REVIEW ARTICLE

Exploring Clinical Decision Support System in Health-Care Settings – Challenges and Barriers to Implementation – A Literature Review

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Abstract

A clinical decision support system (CDSS) has been introduced as an important tool in health-care sectors to make the appropriate decision for patients and health-care delivery by health-care professionals. The decision support system (DSS) is comprised electronic software which assists professionals such as physicians and others to make patient-specific assessments for better health-care delivery and health outcome. Although the implementation of CDSS in health care is a challenging and complex process and it was found that their multiple factors and barriers associated with the successful implementation or practice of CDSS in clinical settings both in Saudi Arabia and other countries.

Key words: Barriers, Challenges, Decision-making, Health care, Physicians

BACKGROUND

The demand for long-term health care is increasing dramatically in many countries both national and international levels.[1] To raise the health-care standards, clinical decision support system (CDSS) has been introduced as an important tool in health-care sectors.[2] A CDSS aims to improve health-care delivery by supplementing medical choices with targeted clinical knowledge, patient data, and other health-care records.[2,3] The earlier literature discloses that CDSS implementation has both advantages and disadvantages, as well as the elements that influence their acceptability. Furthermore, as demonstrated throughout the literature analysis, the importance of their effectiveness and the areas for development in CDSS implementations are well recognized in the health-care industry.[2,3] The CDSS software is supposed to be direct assistance in decision-making, in which a particular patient's features are matched to a computerized clinical knowledge base, and patient-specific assessments are offered to the clinician to make a decision.[4] However, the computerized provider order entry (CPOE) allows health personnel to enter procedure and prescription orders directly into a computer[5] rather than on paper[6] which ensures legible, comprehensive orders[7] and allows clinical decision support (CDS) tools to be integrated (CDSS). In addition, it was evidence that DSS contributes to supporting decision-making for GPs in reducing medical errors.[8]

Although the CDSSs are most commonly employed at the point of care today, allowing clinicians to integrate their knowledge with information or suggestions offered by the CDSS. However, CDSSs are increasingly being developed with the potential to use data and observations that would otherwise be unavailable or unintelligible to humans.

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According to a report from HealthIT.gov, the CDS consisted of computerized alerts and reminders to care providers and patients; clinical guidelines; condition-specific order sets; focused patient data reports and summaries; documentation templates; diagnostic support, and contextually relevant reference information, among other tools.[9] However, earlier literature witnessed that a decision support system (DSS) has been implemented in both inpatient and outpatient settings, for drug prescribing in both developed and developing countries. Despite the broad implementation of CPOE and CDSS in hospitals around the world, the quality of evidence about their effectiveness in reducing prescription errors and harm is mixed.

CDSS IN HEALTH CARE

From early detection of infection to providing insights into highly tailored chronic therapies (cancer, diabetes, and tuberculosis), the core principles of CDS can be used in inpatient care in an unlimited way. For instance, an earlier report found that after implementing a computerized surveillance algorithm, the hospital's sepsis death rates dropped by 53%.[9] Similarly, another recent report from real-time analytics notified that providers of new sepsis diagnoses or worsening vital signs, as well as reminders about how to treat patients with the fatal condition, would be directed by DSS. Similarly, earlier data indicated that the CDSS tool is now being used by Mayo Clinic to assist nurses in providing full and accurate phone screenings of individual patients seeking advice or appointments [Figure 1].

Health-care professionals such as physicians and nurses are guided through a sequence of standardized questions based on current health-care guidelines obtained by computerized decision software, ensuring that vital information about the patient's health is not overlooked.[9] In the United States, earlier research reveals that combining a CDSS with genetic testing resulted in reduced hospital readmissions by 52% and emergency visits by 42%. Furthermore, testing for drug-drug and drug-gene interactions on high-risk patients resulted in a cost savings of more than $4300 per capita. In addition, a previous study in Saudi Arabia reported a substantial difference (44.8% vs. 35.8%) in drug-related problems and incidence pre-and-post-CPOE implementation. The CPOE system considerably reduced drug-related incidence in the pediatric population.[10] Similarly, another study in Saudi Arabia found no significant difference in the number of medication errors discovered when one type of CDSS alert was activated versus when it was deactivated.[11] In other words, CDS systems are intended to aid in the sifting of massive volumes of digital data to recommend the next steps for treatments, alert physicians about available information they may not have noticed, or detect potential problems such as dangerous prescription combinations.

CHALLENGES AND BARRIERS AND RISK OF USE OF CDSS

Although many health-care organizations yet facing significant challenges when it comes to creating intuitive, user-friendly, and effective protocols for alarms, alerts, and decision-making pathways, CDS tools are frequently integrated into the electronic health record (EHR) to streamline workflows and take advantage of existing datasets. The most commonly cited barriers to implementing a DSS were a lack of CDSS understanding among physicians, a large number of superfluous warnings in the system, the requirement for technical help, and the time spent using CDSS being deducted from time spent communicating with patient's electricity outages and a lack of technical understanding were also hurdles in deploying CDSS in rural health care in poor countries (Zakane *et al*., 2014).[12,13] The enormous number of alerts, the high expense of integrating the system with existing health-care practice settings, and the potential negative consequences on privacy, confidentiality, data accuracy, and alert creation are all barriers connected with CDSS (Gullapalli *et al*., 2015).[14] Furthermore, the previous study by Khalifa in 2016 allocated the barriers related to CDSS in Saudi Arabia into three categories; financial, organizational, and regulatory.[15] However, in rural health-care settings, most cited challenges of implementing CDSS included electricity outages and inadequate technical knowledge.[13]

Another study in Saudi Arabia recently revealed two potential determinants perceived as risk factors, the first of which is time risk, with physicians believing that CDSS can be time consuming during patient consultations due to the requirements for the input of data, both necessary and unnecessary, which lengthens consultations and increases patient waiting time overall. The second determinant is a systemic function, which refers to the fact that CDSS may be halted or unplugged from use due to system faults, causing delays or slowing the process of collecting required patient data; this, in turn, has a direct impact on CDSS acceptability.[12]

Alert fatigue and clinical burnout are significant side effects of poorly integrated clinical decision assistance technologies that overwhelm users with irrelevant data or cause annoying workflow freezes that necessitate further clicks to resolve. According to a previous study published in the 2016 journal of the American Medication Association (JAMA), internal medicine EHR users spend more than an hour every day handling notifications. For instance, a previous study reported that an average of 76.9% of notifications in a day was faced by primary care practitioners. However, not all of those alerts come from CDSS s, many come from laboratory findings, pharmacies, or other doctors, with the results of adding CDS, alerts to an inbox already overflowing with information can cause more harm than good. Therefore, it is essentially important for the successful full implementation of DSS that improves service quality while avoiding the

frequent drawbacks of ineffective workflow tactics and poorly distributed notifications.

SAUDI ARABIA VISION 2030

From the beginning of the last eight decades, Saudi Arabia has undergone tremendous changes along with rapid and advanced development in the health-care industry. In 2016, Saudi Arabia announced a strategic reform called Vision 2030. The reform aimed to reduce the country's dependency on oil and diversify the economy of the kingdom. Furthermore, it is meant to develop public services in education, health care, tourism, and so on.[16,17] The Ministry of Health has implemented several initiatives including the strategic plan for Ministry of Health 2010–2020 that point to three major objectives to encounter these previously stated challenges. This includes ease of access to health services improving the quality and efficiency of healthcare services promoting prevention against health risks focusing on improving preventive and therapeutic health-care services.[16]

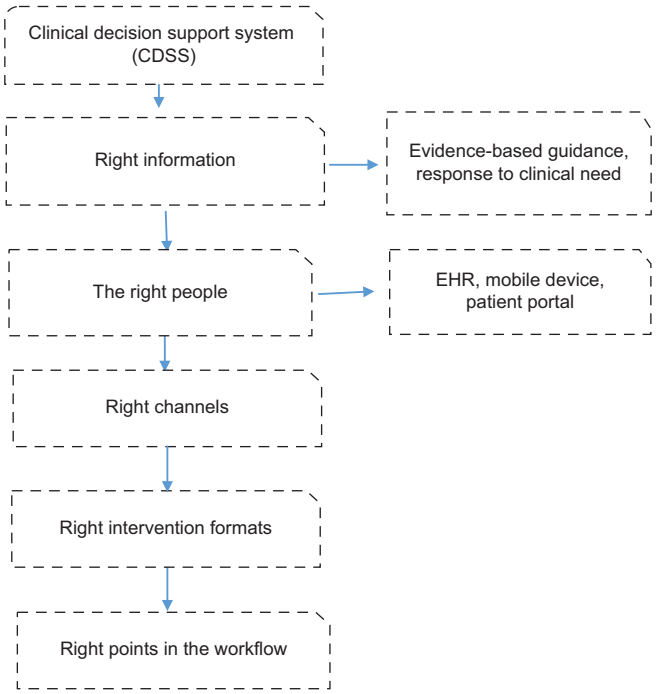

Figure 1: Workflow intended to deliver clinical decision support system

The main aim of health reform is to adhere to international standards, gain the people's trust, and respond to the growing prevalence of non-communicable diseases.[17] Earlier literature suggested that the Ministry of Health has "started shifting focus and investment from secondary and tertiary healthcare facilities toward reforming and restructuring primary health care, aiming to realize these goals." Medication-related errors in Saudi health care need to change, and these changes won't happen if the same manual data records and entries are maintained among the health-care sectors by professionals. This necessitates a focus on using advanced technologies to add computerized order entry, the implementation of DSS s in conjunction with extensive health education, and encouraging health-care organizations to seek and implement DSS s in PHC centers to allow them to solve current problems in providing adequate health care.[17,18] Many previous studies among public and professionals reported in Saudi Arabia reported lower knowledge of various diseases and the prevalence of various diseases on raise.[19-29] In addition, Saudi Arabia government has created the foundation for a bright future by recognizing requirements and working to meet them through Saudi Vision 2030. This vision arose through the efforts of all ministries, who were all involved in a collective solidarity activity to achieve the objective that was with the leadership of the Kingdom of Saudi Arabia's full support (Saudi Vision 2030, 2020).[29]

FACTORS INFLUENCING THE ACCEPTANCE OF CDSS IN HEALTH CARE

According to the literature, the following factors were found to influence acceptance of CDSS in health-care settings such

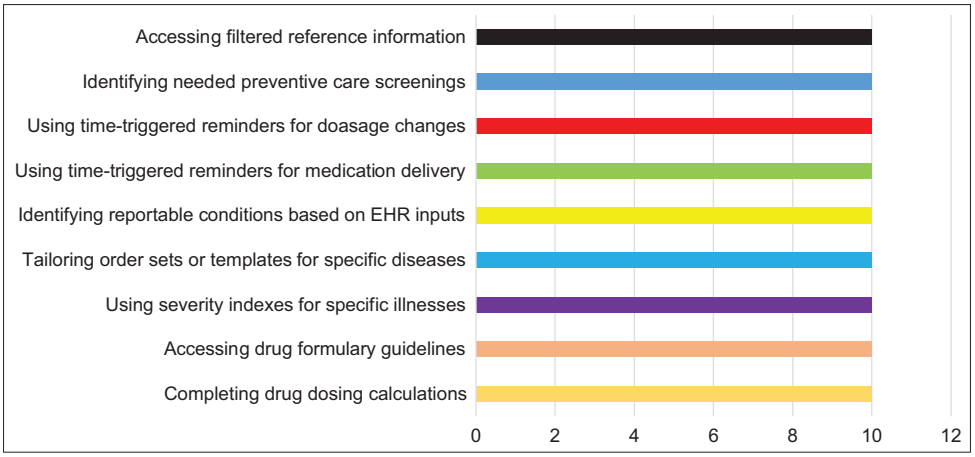

Figure 2: Applications of clinical decision support system in health care

as expectations for performance followed by expectations for effort, facilitating conditions, task-technology fit, technology characteristics, task characteristics, patient satisfaction, informativeness, and connectivity to patients [Figure 2].

CONCLUSION

Thus, the current literature suggests that the importance of CDSS in a health-care setting enhances medical decisions by providing clinical knowledge and patient information, thus improving health-care quality. Furthermore, this review identified several barriers to successfully implementing the CDSS in health care, which can be solved or corrected through additional training, education, and awareness program. Furthermore, more studies are needed to examine the feasibility of using CDSS to support doctors' decision-making in health care.

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