Ontology design for pneumonia diagnostic

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Abstract—**Pneumonia is among the diseases affected by misdiagnosis. Here, we are interested in a design of pneumonia ontology for clinical decision support system to reduce diagnosis errors made by physicians. We use a semi-automated method in the process of development of our ontology. We follow the principles of the Open Biomedical Ontologies (OBO) Foundry.**

I. INTRODUCTION

The overload of clinical information significantly exceeds the human cognitive capacity and leads often to medical errors including the diagnosis step. One of the diseases affected by misdiagnosis is pneumonia [1]. In order to reduce diagnosis errors we develop an ontology of pneumonia, which will be a core of SEKMED [2] decision support system. We work principally on pneumonia clinical guidelines to extract useful concepts. We reuse parts of some existing biomedical ontologies and use electronic health records (EHR) to evaluate and improve our ontology.

II. MATERIAL AND METHODS

First, we defined the domain of our ontology and its scope with physicians. Next, we identified 13 national and international pneumonia clinical guidelines and extracted relevant concepts using Tex2Onto [3]. We used MetaMap [4] to identify UMLS concept unique identifier (CUI) for each concept for the purpose of interoperability with other biomedical ontologies. We also reviewed the existing ontologies to identify those that cover pneumonia. It allowed us to enrich our ontology with specific concepts related to pneumonia and not mentioned in the clinical guidelines.

For the purposes of interoperability and reusability of our ontology with other biomedical ones, we followed OBO Foundry ontology development principles [5] and Cimino's Desiderata for terminologies [6]. Hence, we implemented the Basic Formal Ontology (BFO) as the upper ontology. To evaluate and improve our ontology, we use the publically available Multi-parameter Intelligent Monitoring in Intensive Care II (MIMIC II) database [7] which is an EHR database of 32,535 critically ill patients.

III. RESULTS

Our ontology covers symptoms and signs, all the types of pneumonia (community-acquired pneumonia, health-care associated pneumonia, and hospital-acquired pneumonia), antecedents, pathogens, and diagnostic testing. It also includes diseases that may have the same clinical signs and diagnostic test results. The ontology contains 550 classes and 160 objects properties. Currently, we are working on integrating the ontology into the decision support system of SEKMED. The first evaluation results show that most of the terms in MIMIC II database are correctly identified in our ontology.

IV. CONCLUSION

We present in this paper the process of semi-automatically building of pneumonia ontology for diagnostic decision support system. We focus on pneumonia clinical guidelines to extract concepts and reuse existing biomedical ontologies. We follow the principles the OBO Foundry to assure the interoperability with others ontologies.

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