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Clinical Decision Support and the Electronic Health Record—Applications for Physiatry

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Abstract

Clinical decision support (CDS) is a process that provides information to assist the user in decision making for evaluation and treatment. Although many think only of rules and alerts, CDS is much more than that. Order sets, clinical documents, information fields, and medication sentences are just a few other CDS tools to be considered. CDS has been shown to improve care. Forming the third point of the triangle, CDS, along with process redesign and workflow considerations, improves care and helps create successful outcomes. Failure to address all 3 of these elements creates a less-than-perfect and potentially dangerous result. Examples of the application of CDS in the field of physical medicine and rehabilitation remain limited. This field has a huge opportunity to use CDS to enhance patient care, and is an open area for CDS development and research.

What Is Clinical Decision Support?

As defined by the Health Information Management System Society (HIMSS), clinical decision support is

> *"a process for enhancing health-related decisions and actions with pertinent, organized clinical knowledge and patient information to improve health and healthcare delivery. Information recipients can include patients, clinicians and others involved in patient care delivery; information delivered can include general clinical knowledge and guidance, intelligently processed patient data, or a mixture of both; and information delivery formats can be drawn from a rich palette of options that includes data and order entry facilitators, filtered data displays, reference information, alerts, and others."* [1]

This definition needs to be broken down and amplified further to better understand what clinical decision support (CDS) really is. The primary focus of CDS is to assist decision making for evaluation and treatment by the individual receiving the information. The end game is to make certain that these actions improve patient safety, clinical outcomes, and *primum non nocere*. To improve decisions and actions, it is necessary for the recipient to receive pertinent information. This information must address the situation at hand and must relate to the patient being treated. It needs to be timely and within the provider's workflow.

Clinical decision support is not only for providers, but for patients as well. Having appropriate and relevant information can assist them with their personal health care. It can also supply needed facts to assist in the care of a significant other, for example a child, parent, or spouse. The information may be directive: for example, what to do next, or how to address a problem. It may present general knowledge to aid the caregiver in better understanding a condition or plan of care. In addition, the way in which data or information is presented must be appropriate for the individual receiving it—more technical for the medical provider, and in lay format for the patient. If possible, patient information should ideally be in the patient's own language.

History of CDS

Where did all this begin? Although computer science has its beginnings in the first recorded treatise of algorithms in 800 BC with the ancient Sanskrit *Shulba Sutras* ("Rules of the Chord"), it is most commonly ascribed to Charles Babbage, who designed the first automatic

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mechanical calculator in 1822. Clinical decision support began in the late 1950s [2]. The first work in medical informatics is believed to be the article by Ledley and Lusted "Reasoning foundations of medical diagnosis; symbolic logic, probability, and value theory aid our understanding of how physicians reason" [3].

Although additional work occurred in medical informatics, it was not until 1969 that Howard Bleich developed a system that suggested therapy for acid-base disorders, which included both diagnoses as well as treatment, a first in CDS. Several years later, in 1972, Sittig and Evans developed the HELP (Health Evaluation through Logical Programming) system, still in use for CDS research. In 1976, Dr. Clem McDonald, the developer of one of the first electronic medical records at the Regenstreif Institute in Indianapolis, published "Protocol-based computer reminder, the quality of care and the non-perfectibility of man."

Although dating back to work that was begun in 1984 at Beth Israel Hospital in Boston, in 1993, the Brigham and Women's Hospital in Boston began using the Brigham Integrated Computing System (BICS), developed mainly by Jonathan Teich. It included CDS that "gave a suggestion to the provider with the option to override it, however it must be signed by the physician before the order is released" [4].

Since the 1990s, the major vendors have included CDS as part of their offering, embedded in their electronic health records (EHRs). Most of these are basic, such as the drug-drug and drug-allergy alerts and evidence-based medical information. The systems allow users to develop additional CDS options, such as order sets and drug-medication and drug-laboratory alerts. Most recently, in the Protecting Access Medicare Act of 2014, "Congress mandated the use of Clinical Decision Support for any provider ordering advanced outpatient imaging exams for Medicare patients" [5].

Part of CDS's design is the opportunity to make an accurate diagnosis. The modern version of this is Isabel [6], begun in 1999 after the founder's daughter was misdiagnosed and nearly died. The company has developed sophisticated algorithms, in which symptoms and laboratory data are entered and a differential diagnosis listed by probability is provided. This is not meant to supplant physician education but, rather, to supplement it, especially when considering more obscure and uncommon diagnoses. The ability to tie these pieces of clinical information together is what physicians are trained to do. However, unusual presentations or diseases rarely seen can be daunting; thus the computer-aided CDS can assist and can potentially save lives.

Types of CDS

Many consider CDS as only rules and alerts. In its simplest form, these are algorithms based on the "if, then" logic. For example, *if* you are allergic to penicillin and the prescriber orders penicillin for her patient, *then* fire an alert warning the provider and sometimes suggest an alternative. However, CDS is much broader than that. CDS is about "doing the right thing"—to provide the highest quality of care and safety for the patient. Order sets are such an example fitting that bill. Order sets are groups of orders most often created around a clinical condition or procedure. An illustration would be an admission order set for embolic stroke.

There are many items to consider for the acutely ill patient. Some are mandatory and some are elective. How to remember them all is at times challenging and it is not uncommon to forget an important order due to time constraints, fatigue, or distractions. An order set creates a logical format that takes into account the most common possibilities, both obligatory and optional choices. It is front-facing: that is, it presents the user with options in a user-friendly format. Order sets need to be well-developed, evidence-based orders, providing the user with the pertinent choices and therefore not having to recall everything without a prompt. This creates less likelihood of omissions. An example of this is an order set for postoperative care. As these types of orders are fairly rote, surgeons can choose their frequently used standard orders, have alternatives available depending on the individual patient, and still provide evidence-based care. Prior to EHRs, order sets were paper based. In the EHR, order sets now flow electronically, directly to nursing, pharmacy, laboratory, radiology, and therapy services, versus having a unit clerk transcribe those illegible orders for faxing, tubing, or scribbling on a 5 $\times$ 7 card.

Easily accessible clinical and referential information is another form of CDS. It is impossible to be knowledgeable about all of the latest medical advances. There are organizations that scan a huge amount of the medical literature and create synopses to embed those information sources in many EHRs. Third-party vendors such as Provation (Up To Date), Zynx, and VisualDx to name a few, have worked with the EHR vendors. With a single click, the user can have access to most of the recently produced medical material designed to cover topics including diagnoses and treatment. This literature and reference material is vetted and kept current by these companies and their large staff of physician reviewers.

CDS is used with medication ordering to decrease errors. Prescribing can be dangerous. Written medication orders are known to have sometimes been illegible and errors made by pharmacists assuming that the prescription was for a particular drug when another was intended. In the EHR, "medication order sentences" have been created, providing not only a legible order but the appropriate dosage, route, and frequency built in, thus preventing inappropriate dosing. In addition, medication CDS can help prevent therapeutic duplication by alerting to duplicate class drugs, for example angiotensin-converting enzyme inhibitor when another