An Ontology to Improve Accessibility and Quality of Patient Instructions

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Abstract. In the Finnish health care system, patient instructions are public documents written for patients to support them through the care. The ontology introduced in this paper addresses two problems with the patient instructions of Intermunicipal Hospital District of Southwest Finland: the instructions are not extensive and readable enough to fully support patients and the collection of these instructions is poorly organised. The ontology is being developed in cooperation with Intermunicipal Hospital District of Southwest Finland and will be evaluated as a part of a pilot study for an authoring tool in Turku University Hospital. To the best of our knowledge, there are no other suitable ontologies available for modelling Finnish patient instructions.

The ontology is an OWL DL ontology produced with the Protégé resource. It models the document structure and the associated metadata specifying the usage and content of the document. The metadata include the topics essential in supporting patients, the characteristics of the intended reader, the phase of the care as well as the organisational hierarchy and the health care processes of the hospital district.

The ontology can be utilised in the organisation of patient instructions and can aid in the efforts to improve their quality. The documents can be filtered through the provided facets for improved accessibility. The writing process can be supported by ontology-based methods that facilitate giving feedback: preferred or commonly used pieces of text can be automatically suggested based on a given topic and machine-learning methods can be employed to notify the author of text unintentionally drifting from one topic to another or not matching its assigned topic. The author can also be notified of missing or irrelevant topics by comparing the content of the document to its expected content. These approaches help to write coherent and comprehensive instructions. In the future, patient instructions could be personalised e.g. by focusing the content on issues specific to a particular patient while excluding irrelevant details.

Keywords: Ontology; Patient Instruction; Text Mining

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1 Introduction

Patient instructions are public documents in the Finnish health care system. They contain information relevant to the care, ranging from the descriptions of procedures and symptoms to actions to be taken before and after the treatment. They are written for patients and routinely handed out before or during the care but also made available on the web. Although patient instructions have an important role in the successful treatment of patients, most specifications (such as HL7[1]) focus on patient records and other clinical information.

This abstract discusses how an ontology could be utilised to make patient instructions more easily accessible as well as to improve their quality. The study was motivated by two observations regarding publicly available patient instructions of Intermunicipal Hospital District of Southwest Finland. First, the instructions are poorly accessible on the web for patients who do not (and should not) know the classification of instructions by professionals. Second, the instructions should be more comprehensive and apprehensible to support patients through the care.

The discussed ontology models the content of instructions as well as the relations to relevant actors in health care. The ontology is work in progress and being developed in cooperation with Intermunicipal Hospital District of Southwest Finland. To the best of our knowledge, there are no other suitable ontologies available for modelling Finnish patient instructions.

2 Materials and Methods

The ontology is being developed as an OWL DL ontology using the Protégé resource (`http://protege.stanford.edu`). It contains two major sections: the document structure and the associated metadata. Both are needed to describe the content in sufficient detail to computational methods that guide authors in the writing process. In addition, the latter facilitates the organisation of instructions based on their usage and content.

The metadata is currently limited to the topics specified in the criteria of good patient instructions[2], the characteristics of readers as well as the organisational hierarchy and the health care processes of the hospital district. The last two aspects determine when and where instructions are used. The criteria of good patient instructions describe, among others, the topics that should be discussed in a document in order to address all the problems patients may encounter.

The needed ontology concepts are mostly determined in a very straightforward manner by the health care organisation. For example, the care processes are explicitly present in the organisation and their number is manageable. The details of the topics are determined by annotating existing instructions after which missing yet essential concepts are filled in by domain experts.

The ontology will be evaluated as a part of a pilot study for an authoring tool in Turku University Hospital. In this tool, instructions are written using a form that produces structured text documents and ensures that the author gives all the compulsory metadata. The usability of the tool will be evaluated and compared to that of the tool currently in use (WYSIWYG HTML editor) while the content of the resulting instruc-

tions will be assessed for improved quality with established method[2]. The capability to enhance accessibility will be evaluated by asking professionals and patients to classify instructions using the ontology and comparing the classifications to those of the authors. Also, the applicability of the ontology to the instructions of other Finnish hospital districts will be studied.

3 Results

A patient instruction (*document*) is modelled with *part of* relation to consist of textual elements: *document*, *chapter*, *section*, and *paragraph*. The elements are associated through *is about* relation with *topics* reflecting their content. The document as a whole is also associated with the other pieces of metadata through e.g. *intended for [reader]* and *used in [hospital unit]* relations.

The reader is currently characterised by *role* (patient or guardian), *gender*, and *age group*. The associated health care process is characterised from both professionals' and patients' point of view in order to provide an easy access for both groups. For example, professionals would classify the instructions related to angioplasty under *Coronary arteries disease* (disease) treated in *Cardiology* (speciality) within *Internal medicine* (hospital unit) while patients would expect to simply find them under *Heart* (anatomical unit). The temporal aspect of the health care processes is addressed by associating the instructions with the *phase* of the care: either *Preparation*, *Treatment*, or *Post-treatment care*.

4 Discussion

The ontology provides facets by which the document base can be filtered. This functionality can be easily implemented as a search engine. For example, a person with a scheduled knee surgery could search for *Knee – Preparation – Surgery* to get information about how to prepare for the upcoming procedure. Leaving out Preparation from the query would yield all the instructions associated with a knee surgery allowing the person to get familiar with the whole process he or she is about to enter.

The authoring of high-quality instructions can be supported by ontology-based methods that facilitate giving feedback during the writing process. The topics provide a classification with which machine-learning methods can be trained to analyse text. Several such methods are currently being developed to answer questions like “Does the content of a chapter match with its assigned topic?” and “Is a section coherently discussing a single topic or drifting from one to another?”. Similarly, the system can suggest preferred or commonly used pieces of text to be written under each topic. These approaches help to write coherent and comprehensive instructions.

In addition to text mining, the document can be analysed by comparing its structure to the specifications of a particular instruction type and the author notified of missing or irrelevant topics. For example, surgery-related instructions should always consider, among others, how long a sick leave is needed and which post-operation symptoms require contacting the hospital. These specifications are still largely under construction.

In the future, patient instructions could be personalised so that the details irrelevant for a particular patient are omitted. For example, if a certain medication interferes with the treatment, only those patients who are on that medication should be instructed to pause it.

5 Conclusion

Patient instructions are routinely used in the Finnish health care system but their accessibility and quality could be improved. The introduced ontology models patient instructions for this purpose. It can be utilised in organising instructions effectively and serves as a basis for the development of text mining tools supporting the authoring of high-quality instructions. In the future, it may be extended to take into account the characteristics of individual patients.

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