Archetypes as interface between patient data and a decision support system

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Abstract

We propose an experiment to validate the hypothesis that archetypes enable better access and reliable use of patient data by a decision support system, mainly because they are designed to consistently link patient data with terminological systems and metadata.

Introduction

Computerized Clinical Decision Support Systems (CCDSS) need to access patients' data in the Electronic Health Record (EHR), raising two main issues: to find them in the EHR and to assess their reliability for decision support. Archetypes are structured clinical models of patient data.1 They can normalize the semantic content of clinical data by linking them with external terminological systems and they are designed to record the useful metadata to assess clinical data reliability for any intended use.

We propose to evaluate the value of archetypes as interface between patient data and a CCDSS. An implementation with archetypes, inspired by Rector et al.,2 will be compared to one without archetypes.

Material and method

CCDSS – Ten evidence-based recommendations for hypertension management have been extracted from clinical guidelines to compose the CCDSS knowledge base. They have been expressed as rules defining the recommended treatment (drug choice) according to medical history (patient data).

Implementation without archetypes – The first implementation uses patient data as recorded in an existing EHR, without links to external terminological systems and metadata.

Implementation with archetypes – Archetypes for drug treatment and clinical conditions indicating or contra-indicating specific drugs were formalized in an archetype editor developed in Sweden (Linköping University).3 A dedicated database will be developed with clinical data stored through archetypes, along with custom metadata and links to the concepts of an ontology for hypertension management.

Points of comparison: patient data access by the CCDSS, reliability of data use and maintenance cost.

Results and discussion

CCDSS rules and terminological needs – Without access to an external terminological system, no terminological reasoning is possible in the first implementation. Thus, the rule “If a patient already suffered from a complication of atherosclerosis, then he should get drugs to lower his cholesterol level” had to be multiplied as many times as there are types of atherosclerosis complications: stroke, myocardial infarction, peripheral arterial disease, etc. In the second implementation, with archetypes and ontological links, these complications will be children of the atherosclerosis complication concept in the ontology. If a patient had a stroke, the CCDSS will be able to infer by subsumption that he had a complication of atherosclerosis and should get drugs to lower his cholesterol levels. Thus, only one rule will be needed to represent this therapeutic recommendation, improving the readability of the knowledge base and easing its maintenance.

Metadata to judge clinical data reliability – In the experimentation without archetypes, the lack of relevant metadata in the EHR hindered the evaluation of clinical data reliability. The reliability of records had to be assumed, which is not a trivial step even if the clinical staff is experimented. By contrast, reliability checks will be possible in the experimentation with archetypes, because clinical data required metadata for their assessment. For example, the patient's state (lying or supine, after exercise or at rest, etc.) and measurement protocol (clinic or home measurements, cuff size, etc.) will be recorded with the blood pressure readings.

Conclusion

This experiment will explore the benefit of archetypes to link a CCDSS with patient data. In this regard, the ability to interface the inference model (CCDSS) and the clinical model (patient data) with a conceptual model (terminological system) seems to be crucial.

References