Identifying Functional Discrepancies among Systems, Users, and Activities of Electronic Dental Records: A Work Domain Ontology Approach

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Abstract
A work domain ontology (WDO) was developed by constructing and integrating three models—user, system, and activity models. The user model was built on results of a user need survey. The activity model was built by shadowing the workflow. The system model was developed by analyzing an Electronic Dental Records (EDR) system. The WDO reflects the objects, activities, constraints and should serve as the reference and baseline for the design and evaluation of EDR systems.

Introduction
More than half of Electronic Health Record projects fail. Most of these failures are not due to flawed technology, but rather due to the lack of systematic considerations of human issues. A WDO is an abstract, declarative characterization of the work domain in terms of goals, objects, operations, and constraints. It allows us to describe essential requirements of work in an abstract model. It tells us the inherent complexity of the work, and it supports identification of overhead actions that are non-essential for the essential work. The objective of this project is to identify the functional discrepancies among systems, users, and activities and develop a WDO by consolidating the discrepancies.

Methods
For building the user’s model, a concise survey with 7 open-ended questions was used to collect what functions of the current EDR system in UTDB are used, and what are the functions that users would like to have but are not available in the current system. The subjects are 32 current EDR system users (3 dentists, 23 dental students, 4 staffs, 2 administrative personnel). All responses were free text. The results of the survey were analyzed with NVivo1.0. An activity model is defined as the collection of all the objects and operations provided by a present EDR system. After the three models were built, the overlapped and discrepancies of operations are reviewed and coded. A WDO was built with Protégé-OWL 3.2.

Results
In user model, the users only recognized 13 different kinds of operations provided by the present EDR system. However, the users would like to have 28 functions, 23 tasks, 21 features and 8 characters in the ideal EDR. This showed that the user does have a lot more needs than what the EDR system provides. However, the users do not know all the functions that current EDR have. In the activity model there are a lot of times that the user was using traditional methods (paper, x-ray) instead of the EDR system. Dentists (2%) and dental assistants (<1%) spent little time with the EDR. Even the EDR system has functions supporting some of the operations. In the system model, a thorough walk-through over the system is as good as analyzing the user manual. The discrepancies among the three models show the gaps among what the EDR system offers, what users want, and what happens in the real world. A WDO, implemented in Protégé-OWL, was developed by combining the three models. A future evaluation of the ontology will be performed.

Conclusion
The value of identifying functional discrepancies among systems, users, and activities in the development of a WDO for EDR can be used as the reference and baseline for the design and evaluation of human-centered EDR.

References