

# Clinical Decision Support Knowledge Management: Strategies for Success

Mohamed KHALIFA<sup>a,1</sup> and Osama ALSWAILEM<sup>a,2</sup>

<sup>a</sup>King Faisal Specialist Hospital and Research Center, Saudi Arabia

**Abstract.** Clinical Decision Support Systems have been shown to increase quality of care, patient safety, improve adherence to guidelines for prevention and treatment, and avoid medication errors. Such systems depend mainly on two types of content; the clinical information related to patients and the medical knowledge related to the specialty that informs the system rules and alerts. At King Faisal Specialist Hospital and Research Center, Saudi Arabia, the Health Information Technology Affairs worked on identifying best strategies and recommendations for successful CDSS knowledge management. A review of literature was conducted to identify main areas of challenges and factors of success. A qualitative survey was used over six months' duration to collect opinions, experiences and suggestions from both IT and healthcare professionals. Recommendations were categorized into ten main topics that should be addressed during the development and implementation of CDSS knowledge management tools in the hospital.

**Keywords.** Clinical Decision Support Systems, Knowledge Management, Clinical Rules, Hospitals.

## Introduction

Clinical Decision Support Systems (CDSS) have been shown to increase quality and patient safety, improve adherence to guidelines for prevention and treatment, and avoid medication errors [1]. Systematic reviews have shown that CDSS can be useful across a variety of clinical purposes and topics [2]. All clinical decision support systems and interventions have a life cycle that requires an underlying technical and organizational infrastructure [3]. CDSS and interventions rely mainly on clinical knowledge that is constantly changing and so must be regularly reviewed and updated. Knowledge management is an important focus of successful CDSS [4]. There are two types of knowledge management essential to the successful use, deployment and implementation of CDSS. First, organizations must make sure that the patient information within the EMR is up-to-date and accurate. This activity depends mainly on those people responsible for entering clinical information into the hospital information systems and electronic medical records. Information cannot be helpful if it is not valid or not accurate. CDSS are essentially only as good as the information entered into the hospital information systems and electronic medical records [5].

Most of the studies that found that users are overriding CDSS alerts, such as drug safety alerts, have shown that the hospital information systems used and electronic

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<sup>1</sup> Consultant, Medical Informatics. Email: khalifa@kfsshr.edu.sa.

<sup>2</sup> Chief Information Officer. Email: alswailem@kfsshr.edu.sa .

medical records contained out-of-date clinical and/or medication information [6], for example when the information about the patient allergies are changed or some of his/her medications were discontinued and these changes were not updated in the medical record, just like what is happening at King Faisal Specialist Hospital and Research Center, where drug alerts appear due to potential drug interactions between active medications and inactive old medications. If the information used in the CDSS to trigger the alerts is inaccurate, the alerts will be inaccurate too and overriding them may make sense. Frequent inaccurate alerts can lead the clinicians to ignore all of the CDSS advice, in what is known as alert tolerance or alert fatigue [6].

In addition to the clinical information about the patient, the medical knowledge that informs the alerts must be updated as often as is necessary. This type of knowledge management is much more difficult to achieve. When the amount of information and knowledge content in a hospital information system or a CDSS is small, keeping it current is usually manageable. However, as the amount of content increases, maintaining currency becomes increasingly challenging [7]. Many of the clinical rules of CDSS and interventions change quickly; new clinical guidelines are published, new drugs are introduced to the market, and new medical evidence becomes available. These, in turn, necessitate a change in the CDSS content. Implementing even apparently simple rules can be a significant organizational challenge and requires a commitment to maintain the rules and individuals dedicated to this task [8].

Hospitals and healthcare organizations must either dedicate staff and resources to maintaining clinical knowledge or outsource the activities to commercial vendors or other organizations [9]. In general, good knowledge management depends on skilled information systems staff, either in managing outsourced content or working with clinician experts, a well-developed and collaborative decision making structure and appropriate technology to assist [10]. The quality measures or clinical objectives which drive an organization's CDS interventions might be different based on patient population or location. Thus, the knowledge required might be more specific to a region, and therefore more rarified, making outsourcing difficult [11].

## **1. Methodologies**

At King Faisal Specialist Hospital and Research Center, Saudi Arabia, the Health Information Technology Affairs worked on identifying best strategies and requirements for the successful CDSS knowledge management. A careful review of literature was conducted to identify the main areas of challenge and the factors of success for such systems. A qualitative survey method was also used over six months' duration to collect opinions, experiences and suggestions from both information technology professionals and healthcare professional users through an electronic website portal and semi-structured interviews. The strategies and recommendations were categorized and sorted into ten main topics that should be addressed during the development and implementation of CDSS knowledge management tools in the hospital.

## **2. Results and Discussion**

CDS knowledge management strategies and recommendations could be classified into ten main domains. Utilizing a multidisciplinary team within the hospital to create and

maintain the knowledge of CDSS; a team of physicians from different specialties with informatics experience should work on translating clinical guidelines into CDS rules. Encoding guidelines in a computer understandable format and integrating them with hospital information systems enables delivery of patient specific recommendations when and where needed [12]. Pharmacists should develop and maintain drug safety information and alerts. The team should also include specialized medical informaticians, nurses, dedicated software developers and project managers [13]. Developing an external electronic clinical content knowledge base is one practice; to maintain clinical knowledge separate from hospital information system or CDSS code in an external knowledge base that is accessible and searchable by users. Often this knowledge base consists of either a database or a storage system with an application interface and can simply be classified as passive knowledge base; delivering advice to physicians or nurses upon their request rather than interacting with their work through actively generated alerts and reminders, as the case is with active CDSS [11].

Developing an online tool for content development and sharing; many people will be involved in knowledge development, including physicians, nurses, pharmacists, software developers and quality professionals; they need a tool to keep them connected. Internet-based tools allow asynchronous discussion regarding advantages and disadvantages of specific CDS rules which can help developing new content and achieving organizational consensus, especially for guidelines based systems. Developing a hospital-wide tool to maintain terminology, definitions and formulae; where advanced, patient-specific CDS rules depends on availability of a controlled clinical terminology, proper functional definitions and valid and accurate calculation formulae. Without such controlled terminology, CDS developers will have difficulty using free text in developing clinical concepts. Definitions are required to maintain standards of performance, triggers and alerts, while valid and accurate formulae guarantee that quantitative measures are calculated accurately [9, 11].

Assigning an expiration date to the clinical knowledge components; this strategy will help to keep the knowledge base current and up-to-date. These time limits should be set to match with the expected life cycle of the clinical knowledge and rules and it should trigger review by an appropriate specialty expert after a predetermined time. Periodically reviewing, checking and updating content against current practice; the hospital should develop a schedule for annual or periodic reviews, every six months for example, where the clinical knowledge content is checked against current medical practice and updated as needed. This should also be managed through a team [14].

Assigning and encouraging owners responsibility and contribution; since all clinical rules and medical knowledge should be owned by clinicians or by committees, not by the IT department in the hospital, so medical specialties, nursing specialties and other clinical areas should own and take control of creating and updating their specialty clinical rules and content. Establishing a clinical content management committee; to be responsible for addressing ambiguities in the clinical guidelines and to develop the specific criteria necessary for creating computer executable clinical rules, the committee should also be responsible for conducting review of literature to gather evidence and uses the clinical expertise in published research [15].

Implementing an alternative solution for in-house CDS knowledge development through searching for other healthcare organizations that might share their current CDS rules through vendor user groups or other consortiums is one option. This new coalition can facilitate the process of knowledge development and management and can also standardize the clinical content utilizing the same rules and alerts in reference to best

practice and available evidence. Outsourcing the whole project of the CDS knowledge development and management to an external supplier, vendor or organization; can be less time consuming and requires fewer resources in the hospital to utilize, integrate or interface commercially available knowledge bases. In this case, efforts will be needed to customize the ready-made content for the hospital specific needs. Contracts issues such as cost, frequency of updates and source of knowledge should be discussed [16].

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