MEDINFO 2007
HISA Ltd Australia
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Representing Clinical Knowledge as Archetypes

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Abstract

The Copenhagen Region has developed an extensive set of clinical content specifications to be used in EHR systems. A clinical content specification is a standard plan linking a clinical problem/diagnose with predefined, detailed plans/ activities and the expected outcomes. In order to achieve a more coherent structure of the clinical content specifications and to link terms to SNOMED CT, a part of the specification has been transformed into archetypes. In this trial, archetype tools and terminology tools were used and assessed. The trial indicated that by using the tools the quality of the clinical content specifications was improved and the specifications became more suitable for incorporation into EHR-systems.

Keywords:

archetype, clinical knowledge, SNOMED CT, electronic health record

Introduction

The "Clinical Content Project" was established in the Copenhagen Region in 2004 as part of the EHR implementation plans. The purpose of the project is specifying the clinical content of a highly structured EHR, based on the National Basic Model for EHR. This model supports a problem-oriented, longitudinal and cross professional EHR for the purpose of continuity of care [1]. The Clinical Content Project aimed at contributing to improved quality of the clinical documentation, re-use of data in an interdisciplinary contexts, and enabling use of EHR data for quality improvement.

The clinical content specifications are similar to structured clinical guidelines or clinical care pathways [2], and supports clinical decision-making. It has been shown that clinical guidelines provided as real time decision support systems' in daily clinical workflow will improve patient care significantly [3] and are an effective instrument to decrease undesired practice variability [4].

The Clinical Content Project has produced an extensive, detailed set of specifications of what to document in various clinical situations. However, the project identified a need for reducing redundancy, improving the consistency of the structure, linking the clinical content specifications to SNOMED CT, and documenting the clinical content in a format more suitable for use in EHR systems. Therefore, a trial was set up to transform a part if the clinical content specifications into archetypes.

The archetypes discussed in this paper are based on the openEHR reference model [5]. This is equivalent to the CEN pre-standard 13606 (EHRcom), which is currently under revision [6]. OpenEHR describes archetypes as "… reusable, structured models of clinical information concepts that appear in EHRs". Archetypes are described in a formal language and concepts in the archetypes may be linked to a terminology.

The templates discussed are based on the openEHR concept where archetypes can be adjusted to local needs and connected to entry forms. OpenEHR describes archetypes as "a selection of archetypes, terminologies, language and other details relevant to the particular local use of archetypes"

Methods

The clinical content specifications have a diagnosis or clinical problem, as a starting point. For each diagnose/ problem the standard plan describes in detail, a number of activities normally carried out, what expected observations are connected to the activities, and what data to enter for each observation.

It is estimated that clinical content developed in the Copenhagen Region is covering more than 75 % off the clinical documentation need, containing more than 600 standard plans.

The material is currently documented in MS Word tables and Visio flow-charts. The clinicians are comfortable with using these programs, but the specifications produced cannot easily be imported into or integrated with EHR systems.

The trial was attempting to show that using archetype tools the clinical content specifications could be made more suitable for incorporation into EHR-systems and the quality of the clinical content specifications could be improved.

The tools used were the openEHR archetype editor and the template tool and the terminology server from Ocean

Informatics, i.e. software supporting the openEHR architecture [7].

The archetype editor is an open source authoring tool for expert clinicians to create and edit archetypes. The tool was used in the trial to transform the clinical content into an archetype format and to link elements to SNOMED CT.

The template tool is an authoring tool for templates supporting design of archetype-enabled data entry. The tool was used for combing archetypes, creating variants of one archetype, and generating examples of data entry forms.

The terminology service in combination with a terminology query editor was used to create subsets of SNOMED CT – linked to the archetype. In the entry forms the subsets provided the set of selectable terms for a given data field.

Results & discussion

The selected areas from the clinical content documentation had a relatively simple structure. Areas were selected in which archetypes already existed in the openEHR repository [8].

For the clinical content specifications transformed to the "observation" archetypes, there were in generally good coherence between the two representations.

The "observation" archetype distinguishes between the list of data about the observation, the patient state, the protocol (i.e. measuring methods), and the temporal aspects. By applying this structure to the clinical content specifications, the ambiguity could be reduced and it became clearer if parts of the specification were missing or omitted.

However, the following challenges were encountered when comparing archetypes with the clinical content specifications:

- In some cases the lists of data about the observation or the protocol list needed to be extended. Since the archetype is meant to be the "maximum data set", this calls for a change of the archetype.
- Allowable values of observations may be represented as a list. However, some professionals would need a larger classification in addition to the list. The archetype editor seems only to offer functionality to hold either a list or a link to a classification.

The "section" structure was tried out for a few specifications, and the functionality seemed to be sufficient. This structure mainly groups archetypes into a larger, compound archetype.

The archetype editor could be improved by integrating it with a data dictionary. In this way the author could get an overview over terms used as well as their definitions, and this would support the re-use of terms or parts of archetypes

The template editor was used to develop templates and entry forms for doctors and nurses respectively – based on the same archetype. This functionality seemed to be sufficient.

The terminology server was tried out with only a few examples. It was relatively easy to define a subset of SNOMED CT based on the clinical content specifications; the main challenge being to identify the correct terms in SNOMED CT based on the terms in the clinical content specifications. The terminology query editor has a good facility for creating a search tree where parts of the tree are for navigation only and other parts can be selected by the user.

The linking of the SNOMED CT subset to the archetype element did also function well. An URL pointer was introduced instead of a value list in the archetype. However, sometimes i.e. doctors and nurses in principle can share the same template but require different terminology subsets. This requires an option to make further restrictions of the SNOMED subset at the template level, which is currently not possible.

Conclusion

The archetype editor helped structuring the clinical content specifications. There was generally good coherence between the two representations. Using archetypes made the linking to SNOMED CT more manageable, and made the clinical content more suitable for incorporation into EHR-systems.

It is a challenge to manage a large number of the archetype components, templates and entry forms. A link to a data dictionary could be considered to ease the re-use of the elements.

It is a large advantage that the clinical content specifications can be stored and exchanged in a standardised format. However, it is still an outstanding issue if EHR vendors are able to handle the archetype concept and import the archetype format.

Many clinical areas are not covered by existing archetypes, and some archetypes needs to be extended. This calls for an improved strategy and tools for managing the development, maintenance and approval process at an international level.

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