Changing Before Our Eyes:
An Evolution of Clinical Decision Support in Healthcare

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March 2013
The words ‘clinical decision support’ can elicit a variety of responses from clinicians. Several may remember some not-so-favorable experiences. Others might recall useful interactions with it. Some may be excited thinking of the possibilities of what it could do for them.

For years, stakeholders involved in healthcare, including clinicians, staff, patients and their caregivers, and governmental agencies have been in agreement about the need for advancement in technology to help improve patient care. The Institute of Medicine recognized problems with the quality of healthcare in the United States and advocated for using health information technology (HIT) to improve quality, including clinical decision support tools.\(^1\,^2\) The Institute of Medicine has stated that to improve safety, health IT systems should be designed to make it “easy to do the right thing.”\(^2\)

To improve the quality of care provided in the United States, many entities, including researchers, practitioners, and corporations have made and are continuing to make efforts to increase the practice of evidence-based medicine through the use of clinical decision support (CDS) systems. In general, these systems are designed to provide clinicians, often at the point of care, with clinical knowledge and patient-specific information to help them make decisions that enhance patient care.\(^3\)

Recently, several initiatives have been provided to incentivize practitioners to use CDS systems. The Agency for Healthcare Research and Quality (AHRQ) and the U.S. Department of Health and Human Services Office of the National Coordinator for Health Information Technology (ONC) funded the development of a Roadmap for National Action on Clinical Decision Support and conducted workshops to support CDS system development and implementation (and AHRQ also funded CDS demonstrations). In addition, the American Recovery and Reinvestment Act of 2009 (ARRA) created financial incentives through Medicare and Medicaid for practitioners to ‘meaningfully use’ qualified electronic health records (EHRs). In their Notice for Proposed Rulemaking for the EHR Incentive Program, the Centers for Medicare and Medicaid (CMS), stated that the criteria for meaningful use needed to include the implementation of five clinical decision support rules, including the ability to track compliance with the rules.\(^4\,^5\)

Despite the advancements and the ever-increasing changes in technology, as well as recent initiatives that provide support for CDS adoption, challenges remain with the acceptance of CDS by some clinicians and the obstacles encountered in the implementation of CDS systems. Depending on who you ask in the clinical community, you may hear the highest words of praise about CDS systems or you may hear resounding negativity. It appears that many factors are involved in whether one likes one CDS system over another or if some ‘work better’ than others.

Several research studies have repeatedly shown the effectiveness of CDS systems. A recent review of many, many studies over several years focusing on CDS systems found that they do, in fact, help improve the health care processes related to preventative care and to help improve the rate of recommended therapy prescriptions.\(^6\) It is believed that with continuing evidence showing the value of CDS and with improved implementation processes, practitioners and organizations will realize the tremendous value that CDS can provide to them.
Clinical Decision Support Defined

Clinical decision support appears to mean different things to different people. If one asks a clinician to define it, she will do so in a way that means something to her in her chosen field of clinical work. Often, it may be quite specific and focused on what would assist her in her job or tasks. Some key questions to ask when considering CDS systems are “whose decisions are being supported, what information is presented, when is it presented, and how is it presented to the user?” Osheroff et al. offer what they call the “five rights” of CDS which provides a relevant summary of what is needed for effective delivery: “CDS should be designed to provide the right information to the right person in the right format through the right channel at the right time.”

One definition states that a CDS system is “any electronic system designed to aid directly in clinical decision making, in which characteristics of individual patients are used to generate patient-specific assessments or recommendations that are then presented to clinicians for consideration.” A working definition has been proposed by Dr. Robert Hayward of the Center for Health Evidence; “Clinical Decision Support systems link health observations with health knowledge to influence health choices by clinicians for improved health care.” This definition has the advantage of simplifying Clinical Decision Support (CDS) to a functional concept.

CDS systems are not intended to make decisions for a clinician. Their role is to support clinicians in their decision making processes. Examples of CDS systems include alerts, reminders, order sets, drug-drug interaction alerts, drug-allergy alerts, drug formulary checking, and care-summary dashboards that provide performance feedback on quality indicators or benchmarks.

Clinical Decision Support Systems: Past and Present

Early CDS systems originated from expert systems research where developers attempted to program computers with rules that would allow the computer to think like an experienced practitioner when given patient information. This led to a realization that such systems could be valuable beyond a research point of view. These systems could be used to help practitioners with their decision making and, by taking over some routine tasks, making them aware of possible problems or by providing suggestions.

In their article, A Four-Phase Model of the Evolution of Clinical Decision Support Architectures, Drs. Adam Wright and Dean Sittig conducted an extensive review of the clinical decision support literature since 1959, sequenced the systems and developed their model. The model has four phases where each phase advanced the one before it. The phases they proposed are:

1. Standalone decision support systems, beginning in 1959.
2. Integrated systems, beginning in 1967.

The researchers found that each of the four evolutionary approaches to decision support architecture had unique advantages and disadvantages. They concluded that there were common limitations almost all the approaches faced and that no single approach had been able to fully overcome. The limitations identified were: (1) fixed knowledge representation systems inherently limited the type of knowledge that could be represented in them; (2) there were serious terminology issues; (3) patient data could be spread across several sources with no single source having a complete view of the patient; and (4) major difficulties existed in transferring successful interventions from one site to another.
Since their inception, clinical decision support systems have been used for several purposes, from quality and safety to efficiency, and across several clinical areas including evaluation, diagnosis and treatment. A considerable amount of evidence exists to indicate that decision support systems can be extremely effective.\textsuperscript{11,12,13,14}

A number of systematic reviews or meta-analyses of CDS randomized controlled studies have been conducted and provide similar results. The meta-analyses of studies of alerts and reminders for decision support have been fairly consistent in showing that they can alter clinician decision making and actions, reduce medication errors, and promote preventive screening and use of evidence-based recommendations for prescribing medications.\textsuperscript{7}

A recent systemic review by Garg found that in 100 studies of clinical decision support, “CDSS improved practitioner performance in 62 (64%) of the 97 studies assessing this outcome, including 4 (40%) of 10 diagnostic systems, 16 (76%) of 21 reminder systems, 23 (62%) of 37 disease management systems, and 19 (66%) of 29 drug-dosing or prescribing systems.”\textsuperscript{12} The data on how those decisions affect patient outcomes are more limited, although a number of studies have shown positive effects.\textsuperscript{12}

**User Experience**

Users want and need different things from a CDS system to do their jobs effectively. It often appears that no two clinicians use CDS systems exactly the same way. Some clinicians want to be reminded about patient-specific items with pop-up windows. Others are distracted by them and want them turned off. Some clinicians want to know about all possible drug-drug interactions that may exist for a patient. Others only want to know possible fatal interactions. Some clinicians want CDS systems to offer diagnostic suggestions to them for a patient. Others are insulted by the thought that a computer program could ever be better than their own judgment.

In his blog “Decision Support in Psychiatry,” Steve Balt, MD, describes how he was once an advocate of decision support (in fact, he actually helped design a CDS system) but has now changed his mind about them. He states, “Now that I spend most of my time actually practicing medicine, and using two different EHR systems, I’m having second thoughts. While I appreciate the ability to enter patient data (and my notes) into a system that is instantly accessible by any provider in my office at any time, and write prescriptions with a few clicks of my mouse, I’ve begun to resent the ways in which EHRs tell me how to practice, particularly when (a) they give recommendations that I would employ anyway (thereby wasting my time), or (b) they give recommendations that deviate from what I believe is right for the patient.”\textsuperscript{15}

It is unlikely that these differences in opinion about CDS will ever go away. However, what will not go away is the momentum that CDS systems have gained and their proven usefulness and effectiveness. Healthcare stakeholders are now frequently using Internet resources, such as Internet-based knowledge resources and Internet-based technologies such as service-oriented architecture (SOA), with the goal and ability to facilitate broad distribution of CDS interventions and information.\textsuperscript{16} Thus, it is up to the designers of CDS systems and the organizations that use them to make CDS systems useful to all practitioners in the organization.

**CDS Implementation**

With regards to the implementation of a CDS, researchers found that there are four design characteristics that are associated with a successful implementation.\textsuperscript{17} Their review showed:
1. Computer-based decision support is more effective than manual processes for decision support.
2. CDS interventions that are presented automatically and fit into the workflow of the clinicians are more likely to be used.
3. CDS that recommends actions for the user to take are more effective than CDS that simply provides assessments.
4. CDS interventions that provide information at the time and place of decision making are more likely to have an impact.

Workflow Integration

When designing and implementing a CDS system, the issue of workflow is a key element. Workflow includes the structure and organizational features and processes that support clinical care. Many clinicians may think that a CDS system must conform to their established workflow, which is true to an extent. Changes in the workflow may also be needed to optimize care, either prior to, during, or after the implementation of CDS. An analysis of the workflow and how CDS will fit in should be done as one of the first steps in the implementation process. This usually occurs in the needs assessment phase where the CDS requirements are identified.7 It is important that clinicians be involved in the implementation. As Osheroff stated, “Do CDS with users and not to them.”8

Related to workflow integration, in 2008 the Joint Commission issued a sentinel event alert that emphasizes proper implementation practices. Their practices include resolving workflow issues and process issues prior to implementation, involving users, providing training to users, monitoring the system to ensure that it is performing as expected, and addressing the errors that arise and correcting them if possible.18

Information Presentation

Many organizations may find it difficult to get their clinicians engaged in using an electronic medication record or electronic prescribing systems. Clinical decision support systems are often embedded in these applications. If an organization has clinicians that still use a paper and pen method of charting and prescription writing and rely on others to input the information into the computer application, they are absent when relevant clinical decision support information may be presented. While they may rely on others to contact them if such information presents itself, it is a risk venture to assume the information relayed to them is exactly how it was presented at the time. Thus, it is imperative that organizations do what they can to get all of their clinicians to use the computer applications when performing their clinical duties.

With regards to the presentation of information, while some clinicians may state that they do not like “pop-up” alerts, researchers have shown that people who are exposed to modal alerts (eg, pop-ups) were 11.6 times less likely to make a prescribing error than those not shown an alert; those exposed to a non-modal alert (eg, an alert but not a pop-up alert) were 3.2 times less likely to make a prescribing error than those not shown an alert. The error rate with non-modal alerts was 3.6 times higher than with modal alerts.19

Alert Fatigue

An ongoing concern with warnings and alerts, both modal and non-modal, is ‘alert fatigue.’ Alert fatigue occurs when physicians are flooded with alerts to the point that they begin to ignore them. The challenge with solving alert fatigue is trying to figure out to whom an alert is relevant. Some clinicians may think that some alerts are not important for them or for their patients. Other clinicians may disagree. Under ARRA, to meet
meaningful use criteria, hospitals and EPs must implement the drug-drug, drug-allergy, and drug-formulary checks for computerized physician order entry clinical decision support. In its final rule, the CMS acknowledges the challenges associated with alert fatigue related to these checks. However, it states that the benefits of these alerts far outweigh any inconvenience they may cause to a provider. “We recognize alert fatigue is a potential occurrence with drug-drug and drug-allergy checks. However, meaningful use seeks to utilize the capabilities of certified EHR technology, and any means to address alert fatigue requires a critical evaluation of each alert. We believe this is beyond the scope of the definition of meaningful use. We believe these checks are valuable and improve patient care and therefore do not remove them to address alert fatigue.”

Pursuing Perfection

Challenges in clinical decision support continue for all stakeholders in clinical care. Knowledge-based management companies continually try to stay on top of the ever-changing clinical information landscape in order to provide accurate data in their products. Software companies continue to find ways to present CDS systems within EMRs and e-prescribing applications in order to meet the five rights of CDS proposed by Osheroff et al. Treatment organizations continue to determine what information they want and need their clinicians to have available to them. And finally, clinicians continue to try and make judgments from the data that is presented to them to improve their patient’s care. While the current CDS landscape may not be perfect, it is tremendously better than just a few years ago and its momentum for improvement continues on a daily basis.

About Netsmart

Through innovative and interactive solutions and services, Netsmart leads the health and human services industry in transforming the way care is delivered. Our expertise in helping organizations navigate their way through Meaningful Use and Accountable Care shows our commitment to partnering with organizations of all sizes to ensure they have the technology and know-how they need to deliver the highest level of care to those they serve. Healthcare today is an ever-changing, rapidly-evolving world. Organizations must seek technology partners who understand their current needs and have their pulse on the industry to envision how needs can be met in the future. Our obligation is to guide our clients through this rapidly changing environment by providing them with solutions and services that help improve outcomes and reduce costs. We will help each of our clients adapt to these changes so that they can reach their goals and improve the health of the populations they serve.

Providers can utilize Netsmart solutions to meet Accountable Care and all Stage 1 criteria for Meaningful Use of an EHR, avoiding the need to integrate solutions from multiple vendors. Netsmart’s Meaningful Use-related solutions include a Complete ARRA-Certified EHR, e-prescribing, connectivity to health information exchanges, consumer Web portal, and a platform to capture and share outcomes data. Our community of users, the largest in the industry, is already sharing best practices on how to make the internal process changes needed to ensure a smooth path to Meaningful Use.

At Netsmart, we are at the forefront of healthcare innovation and moving forward at the speed of thought. We continue to evolve our services and solutions to meet the needs of our clients today and in the future. We are committed to ensuring that our clients in behavioral health, public health, substance abuse and addiction services emerge from the healthcare reform era as leaders in their respective fields of specialization.

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References


