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Development of Hypertension Management Ontology for a Guideline-based Clinical Decision Support System

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Abstract

For the development of a guideline-based hypertension management system, ontology was adapted as a method for enabling me to represent and to reuse the domain guideline knowledge consistently. Based on 12 of the published guidelines, including the 7th report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of high blood pressure (JNC 7), concepts extracted from the guidelines on the hypertension management and relations between concepts were identified. This ontology includes 11 high-level classes and covers over 300 low-level concepts, and it also defines instances of each concept. This work will help to create a tool for acquiring more specific hypertension knowledge and will contribute to representing, managing and sharing knowledge logic. It will also be used in the further development of hypertension guidelines.

Keywords:

ontology, hypertension management,
computerizing clinical guideline,
knowledge representation

Introduction

In Korea, the Government leads an Electronic Medical Record (EMR) system development for the 152 public health centers, and this is planned to be expanded to a national Electronic Health Record (EHR) system. As a part of this project, a study on the development of clinical decision support system (CDSS) is currently being undertaken. This study is one step in the construction of a guideline-based CDSS that will be used for hypertension management in public care settings. A development of domain ontology is an essential part in representing knowledge in a computerized method, but it is also important for the reuse of knowledge in the interesting domain area.

For the sharing of medical knowledge nationwide, a knowledge management method such as ontology is the main issue from the point of view of CDSS. Ontology has often been used to formalize a shared understanding of a domain, and it enables software applications and humans to share and reuse knowledge consistently.

Materials and methods

This ontology is primarily based on the concepts extracted from 12 published hypertension guidelines, including JNC 7. The hypertension management ontology provides formal definitions, relationships and usage of various concepts relevant to patients with hypertension. Concepts were defined at the modeling stage, and defined concepts were classified according to semantic category. Relations and attributes of concepts were defined, and the Protégé 3.1.1 environment was used. Because the development of ontology is an iterative process, the modification and reconstruction will be continuous during the process of guideline encoding.

Results

In our ontology prototype, about 300 concepts relevant to hypertension management were defined. A medication prescription, laboratory test, physical examination and other related conditions were included in the related concepts. Based on all of this, high-level classes which contained medication, clinical finding, laboratory test, patient education, problem, patient case, event, rule, therapeutic adjustment, temporal predicate and eligibility criteria were defined as the main axis. Each class included subordinate concepts of is-a relation. After that, attributes of concepts were defined.

Conclusion

Through this approach, the creation of a tool for the purpose of acquiring particular domain knowledge is expected to be easier. Furthermore, it is believed that the ontology of hypertension management for a guideline-based clinical decision support system will contribute to the sharing and deploying of knowledge and to the dissemination of standardized clinical guidelines through the reuse of this knowledge