Approaching Harmonised Medication Information Management through Process and Information Modelling

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Abstract. Medication information should be available in a correct content and format and where and when needed in medical care. In this paper process and information models are presented in order to identify the items, their relations, contents, sources and use contexts of medication information. The motivation for this study has been to develop a harmonized information model for medication information to overcome current problems and pitfalls in medication information management and information accessibility.

Keywords. medication information, process models, information models, health informatics

1. Introduction

Medication information is an important part of care processes. Medication is a concern of patients, of medical doctors and nurses, and of pharmacists, and even of patients’ families. It is extremely important that correct medication information is available and accessible for all stakeholders throughout the care processes [1]. Medication errors are common in health care and they may result in severe risks and consequences for health professionals and patients, and for care outcome [1–3]. Medication information management is important for health care practices where all needed information has to be accessible, in valid format and content, where and when needed.

A current problem in medication information management is the lack of a general, harmonized specification or information model for medication information. Additional problems are related to multiple documentation and storage of medication information, lack of harmonized terminologies and standards, difficulties in accessibility and usability of medication information for health professionals in care situations [3–5].

Our research has been focused on analysis and modeling of medication information. The research was divided into two phases: 1) Development of process models that describe the care processes where medication information is related to, 2) development of information models of medication information. The resulting medication information model will support the development of a unified implementation for...
Medication information management in such a way that information can be stored, accessed and used by various organizations, professionals and users in a harmonized manner [1, 3].

2. Medication Information

Medication information refers to information on the patient’s medication covering the history of medication, the current situation and reasons and indications for medication, information on the generic names of the administered drugs, their commercial drug names, their dosage, their uptake, their interactions and information on the care context of prescribing including diagnostic indications [3, 4].

The current situation with medication information can be summarized [1, 3, 6–8]:

1. Medication information is managed and transmitted by and between many health information systems, e.g., electronic patient record systems, electronic prescription systems, order-entry systems, pharmacy systems.
2. Medication information is stored in various formats and contents in these systems, e.g., as prescriptions, as free-text documentations, as medication lists and cards, as summaries and discharge letters, and presented by various classifications and nomenclatures.
3. The types of needed medication information are many: information on medical history, medication changes and their justifications, cumulative information on the progress of medication and its effects during care, information on drug side-effects, adverse effects and interactions, detailed information on current medication, information on the potential medication problems and risks, and information on the relations to diagnoses and care indications, temporary and permanent medication information especially in the case of chronic diseases, and detailed information on selected drugs and their expected effects [1].
4. Legislation and other normative rules settle restrictions on the storage, use and access of the patient’s medication information.
5. Medication information needs to be valid, up to date, in correct format and content, and it needs to be available, understandable and accessible when and where needed.

In the Finnish core data set [9] medication information is considered from four perspectives: 1) Long-term medication, currently in use, 2) long-term medication, taken when necessary, 3) short-term medication, currently in use, and 4) ceased medication, both long-term and short-term medication that has been stopped now.

Normative Rules and the National Infrastructure from the Medication Information Perspective

Legislation for data protection and security concerns also patient’s medication information as this information is health-related, private, confidential, sensitive, and needs to be protected from un-authorizsed access. In Finland the data protection and security rules follow the EU directives and are very strict in protecting the security and safety of patient data. Our national laws [10, 11] settle additional rules on the rights to access, use and manage patient data. These laws and directives build a framework for
safe and secure data management where equal protection levels are used in all organizations [8].

Currently we are building our national health IT infrastructure and architecture, which enable digital storage of all patient documentation into a national archive [12]. Part of the national health IT infrastructure will be an electronic prescription system with a centralized prescription database.

3. Results: Information Model of Medication Information

Though our national IT infrastructure gives guidelines on how patient data will be stored in the national archive, medication information is not seen as a specific information entity that would need own rules and specifications. Thus the information model, developed in this research, would help to define all concepts, and terms, and their relations in medication domain. Modeling is the only way to build a harmonized approach on medication information management [13–15]. In this chapter the methods and results of information model building are presented.

Information Model

Information models can be developed using various modeling approaches, the most often used ones are information modeling, entity-relationship modeling and ontology development [16–18]. Information modeling focuses on identification of the domain concepts and terms and on describing their attributes and relations. Information modeling should be part of any information system development. In this research we have applied the entity-relationship (ER) modeling approach. ER modeling was very suitable in this case as in the process models [3] we identified the actors and the processes that deal with medication information and in ER-models we could then proceed with identification of the medication information entities and their attributes and relations. ER models were also considered understandable by the health professionals and that supported their use in this research. The information model was developed with health care professionals in an interactive manner. The model development phase included many iterative phases during the two years of development.

The resulting information model is presented at two levels. Level 1 models the context where medication information is created and used, and level 2, Figure 1, presents a more detailed analysis of the concept medication information: the entities, attributes and the relations between entities.

4. Discussion and Conclusions

The developed medication information model is an important result, because it describes how medication information management could be harmonized. The model specifies both the content and structure of medication information. The model covers all items related to medication management and it covers all national legislative and other definitive regulations and guidelines that have been produced by health care authorities. Additionally the model covers the health professionals (i.e., doctors, nurses
were not included) requirements and needs for medication management in clinical practice. We had intensive walk through discussions with health professionals on these models during their iterative development in years 2006–2008.

Figure 1. The medication information model (level 2)

The resulting information model for medication information management forms the basis to develop a relation schema and a relation database for medication data. This relational database could then either be included or integrated with the existing electronic patient record systems and their databases and thus in all these systems the contents and structure of medication-related data would be harmonized and equal.

The model has been compared only with the model by Eurorec organization [2]. Our model is well in line with the Eurorec-model. Comparison with other relevant models, like HL7 RIM, CEN ENV 13606/13607 and archetypes are ongoing. However, as such, the developed model has offered health care professionals a better access to health care practices and has shown to be useful and usable in practice.

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References


