USE OF SUPER-CONCEPTS TO CUSTOMIZE ELECTRONIC MEDICAL RECORDS DATA DISPLAY

P. Massari\textsuperscript{a}, S. Pereira\textsuperscript{a}, B. Thirion\textsuperscript{a}, A. Derville\textsuperscript{b}, SJ. Darmoni\textsuperscript{a}

\textsuperscript{a}) CISMeF, Rouen. University Hospital & GCSIS, LITIS EA 4108, Institute of Biomedical Research, University of Rouen, France

\textsuperscript{b}) IS@S Company. Paris. France

Presenting author:

P. MASSARI, MD

philippe.massari@chu-rouen.fr
Electronic Health Records (EHR) features

• They are structured to a certain degree, according to patient record system used, and most of the EHR contain a majority of unstructured texts.

• The most common presentation of data is a time related presentation.
  - Information retrieval can be difficult, in this type of view, when patients have a long medical history.

• To optimize information retrieval in EHR, problem-oriented medical record views could be used.
  - It does not yet have a wide spread because of the requirement on structuring patient-data entries.
Aim of the Study

• Another way is to implement appropriate views, using terminological tools.

• The CISMeF metaterms are super-concepts which were defined to draw together MeSH terms from the MeSH thesaurus.
  
  *CISMeF's metaterms correspond to medical specialties (e.g. cardiology), types of medical procedures (e.g. surgery) or health topics (e.g. diagnosis, therapy).*

• The aim of this study is to describe and evaluate individual medical records sorted by typology of elements and by medical specialties based on terminological tools, using CISMeF super-concepts.
Patient medical record system of the Rouen University Hospital

- EHR was introduced in 1992 and took into account:
  - medical contacts
  - discharge ICD codes
  - medical procedures codes
  - medical procedures and discharged reports

- Currently EHR includes all the computerized data from 1992 until now, corresponding to:
  - 1.2 million patient records
  - 8.6 million contacts
  - 1.2 million discharge reports
  - 3.1 million medical procedure reports
CISMeF metaterms and MeSH

• Creating metaterms were firstly designed to optimize information retrieval in CISMeF and cope with the relatively restrictive nature of these medical specialties as MeSH (keywords) descriptors.

• The MeSH thesaurus does not allow to have a global vision of a medical specialty.

• In the CISMeF terminology, metaterms can be considered as “meta-concepts”.

• Metaterms have been manually selected by the chief medical librarian (BT).
Semantic links between CISMeF metaterms and MeSH terms
Semantic links were manually created between super-concepts and each code of ICD 10, CCAM, CDAM, ADICAP classifications.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number of codes</th>
<th>Number of semantic links</th>
<th>Min-Max by codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD10</td>
<td>10,505</td>
<td>13,650</td>
<td>1-3</td>
</tr>
<tr>
<td>CCAM*</td>
<td>7,389</td>
<td>12,538</td>
<td>1-5</td>
</tr>
<tr>
<td>CDAM</td>
<td>7,699</td>
<td>13,508</td>
<td>1-5</td>
</tr>
<tr>
<td>ADICAP</td>
<td>279</td>
<td>372</td>
<td>0-3</td>
</tr>
</tbody>
</table>

* A partial evaluation of the manual semantic links between super-concepts and CCAM codes was performed by automated indexing tools.
EHR views using super-concept

- To filter data of one or more medical specialties, customized views using metaterms have been implemented in our Medical Record System.

- Metaterms used in the queries are those which have links with:
  - ICD10 codes of stays
  - CDAM and CCAM codes for therapeutic and diagnosis procedures
  - ADICAP for pathological exams
  - Service points for medical consultations

- These queries allow to make containers of data, classified by type of EHR elements (stays, diagnosis, surgical procedures…) and filtered by medical specialties.
Evaluation

• The potential advantage of specialty-oriented views of EHR as compared to the "more classical" time related views, depends on the number of elements contained in the patient records.
  ➢ a preliminary evaluation needs to study the distribution of patients records size.

• Evaluation was performed by RUH physicians of various specialties (cardiologists, lung specialists, gastroenterologists).
Size of the health records

- Between 1 January- 31 March 2006, 81,471 patients came to the Rouen University Hospital for hospitalization or consultation.
- 33.46% of the medical records contain more than 20 medical contacts
- 34.01% more than 20 medical procedures registered.
Time oriented view

Specialty view

Use of Super-concepts to Customize Electronic Medical Records Data Display – 2008/05/28 – MIE 2008
### Example of distribution of medical record elements

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Number of elements in the whole record</th>
<th>Number of elements filtered by &quot;cardiology&quot;</th>
<th>Number of elements filtered by &quot;pneumology&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departments patient visits</td>
<td>18</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>ICD10 discharge codes</td>
<td>38</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Major procedures</td>
<td>16</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Pathological reports</td>
<td>6</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Radiological procedures</td>
<td>24</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Other procedures</td>
<td>58</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>
Comparison of the two view types in information retrieval

- **Using time oriented view** physicians who do not know when a procedure was performed, cannot find it rapidly in medical records with more than 20 contacts.

- **Using specialties view** no matter if the end-user knows the procedures dates or not, procedure is find in less than 2 minutes, even in heavy records.

- Furthermore specialties views give a more consistent information on the medical past of the patients.
CONCLUSION OF THE EVALUATION

- The evaluation of specialties views based on CISMeF metaterms in EHR was considered as satisfying by the CISMeF team and the Rouen University Hospital physicians.
- Therefore we have decided to implement this specialty view tool in the real environment of the RUH EHR starting with May 2007. These views are actually used daily by a lot of RHU physicians, with positive reactions.
- Moreover, we have considered that this software tool (based on semantic links) was innovative enough to be part of a software that the University of Rouen has sold to the IS@S company.
Discussion

- The information and data retrieval in records containing a large number of events is difficult, and need specific tools.
- The effectiveness of concept-oriented views was reported by several authors [1] [2].
- More recently, a second generation of these tools, using ontologies, have been described [3].

[3] Elisabeth B, Oystein N, Anders G. Ontologies for Knowledge Representation in a Computer-Based Patient Record 14th IEEE International Conference on Tools with Artificial Intelligence (ICTAI'02); 114
Conclusion

• Electronic Medical Report display data and retrieval information can be optimized by specialties views.

• Super-concepts initially designed for medical Web search can be reused to create these views.

• These super-concepts could make possible in the future the creation of problem-oriented views, without the requirement of structuring patient data entries.