to the specific value in the source data structure. Coded content should be the primary method to identify the merge information. This implementation will be application dependent.

585 For HL7 extraction, some systems have their own API to pull in "custom fields". For example the data may come from a central database for the patient/exam (like an old mail merge into a Word document).

2.6 Validating a Report Instance

590 Each report will include unique identifiers for the templates used to generate that instance (e.g., as a URI pointing to the file in the reporting library). These templates could be used to determine whether all or part of the report represents a valid instance of the template. For example, the user may leave required fields empty, or may delete required components of the template. The resulting report will be mostly "compliant" with the template, although some of

595 the content will not match. Vendors may wish to design systems that prevent such non-compliant templates from being signed and finalized by the user, but this validation process is beyond the scope of this document. Specific use cases should be described that motivate the need to validate a report instance against a template.

3   Examples

600   Below are examples of clinical content that might be encoded in fields of various types.

3.1 Text Field Example

Example: "[The lungs are clear.]"

- Field type: text field

- Field name: Lungs

605   • Associated text: none

- Default value: "left"

- Verbal trigger:

- Hint:

- Coded values:

610   • Signature latitude:

3.2 Integer Example

Example: "The unenhanced liver attenuation is [# HU]."

- Field type: integer

- Field name: unenhanced liver

615   • Associated text: "unenhanced liver attenuation is"

- Default value: none

- Verbal trigger:

- Hint:

- Units: Hounsfield Units (HU)

620   • Term set: RID11086 (unenhanced phase), RID58 (liver), RID28662 (attenuation), RID12784 (Hounsfield unit calculation)

- Signature latitude: Alert

3.3 Selection List Example

Example: "[No/Mild/Moderate/Severe] pulmonary edema is present."

625   **Field attributes:**

- Field type: Selection list

- Field name: edema severity

- Associated text: "pulmonary edema is present"

- Default value: "No"

630
- Verbal trigger: edema

- Hint: specify extent of pulmonary edema

- Coded values: RID4866 (pulmonary edema), RID5672 (extent modifier)

- Signature latitude: Unrestricted

- Required format: Sentence case

635
- Select option: Single

Selection item attributes

- Value text: No

- Default value: Yes

640

- Value text: Mild

- Coded values: RID5671 (mild)

- Value text: Moderate

645
- Coded values: RID5672 (moderate)

- Value text: Severe

- Coded values: RID5673 (severe)

3.4 Date/Time Example

650 These findings were communicated to and acknowledged by [provider] at [date/time].

- Field type: Date/time

- Field name: notification date/time

- Associated text: "These findings were communicated to and acknowledged by"

- Default value: none

655
- Verbal trigger: notification time

- Hint: date/time

- Coded values: <current time>

- Signature latitude: Prohibit

4   Use Cases In Scope

660   The following sections describe use cases for the management and retrieval of report templates.

4.1 Importing a Template

A radiologist in the reading room may need a template to help create a report for a specific exam type. They will "go shopping" at a template library such as the RSNA template library, or a library maintained by their own institution or a reporting vendor. Once they have selected the
665   templates they would like, the library packages them into a file in the format described in this document. That file is downloaded to the radiologist's desktop, where it can be uploaded into the vendor reporting system being used. The radiologist then can edit the template using the template editor supplied by the vendor, and begin using it for reporting.

4.2 Migrating Templates

670   If a radiology practice elects to change reporting vendors, the practice will need to migrate its templates from their current reporting system to the new system. They would use the download template function from their old reporting system to create a file of templates that could be uploaded into the new reporting system. The file could be moved using any of the many methods for moving files (e.g., network copy, removable media, ftp, download, email). This
675   eliminates the need for custom programming to reverse engineer the template format of the old vendor.

5 Use Cases Out of Scope

5.1 Query/Retrieving a Template

680 Query and retrieve of report templates is currently out of scope. It is assumed that template libraries, descriptive file names, links on websites, template library applications, etc, will enable the user to locate relevant templates.

5.2 Authoring a Template

An author can compose a new template from scratch.

685 The template can be dictated, typed in by the author, or copied from an existing diagnostic report. Fields can be inserted and configured. Annotations and external hyperlinks can be associated with any portion of the template.

The level of sophistication involved in configuring fields, encoding a template file, and ensuring no structural rules are violated, may require a vendor supplied template authoring tool (for
690 example inside a reporting system).

Template authoring can be launched from inside the reporting system at any point in the report authoring process.

5.3 Editing a Template

An editor can take an existing template, make revisions, and save the revised template as a new
695 template. Most new templates will likely be created this way.

5.4 Reviewing a Template

A radiologist can review a template to decide whether to use it or to provide feedback to the author.

The template is presented in a reasonably concise, human-readable format (since reviewers
700 cannot be expected to learn advanced syntax or have access to advanced tools).

Approaches to accomplishing this when encoded templates (e.g. XML) are used include:

- using a style-sheet to render encoded templates into user readable form
- using viewer processing to render encoded templates into user readable form

5.5 Encoding a Report

705 Encoding of report instances is currently out of scope and is likely to be managed by DICOM Working Group 8.

5.6 Rendering a Report

Presenting a report in human-readable form is currently out of scope.

5.7 Transmitting a Report

710   Sending a report to another system is currently out of scope.

Glossary

Report: a specific instance of a diagnostic imaging report. It may be encoded as raw text, an HL7 message, a CDA instance, a DICOM SR, or some other format.

715   **CDA Template**: a specification of what makes a valid instance of a certain type of CDA report. The Reports produced by a compliant Reporting System would constitute valid instances of the CDA Template. A CDA Template is analogous to a DICOM SR Template.

Reporting Template: report content that is used by a Reporting System to guide it's interactions with the user drafting the Report.

720   **Reporting System**: a device or collection of devices that support the process of creating a report. This could include the image display devices, dictation devices, speech recognition devices, report editing devices, etc.

Usage

A report is **generated** by a user of a **reporting system**

A **reporting template** may be **applied** by the user to assist in the creation of the *report*.