Comparison of EuroMISE Minimal Data Model for Cardiology and HL7 V3 DAM: Cardiology Rel. 2

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Abstract

Background: The EuroMISE Minimal Data Model for Cardiology (MDMC) has been prepared by clinicians for clinical study in 2002. This model has been successfully implemented in an application for clinical data gathering. HL7 v3 Domain Analysis Model: Cardiology, Release 2 (HL7 DAM) has been published in HL7 September 2011 Ballot.
Objectives: The objective of this paper is to compare these two data models. The main motivations for the comparison are nearly identical ways of development, and the same format of both specifications.
Methods: HL7 DAM is much broader than EuroMISE MDMC. Thus I focus only on data elements present in MDMC but absent in HL7 DAM. Also different scales of elements present in both models are compared.
Results: I have found 25 elements out of 181 elements defined in MDMC which are not contained in HL7 DAM.

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Conclusions: Results will be used for further discussion in HL7 Clinical Interoperability Council work group.

Keywords

Data model, EuroMISE MDMC, HL7 V3 DAM Cardiology, comparison

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1 Introduction

Standardization of information content of interfaces, EHR, or EMR is a huge challenge of nowadays biomedical informatics. According to The Generic Component Model [1] building of standardized healthcare IT environment consists of enterprise view, analysis of information content, computational view, engineering view and technology view.

In this article I focus on effort of standardization of a cardiology domain from the information point of view. I compare two data models, a previous work of my colleagues (EuroMISE MDMC) and a current release of a cardiology domain analysis model made by HL7 (HL7 DAM). This work will bring highlights and contributions to the further analysis of the cardiology domain. Both subjects of comparison are described in following chapters.

1.1 EuroMISE MDMC

The Department of Medical Informatics of the Institute of Computer Science AS CR, a part of the EuroMISE Centre, focuses mainly on the applications of advanced statistical methods, on the analysis of biomedical data and knowledge, on utilization of the structured electronic health record, methods for decision support and on data mining in biomedical databases [2].

The EuroMISE Minimal Data Model for Cardiology (MDMC) was prepared by EuroMISE clinicians for clinical study in 2002 [3]. This data model has been successfully adopted by system designers and implemented into an ADAMEK [4], a single-purpose application for clinical data gathering. In following years there was also an effort to map particular data elements of MDMC to ICD 10 and SNOMED-CT [5].

No special software tools were used in 2002 to capture the model. There is an Excel Spreadsheet where rows are data elements, columns are element attributes (name of the element, group, data type or enumeration, and extra attributes). The MDMC is set of 181 data elements (rows). Each element has an associated data type or an enumeration of possible values. Where it makes sense, additional attributes are also filled: data format, minimal value, maximal value, objectivity, reliability, importance, and economic aspect. Elements are also divided into groups according to parts of Czech medical record as defined by a Czech law:

- administrative dataset,
- family history (RA),
- social anamnesis (SA),
- personal anamnesis (OA),
- current difficulties (OB),
- therapy (Th.),
- physical examination,
- laboratory results (Labor.).

1.2 HL7 V3 DAM: Cardiology, Rel. 2

Health Level Seven International is a global authority on standards and interoperability of healthcare information technology. The development is based on voluntary work of experts around the world [6]. A HL7 Clinical Interoperability Council is a HL7 work group. It has developed HL7 V3 Domain Analysis Model: Cardiology, Release 2 (HL7 DAM). The specification has been submitted to a HL7 September 2011 Ballot Cycle [7].

The DAM contains the information analysis of clinical content related to the Acute Coronary Syndrome domain, heart failure, electrophysiology, vascular analysis and intervention. It also contains observations related to general cardiology. The DAM involves use cases, activity diagrams and UML class diagrams; Enterprise Architect is used as a maintaining tool. In total there is approximately 350 data elements which were adopted or harmonized from following sources [8]:

- the NCDR registries (National Cardiovascular Data Registry),
- the ACC/AHA Adult CV EHR Data Elements (American College of Cardiology/American Heart Association),
- the CDISC (Clinical Data Interchange Standards Consortium) standards Acquisition Harmonization elements,
- the FDA Cardiovascular Endpoint Data Elements,
- the NCI EVS Vocabulary (National Cancer Institute),
- other published cardiology standards (AHA, STS).

The ACC/AHA data standards cover broad areas within cardiology including outpatient care, heart failure, atrial fibrillation and cardiac imaging. The NCDR CATH-PCI registry is used for patients undergoing diagnostic and interventional catheterization; the ACTION registry is used for patients experiencing acute coronary syndrome, and the ICD registry is used for patients experiencing electrophysiology disturbances and heart failure. The STS Adult Cardiac Registry is used for patients undergoing cardiac surgeries [8].

As authors declare: "It is not intended for products to be derived from this model or directly implemented. Additional technical specifications and system requirements are necessary for implementation" [8].

2 Objectives

The main objective of my work is to find out whether MDMC is a subset of HL7 DAM. If it is not a subset the problem will appear in a future: ADAMEK will not be able to transmit all gathered data to another system using standardized HL7 messages. It will generate additional costs on our side. It is not a good idea to be data-locked with the only one software, even with our own.

If HL7 DAM is missing some elements, there should be an action taken, probably to join and participate with the Clinical Interoperability Council workgroup. In this case, this paper will serve as a starting point for discussions.

The second objective of this paper is to bring a short introduction of HL7 DAM to an attention of readers who are not familiar with HL7. Citizens of the Czech Republic have high average risk factor of cardiovascular disease. Our government invests lot of money to a Cardiovascular research [9]. Information Technology perspective of such research should be in concordance to the international state of the art.

3 Methods

Although definition of MDMC is captured by simple technology in contrast to HL7 DAM captured in Enterprise Architect, although the size of HL7 DAM is 3 times bigger than MDMC, these sets of data elements are very similar and easily comparable. I used a simple and

straight method of comparison: for each data element in MDMC I search for an equivalent in HL7 DAM. When found, the data type (or the enumeration) is compared, too.

Due to only a brief description of each data elements in HL7 DAM and no description of element in MDMC, there is no space for semantic discrepancies.

4 Results

According to the methodology, all data elements of MDMC were examined. MDMC data elements without a HL7 DAM equivalent can be divided into clinically significant discrepancies and elements of administrative purpose.

Clinically significant elements missed in HL7 DAM:

- SA: overall psychological stress faced (none, low, middle, high),
- SA: physical activity at work (none, low, middle, high),
- SA: physical activity at home (none, low, middle, high),
- SA: smoker (how many cigarettes per day),
- SA: alcohol (beer, wine, distillates),
- OA: body temparature,
- OA: body mass index (BMI),
- Th.: hypertension treatment (none, life style, antihypertensive agents),
- Th.: dyslipidemia treatment (none, life style, hypolipidaemic agents),
- Th.: Peripheral Arterial Disease therapy (none, conservative, PTA, stent, surgical),
- Th.: Renal Artery Disease therapy (none, conservative, PTA, stent, surgical).

Other missed elements of HL7 DAM can be seen as administrative, technical, or superfluous. These elements are probably out of scope of Clinical Interoperability Council because other attributes of HL7 V3 RIM [10] classes hold the information, or they are defined in other HL7 V3 domains. Values stored in those elements are still significant from clinical and informational point of view. Elements missed in HL7 DAM:

- patient: administrative gender,
- RA: family history of father, mother, brothers (elements of every clinical term have been assigned, but the attribute of family relationship is missing),
- SA: patient marital status,
- SA: patient education,
- AL: drug allergy (name of a drug, chemical name),
- OA: date of first observation of a disease (every indicator of HL7 DAM),
- Labor.: laboratory results (glycemia, uric acid, total cholesterol, HDL/LDL, triacylglyceride).

5 Discussion and Conclusions

When talking to semantic interoperability, I usually see lots of academic discussions how far proposed 2 concepts are identical, similar, or completely misleading. This gets much worse when concepts are not in the same language, which was my case, too (Czech vs. English).

Fortunately, HL7 DAM provides a brief description of each concept, whereas MDMC is just a list of data elements with scales but without any description. At this level of information, there were no such discussions and mapping has been done smoothly.

I have mapped 181 data elements of MDMC to HL7 DAM elements. I have identified 12 clinically significant elements missed in HL7 DAM. The relevance of these elements should be discussed with the HL7 Clinical Interoperability Council. I have also identified 13 elements of MDMC missed in HL7 DAM, but found somewhere else in HL7 V3. From the information point of view (in terms of Generic Component Model [1]) both groups are significant at the same level and require attention. The latter group can be easily addressed in terms of HL7 V3 classes.

I see one other huge source for contributions to the HL7 DAM. The Czech Medical Association of J.E. Purkyně, Cardiology section provides 40 textual Clinical Practice Guidelines listed in a catalogue of Czech published guidelines [11]. Therefore it seems that the Cardiology section of the Czech Medical Association has the sufficient credit and ability to contribute to HL7 DAM.

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