

Chapter 32

A Decision Support System (DSS) for Colorectal Cancer Follow-Up Program via a Semantic Framework

Kalpdrum Passi

Laurentian University, Canada

Hongtao Zhao

Laurentian University, Canada

ABSTRACT

This paper offers insights into evolving a decision support system (DSS) to aid primary care physicians and/or nurses in the post-surgical care of patients with Colorectal Cancer in a clinical setting. Presently, the oncologists in the cancer center, who are familiar with the Clinical Practice Guidelines (CPGs), are primarily responsible for the provision of follow-up care to their patients on the basis of the CPGs; in contrast, the attending primary care physician and/or nurse assisting the oncologist may be unfamiliar with these guidelines. These caregivers would, therefore, either require hardcopies of the CPGs or can be aided via a DSS for them to be able to provide the appropriate follow-up care for the respective cancer patients. Clearly, the Colorectal Cancer follow-up CPGs have to be analyzed and the ontology representing the knowledge embedded in the guidelines designed prior to realizing such a DSS. The designed ontology is often coded into Web Ontology Language (OWL) as a standard ontology that can be accessed through the Web. The authors' research team designed and presented the semantic framework of the web application, using the designed ontology that combines the current Web technology with database storage to achieve a unified development of the DSS. The authors also designed a user-friendly interface of the Web application to provide medical practitioners the functionality of the CPGs and the flexibility to customize the desired follow-up care schedule. The resulting DSS provides the physicians with follow-up program for the Colorectal Cancer patients based on the CPGs. The system was built using the semantic framework for the follow-up program and queries on the system are executed through SPARQL query engine.

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1. INTRODUCTION

According to Sahay & Aktar (2008), health informatics (HI) is taking center stage in research and development applications of the health-care industry with considerable efforts and resources being put into this domain. With advances in information technology (IT), the processing of health care procedures can now be implemented more efficiently, while the accuracy and security of the health records and personal information can be vastly improved.

The follow-up program for patients with colorectal cancer involves regular medical checkups and tests. This typically includes a review of the patient's medical history and physical exams. The purpose is to check for (cancer) recurrence, the return of cancer in the primary area, or metastasis, which is the spread of cancer to another part of the body. Visits to the oncologist during follow-up care may be helpful to identify and/or address some treatment-related problems patients may have, or to check for problems that may arise or continue after the treatment ends. Follow-up care is specified depending on the type of cancer, the type of treatment a patient has received and the patient's overall health condition. Follow-up care may be classified into long- vs. short-term as determined by the length of the program. Alternatively, it may be classified as high- vs. low-intensive program, which is judged by the visit or test frequencies. For each follow-up care program, some guidelines are usually followed although, in practice, different doctors may focus on treating patients differently. Even so, most of the family physicians are either new to and/or unfamiliar with the colorectal cancer follow-up program. A computerized follow-up program can therefore aid the physicians effectively in offering follow-up care, making better-guided and more accurate decisions, and, at the same time, tracking the progress of individual patients throughout the program.

Clinical Practice Guidelines (CPGs) for follow-up care (Council of Europe, 2001; Desch, et al., 2005; Institute of Medicine, 2011) serve as the key knowledge base to progress cancer treatments both for the family physicians as well as the patients. It represents the best available set of evidence-based recommendations to be used in a more general clinical setting where a specialist is not required. In order to give proper follow-up care, physicians need access to the guidelines and must be able to extract the relevant information or algorithm from these guidelines and then apply this knowledge to individual patient. Compared to traditional approaches, modern CPGs are developed based on current evidence within the paradigm of evidence-based medicine (Burgers, et al., 2003). It is a derivative and summary of current best practices. Health care providers (physicians, nurses, etc.) have to decide whether or not to follow the recommendations provided in the CPGs for any individual patient given that they are obliged to know the CPGs of their professions (Desch, et al., 2005). The objectives of CPGs are to identify, summarize and evaluate the highest quality evidence and most current data about prevention, diagnosis, and therapy. These guidelines aid in defining the key questions about clinical practices and identify all possible decision options and their outcomes. If the procedure can be handled by a computer system through a user-friendly interface (web-based), it will be more convenient, accurate and efficient for a physician or a nurse to provide the follow-up care.

Semantic Web (semantic web, w3.org) is often referred to as the technology of "Web of linked data" that can enable people to create data accessible through the Web, building vocabularies to eliminate the ambiguities, and defining rules to handle data. It can enable computers to understand the semantics and the meaning of the information on the web. The Semantic Web is intended to allow the machines to consume, interpret information on the web and integrate information across different content applications and systems. It represents the knowledge by metadata (data of data), especially those data in the pages,

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