Clinical Decision Support in the Medical Home

AN OVERVIEW

Patient-Centered Primary Care COLLABORATIVE

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With the passage of the American Recovery and Reinvestment Act of 2009 (ARRA), primary care providers have the opportunity to receive financial support for investing in and using electronic health records (EHRs) in a manner that will improve health care quality and efficiency. Some may seek to incorporate EHRs into their existing workflows, without undertaking significant changes in their day-to-day work. Unfortunately, simply using an electronic substitute for paper clinical notes is not likely to lead to improvements in health care quality or cost. Quality and cost are more likely to improve by leveraging enhanced technologies to ensure that patients receive appropriate preventive care and proper management of chronic conditions. The patient centered medical home encourages the use of health information technology (HIT), including clinical decision support (CDS), to improve health care quality and decrease overall cost to the national health care system.

What Is Clinical Decision Support?

CDS is the term used to describe information presented at the appropriate time to enable providers and their patients to make the best decision based on the specific circumstances. By comparing the information in a patient's electronic record with a set of evidence-based clinical guidelines, an electronic CDS system can, for example, remind a provider to ensure that a patient receives recommended immunizations, track a diabetic patient's HgA1c levels over time or notify a provider that the medication he or she is about to prescribe may lead to a life-threatening allergic reaction.

CASE 1

Jimmy S. was diagnosed with asthma when he was six years old. He is now eight and has arrived for his routine well-child visit. The nurse enters the exam room to check Jimmy's growth and vital signs. When she accesses Jimmy's electronic record, she is prompted to measure Jimmy's height, weight, and blood pressure and to do a peak flow. She notes all this information in Jimmy's record, which automatically provides updated growth charts, calculates body mass index and generates a diagram of Jimmy's past peak flows.

- When Jimmy's doctor enters the room, he is presented with a template of tasks to be conducted during an 8-year well-child exam. He is also reminded to ask a series of questions relating to Jimmy's asthma:
- How often does Jimmy use his rescue inhaler?
- Does he frequently cough or awaken during the night?
- Is he short of breath when playing with friends or during gym class?

In addition, the computer notifies the doctor that the discharge summary from a recent emergency room visit is available for review, and Jimmy's prescription history shows that his controller medication is not always refilled on time. Jimmy's mom reports that their health insurance recently changed, and the specific brand of controller medication is not on the new insurance's formulary. The increased co-pay has created a hardship for the family. The doctor issues a new prescription, and the electronic prescription writer indicates any generic drugs available, as well as specific alternatives that are available in the insurance company's formulary. The reduced co-pay should ensure that Jimmy is able to get his controller medication refills on time.

Between visits, the doctor's electronic health record system sends a reminder, by secure e-mail, to Jimmy's mom to schedule him for a flu shot. She is also able to use an electronic personal health record to track Jimmy's controller medication and rescue inhaler use, as well as his peak flows. This information is electronically shared with Jimmy's doctor, and the doctor receives a notification when Jimmy's peak flows become too low. The office then has the opportunity to contact Jimmy's mom to schedule a follow-up visit.

According to a popular CDS guide (see References at the end of this paper) published by the Health Information and Management Systems Society (HIMSS), the goal of CDS is to provide the right information, to the right person, in the right format, through the right channel, at the right point in the clinical workflow to improve health and health care decisions and outcomes.

If properly implemented, CDS interventions can:

- Ensure that the best clinical knowledge and recommendations are utilized to improve health management decisions by clinicians and patients;
- Organize, optimize and help operationalize the details of a plan of care;
- Help gather and present data needed to execute this plan;
- Foster the greater use of evidence-based medicine principles and guidelines;
- Detect potential safety and quality problems and help prevent them; and
- Improve appropriate utilization of services, medications and supplies.

Types of Clinical Decision Support

Providers sometimes assume that CDS will force them to practice "cookbook medicine." However, paper-based decision support has been in use throughout the history of medicine. When a provider refers to a textbook, pocket card or journal article in the course of caring for a patient, he or she is using a form of decision support. CDS helps to make this information more easily available to the provider where and when it is needed.

In order for clinical decision support to be effective, it must fit into the practice's workflow. Not every reminder, alert or other intervention has to be presented to the provider during the visit. Using reminder systems, front office staff can be alerted to make sure that important lab work is done prior to the visit. Documentation of key elements of a patient's exam can be obtained before the provider even sees the patient.

CDS can support disease management by tracking long-term issues that a given patient may need to have addressed for optimal health outcomes. Also, by using CDS with electronic prescribing, the selected drug can be checked against the patient's allergy list, against other drugs for possible interaction, for contraindication based on the patient's problem list, age or pregnancy-related restrictions or

FIGURE 1. Categories of Clinical Decision Support

- Documentation forms or templates (e.g., that provide a list of age-, disease-, or co-morbidity-specific tasks)
- Order creation facilitators (e.g., a set of template orders for specific conditions or built-in calculators to assist in correctly identifying or categorizing conditions or recommending appropriate drug dosing)
- Relevant data presentation (e.g., displaying only liquid formulations when prescribing an antibiotic for a young child, or post-visit reporting on specific patient populations)
- Reminders and alerts that ensure a provider has access to important information at the appropriate time (e.g., drug-allergy or drug-drug alerts during prescription ordering) or carries out specific activities (e.g., follow-up on referrals)
- Algorithms and protocols that guide a provider through use of a clinical practice guideline
- Reference information/guidance (e.g., links to external resources that may provide additional information needed for a task, such as drug prescribing information)

Figure 2. Principal Shortcomings of Clinical Decision Support[1]

1. Decision support systems are often stand-alone applications poorly integrated into the clinician's workflow.
2. Reminders generated by many decision support systems are often interruptive in nature (e.g., pop-ups and alerts).
3. Decision support interventions may not be tightly coupled to actions (e.g., the ability to immediately order the medication triggered by the reminder).
4. The end user may not believe the decision support is relevant to their decision making at hand.
5. There may not always be sufficient coded data to drive decision support.

[1] Schnipper JL, Linder JA, Matvey BP, et al. "'Smart Forms' in an Electronic Medical Record: Documentation-based Clinical Decision Support to Improve Disease Management." *J Am Med Inform Assoc.* 15:4; 513-523.

against the patient's insurance formulary. Patient registries allow providers to monitor their patient population with a specific condition and implement new protocols to improve quality.

CDS can contribute to the medical home by helping to support care coordination. For instance, in Case 1, suppose Jimmy was also seeing an allergist. CDS might support his primary care doctor in reconciling medications and problems lists, reviewing the latest update from the allergist, and making sure that Jimmy is seeing the allergist at appropriate intervals.

Each of these decision support mechanisms leverages information that is known about a particular patient to support the provider in treating a particular condition or providing preventive care.

Keys to Smooth Implementation of Clinical Decision Support

As noted in Figure 2, when properly implemented, CDS may improve health care quality and reduce cost. However, frequently we hear about the downside of CDS: too many alerts that disrupt workflow; recommendations that don't seem to make sense or may not be appropriate for a specific patient; extra steps inserted into the workflow that slow down health care processes. These risks are highlighted in Figure 2. Potential solutions include the following:

- Integrating the appropriate type of CDS into the workflow at the appropriate point in the care delivery system.
- Emphasizing alerts that deliver the highest value, with reduction and elimination of alerts of questionable value.
- Reducing false positive alerts through improved algorithms, and by incorporating more complete and timelier patient data.
- Incorporating detailed information about the patient's medical and pharmacy benefits, and presenting alerts in that context, with specific information about patient out-of-pocket costs and recorded preferences.
- Implementing a robust quality improvement program to identify and correct any unanticipated opportunities for medical errors that may have been introduced by the process change.

It is important that, when implementing CDS, providers and practice staff carefully consider how these tools can be implemented in a way that will complement the practice's workflow. For example, alerts may be ranked based on importance and applicability to a particular patient. A clinical guideline may suggest that an intervention could be helpful for some patients, but stops short of recommending it for all patients. CDS might present an

alert, but allow the provider to click through it without interrupting what he or she is already doing. Another guideline may relate to an important quality improvement intervention on which the practice has decided to focus its efforts, e.g., colorectal or breast cancer screening. The intervention might be incorporated into the standard template used for a specific type of visit, a predetermined order set or an alert to which the provider must either comply or document his/her reasons for not complying.

The key to clinical decision support is to allow the computer to accomplish things that computers do well: mindless repetition, looking for events that occur, and storing large amounts of structured data. Providers should choose an area of the practice that could benefit significantly from clinical decision support, such as improving the care of asthmatic patients or a clinical quality measure on which the practice will be reporting as part of the "meaningful use" payment incentive program. Then develop interventions that will improve the care of appropriate patients in the practice. For example, a provider may write a clinical decision support rule that will identify patients who are using too much albuterol or asking for too many albuterol refills. Also, clinical decision support may be used to remind the front office staff to schedule asthmatics for follow-up every three to six months and remind the nurse to do spirometry at the next visit. The goal is for the computer to monitor for situations where active education or provider intervention will improve care.

Keys to Effective Use of Clinical Decision Support

Medical knowledge is expanding rapidly. Guidelines change often and have complex decision paths. Electronic medical records store patient data, such as vital signs and test results, as discrete data. The computer can then notify providers when values are outside of the recommended range. Screening is a significant task in primary care and the medical home. CDS can compare patient information against age-based or disease management criteria for screening. Simple interventions such as adding an item to a routine visit documentation template to check the date of the patient's last flu vaccine can save significant cost and unneeded morbidity.

As illustrated in Case 2 (see next page), the purpose of CDS is to make it easier for the provider to do the right thing for each patient. There are a variety of methods that can be used to aid in the management of patients:

- Screening reminders, such as reminding pediatricians to provide a vaccine booster at an adolescent visit;
- Ensuring that medications for the patient are correct, and optimally managed for the improvement of patients' health status;
- Practice level process improvement, such as automated reporting of all patients with an HbA1c in the last six months, therefore identifying patients that may be helped by additional interventions;
- HIE across all care providers, including hospitals, emergency departments and outpatient labs and x-ray, can facilitate "relevant data display" to help the primary care provider make a decision on patient management without repeating tests that have already been performed;
- Optimal disease management: In the middle of flu season, it is difficult to remember a specific intervention that a given patient with diabetes may need. CDS can identify all patients in

a given practice with diabetes, Cr > 1.5 and not receiving an ACE inhibitor. A case manager is then able to use a dashboard showing all patients with these criteria and schedule them for appropriate follow-up and testing.

- Disease-specific provider documentation templates can make it easier for the clinical team to document key questions and answers, such as the number of times an asthmatic has used albuterol in the last month, night-time coughing, etc. This can start as early as the nurse triage, when the nurse can be supported in collecting specific information, entering it into the medical record and flagging it for provider follow-up if the answer is outside the accepted range.

CASE 2

Steve H. is a 47-year-old African American with a 10-year history of hypertension. He remains asymptomatic, without evidence of end organ disease, and grudgingly makes his six-month follow-up and blood work appointments. His in-office blood pressure readings are almost always elevated, although validated home readings have typically been at goal until the last couple of months. He claims 100 percent compliance with his medication dosing. A recent job change involves fairly extensive travel, resulting in a higher percentage of meals at restaurants.

Steve uploads blood pressure readings to his personal health record (PHR) monthly. His physician's EHR subscribes to this data and provides an alert if values are not updated or are above the target range agreed to by Steve and his doctor. After receiving a reminder by phone (his preferred contact method) last week, Steve scheduled a blood draw during one of his trips and presents to his primary physician today for a six-month follow-up visit.

He electronically completes an update to his medical record, a problem-specific interval history, a review of systems and an update to his consent profile, while in the waiting room. He also reviews his blood pressure (BP) readings and latest lab results that have been sent electronically to his physician's EHR system. The results were also forwarded to Steve's PHR with appropriate context and explanations about the values. BP readings are trending a little higher than the same period a year ago. The medical assistant (MA) reviews specific elements of his interval history and clarifies a couple of points. Vitals show his BP to be elevated again today, and his automatically calculated body mass index (BMI) is increased from six months ago.

During Steve's face-to-face visit with his physician, they review possible interventions and, together, decide to add a new medication to his regimen. Creatinine clearance/glomerular filtration rate and potassium levels are available during this decision making process. Steve's medication formulary is also available to determine the most clinically appropriate and cost-effective medication options. The medication-management system also provides Steve's doctor with fill information confirming his medication compliance. A prescription for an ACE inhibitor prompts an alert regarding the increased risk of angioedema in African Americans. Steve recalls that his father had problems with "swelling" that may have been medication related. An ARB is chosen instead which will cost Steve $40 a month from his preferred pharmacy. Steve agrees to this course of action and associated costs.

As Steve leaves the exam room, his prescriptions are sent to his preferred pharmacy, an order set is sent to his preferred lab, a care summary (in standardized format) is sent to his PHR along with multimedia educational material on his new medication, a review of behavioral issues affecting hypertension, and specific instructions regarding his plan of care over the next month. The MA is notified that Steve needs an ECG before he leaves the office today. An insurance claim is submitted on Steve's behalf and the front desk clerk is provided with follow-up instructions and Steve's payment responsibility, resulting from real-time adjudication with his insurance plan (all administrative and clinical documentation are completed). An alert is also added to the MA's "tickler file" to e-mail Steve in a week and check on his tolerance of the new medication.

Decision Support and Meaningful Use

To receive incentive ARRA funds, providers must demonstrate "meaningful use" of HIT. A Notice of Proposed Rulemaking to define meaningful use was published in early 2010 by the U.S. Centers for Medicare & Medicaid Services. The HIT Policy Committee, a federal advisory committee, has recommended criteria for meaningful use through a set of care goals, objectives and measures. The objectives and measures have been specified for hospitals and outpatient providers. It is important to note that not every measure will apply to providers in every specialty. The Final Rule was released in July 2010.

The first set of meaningful use objectives and measures will apply in 2011. Increasingly complex requirements must be met to receive incentives in 2013 and 2015. As those deadlines approach, the HIT Policy Committee will recommend more defined objectives and measures. The CDS-related goals and objectives, as well as measures that could be potentially impacted by CDS, are listed here in the Table.

Table 1. CDS and Meaningful Use[2]

Year	Functional Objectives	Core Quality Measures
2011	◗ Implement drug-drug and drug-allergy, and drug-formulary checks. ◗ Send reminders to patients for preventive or follow-up care. ◗ Implement one CDS rule relevant to specialty or high clinical priority.	◗ For patients age 18 years or older with diagnosed hypertension, percentage of patient visits with blood pressure measurement recorded ◗ Percentage of patients aged 18 years and older with a calculated BMI documented in the medical record AND if the most recent BMI is outside the parameters, a follow up plan is documented ◗ Percentage of patients who were queried about tobacco use one or more times during the two-year measurement period, and Percentage of patients identified as tobacco users who received cessation intervention during the two-year measurement period **ALTERNATE MEASURE SET** ◗ Weight assessment and counseling for children and adolescents ◗ Percentage of patients aged 50 years and older who received an influenza immunization during the flu season (September through February) ◗ Percentage of children two years of age who had four DtaP/DT, three IPV, one MMR, three H influenza type B, three hepatitis B, one chicken pox vaccine (VZV) and four pneumococcal conjugate vaccines by their second birthday. The measure calculates a rate for each vaccine and two separate combination rates
2013	◗ Use evidence-based order sets. ◗ Use clinical decision support at the point of care (e.g., reminders, alerts).	
2015	◗ Implement clinical decision support for national high priority conditions. ◗ Use automated real-time surveillance (adverse events, near misses, disease outbreaks, bioterrorism). ◗ Use clinical dashboards	

[2] See the complete Notice of Proposed Rulemaking at http://edocket.access.gpo.gov/2010/E9-31217.htm

Conclusion

The ultimate objective of clinical decision support parallels the objective of providers themselves: Provide the best possible care for every patient. Health information technology holds a vast potential to help providers and their patients manage their overall health in the context of daily life. The path to this lofty vision is not an easy one. It will take time, effort and resources.

Modern quality improvement theory suggests that sustainable improvement happens when individuals or groups make a series of small, manageable changes over time. This is a logical approach to implementing health information technology and clinical decision support. One practice may choose to use electronic prescribing software as preparation for the ultimate leap to EHR. Another practice may use the information available in its practice management system to begin issuing preventive care reminders. However it happens, the important thing is that each practice acknowledges the ongoing need for improvement and takes action as a result.

The Patient-Centered Primary Care Collaborative acknowledges that the U.S. health care system is complex and recognizes the difficulty providers face in developing a truly patient centered medical home within the confines of existing payment structures. The organizations of the PCPCC are actively advocating for health care reform and financial incentives to support providers in making the necessary practice changes to support the medical home.

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