Using the EMR as a Decision Support Tool to Improve Quality

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Abstract

Adoption of the electronic medical record (EMR) in medical practices has remained stagnant at 5% to 10% for many years. Most EMR systems that have been implemented serve primarily as note generators and storage systems. Some improvements in workflow are achieved but at considerable costs. By developing evidence-based guideline-assisted clinical decision support applications and embedding them within the EMR, we were able to demonstrate improvement in the quality of care delivered. These tools, added to our existing EMR, created third and fourth-generation EMR functionality based on Gartner’s classification of computerized patient records generations. Our practice became more efficient and achieved an acceptable return on investment by implementing the EMR, but not until the addition of point-of-care clinical decision support were we able to document and report improvements in quality of care delivered.

Over the last decade, the use of clinical guidelines has become a common method for improving the quality of patient care. However, for guidelines to be effective, their recommendations must be patient-specific and readily available at the time of care [1]. In an attempt to improve quality and reduce errors, some groups are turning to electronic medical records (EMRs) and clinical decision support (CDS) systems. Computerized CDS systems offer the potential to improve quality and reduce the cost of care by influencing medical decisions at the time and place decisions are made [2]. Because they include patient-specific information, they can transform often-ignored guidelines into dynamic programs that offer real-time patient-specific management advice [2].

However, these tools are not widespread in practice. Only 5% to 10% of medical practices have implemented an EMR [3]. Some abandon their systems out of frustration, while many flounder because they are using the EMR predominately as a document generator and storage system instead of the powerful decision support tool it is intended to be. The SCOPE (Safety Collaborative for the Out-Patient Environment) report pointed out that approximately 50% of Americans do not receive routine preventive care services, and 40% of Americans with chronic illnesses do not receive evidence-based recommended care [4]. Implementation of a CDS system offers an approach to addressing these quality gaps.

In our practice, we achieved improved performance in preventive screening using an EMR, but found that important clinical outcomes were not improving. To address this, we created forms using evidence-based guidelines and workflow assessment that allowed the provider and patient to have access to critical decision-making information already residing within the EMR database. In this paper, the development and implementation of this tool is described.

Early EMR Experience

Family Care of Concord (New Hampshire) is a primary care family practice consisting of 1 family practitioner, 1 double-boarded internist/pediatrician (JJJ), 4 nurse practitioners, 4 RNs (2 RNs job share for 1 full-time employee), 2 LPNs, and 4 medical assistants, with a staff/provider ratio of approximately 2 full-time employees/provider. Started in April 1996, the practice grew to over 7200 active patients with approximately 1200 visits/month with a payer mix of approximately 42% managed care, 15% Medicare, 3% Medicaid, 5% self-pay, and 35% commercial insurance. The practice contracted with several managed care companies.

The practice introduced an EMR system (ClinicaLogic® by MedicaLogic) in April 1996, migrating to Logician® by MedicaLogic in December 1997. The practice became more efficient, reduced operating costs, and realized a return on investment on the EMR in just under 18 months after its implementation. Protocol reminders and the ability to run compliance/noncompliance reports enabled the practice to qualify for the maximum “quality bonuses” from several managed care companies. However, despite receiving quality bonuses, actual outcomes and reduction in errors of omission did not change significantly. It was easy to document glycosylated hemoglobin (HbA1c), microalbumin, or...
annual eye exams in patients with diabetes, but the mean reduction in HbA1c remained unchanged and above optimal levels. Low-density lipoprotein and cholesterol screenings were performed on a significant number of patients with documented atherosclerotic heart disease (ASHD), yet the number of patients reaching National Cholesterol Education Program (NCEP)/Adult Treatment Program (ATP) goals did not increase.

We looked closely at the actual workflow process to see if we could identify any barriers to providing optimal care. We discovered that computerized prompts were not timely and not conducive to taking action. Prompting on an action item at an inappropriate time or not allowing the provider to take action easily when prompted made the CDS system “fall on deaf ears.” We also found that despite our making verbal recommendations to the patient based on information gathered from the EMR or from our own knowledge base, patients and providers would make excuses or actually bargain so as not to make changes. For example,

Patient: My blood pressure isn’t usually that high.
Provider: OK, try exercising more, lose some weight, watch your salt intake, and we’ll recheck it next time.

Or, in another example,

Provider: We really should add another medication to your regimen to lower your blood sugars and HbA1c level.
Patient: Why, since you started me on the first medicine, my blood sugars seem better and I feel good. Let me lose some more weight and exercise more. We can start next time if I’m not any better.
Provider: OK.

As the paper or EMR chart did not automatically allow for displaying trends (blood pressure or HbA1c), “next time” becomes “next time” becomes “next time,” and ultimately no action is taken.

Introduction of Guideline-Based Encounter Forms
Using the software program Encounter Form Editor® by Logician, our group developed a guideline-assisted CDS application to overcome these obstacles. To address the problem of disrupted clinical workflow, additional prompts were added that allowed action to be taken at the time of the initial prompt. For example, when the provider was prompted that a patient was due for certain laboratory tests, an additional prompt would ask the provider if he or she wanted to order these tests now. By clicking yes, the provider could complete the order. This eliminated the need to remember to do it at a later date, a major reason for “failure to act.” To address patient reluctance and “bargaining,” we designed prompts that addressed not only the provider, but also the patient. Visual cues were given when certain prompts appeared recommending action in language that the patient could understand. We found that patients were more ready to accept recommendations that were reinforced by the computer monitor. When we asked formerly reluctant patients why they were now willing to take action, patients would often respond, “because the computer agrees with you.” One patient summed it up this way: “When you tell me to do something, I view it as advice from a friend, a confidante. But when it also shows up on the computer, now that’s science!” A patient who was reluctant to take a statin for many months (she had a cousin who died from liver failure and had seen TV ads cautioning about liver disease) agreed to take the medication after seeing a patient-directed prompt. Her reasoning: “The computer will remind you when to check my liver tests and will prompt you if they start to climb so you can’t screw-up.”

We limited our programs to those for the management of common medical conditions for which authoritative evidence-based guidelines were available: asthma (National Heart, Lung, and Blood Institute), congestive heart failure (American College of Cardiology), diabetes (American Diabetes Association), hypertension (Joint National Committee VI), and dyslipidemia (NCEP/ATP II and III). In addition, a preventive care form was developed based on U.S. Preventive Services Task Force guidelines. During a visit, the provider could review the patient’s preventive care service dates, update any entries, order any necessary tests, and display patient-friendly pop-ups reviewing Task Force recommendations, which are automatically printed out as a patient handout.

For dyslipidemia, for example, the provider loads the lipid form and can quickly review information automatically extracted from the EMR database along with a variety of calculations such as the Framingham 10-year risk of heart disease and NCEP III risk factors and lipid goals (Figure 1A). Without leaving the form or disrupting clinical workflow, the provider can also view most recent laboratory tests, the last 4 lipid profiles, a therapeutic recommendation, or a patient-focused pop-up to review and discuss adjunctive measures. By clicking the next tab, the provider can review the further history and provide patient education (Figure 1B). On the third tab, the provider can review the patient’s risk for metabolic syndrome, with risk factor information automatically completed (Figure 1C).

Practice Performance
We began using the encounter forms in early 2001. Significant differences were noted in a number of key quality
Figure 1. EMR-based form to assist with clinical decision making in managing lipids. The first tab (A) focuses on risk factors, the second tab (B) focuses on history and patient information, and the third tab (C) focuses on the metabolic syndrome and triglycerides.
Diabetes
We were already checking HbA1c levels for more than 90% of our diabetic patients prior to program implementation, and this rate did not change. However, there was a significant reduction in patients’ mean HbA1c values, with 89% of patients reaching levels below 8.0, 56% below 7.0, and 31% below 6.5. In the year prior to the implementation of the program, the screening rate for all patients who had not sought care in the preceding 24 months. Prior to implementation of the forms, the screening rate for all patients older than 40 years was less than 50%. For patients with documented ASHD, the rate of screening increased from less than 40% before use of the forms to over 70% after implementation. In those patients with ASHD in which a lipid profile was documented, the percentage of patients reaching a low-density lipoprotein goal of < 100 mg/dL improved from less than 40% prior to implementation to 60% after implementation.

Hyperlipidemia
We also evaluated primary and secondary screening and treatment for hyperlipidemia. We found that after implementing the CDS forms, the rate of screening for hyperlipidemia for all patients ranged from 85% for patients over 40 years, 89% for patients over 45 years, and 91% for patients over age 50 years. The majority of patients not screened were patients who had not sought care in the preceding 24 months. Prior to implementation of the forms, the screening rate for all patients older than 40 years was less than 50%. For patients with documented ASHD, the rate of screening increased from less than 40% before use of the forms to over 70% after implementation. In those patients with ASHD in which a lipid profile was documented, the percentage of patients reaching a low-density lipoprotein goal of < 100 mg/dL improved from less than 40% prior to implementation to 60% after implementation.

Of those diagnosed with hyperlipidemia, 100% were counseled on a therapeutic lifestyle change (TLC) diet and adjunctive measures, and close to 80% were treated with long-term statin therapy. We have no data available on the number of patients counseled on the TLC diet and adjunctive measures prior to using the forms because these data could not be easily captured. Of the 20% of patients not on a statin and failing TLC diet and/or adjunctive measures, half preferred not to start medication while the other half were started but later discontinued medication due to adverse reaction or side effects. Of those patients being treated with a statin, 100% had baseline LFTs and 90% had follow-up LFTs.

## Table. Generation of EMR Evolution

<table>
<thead>
<tr>
<th>Generation EMR</th>
<th>CDS Attributes</th>
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</thead>
<tbody>
<tr>
<td>1st Generation</td>
<td>No CDS required</td>
</tr>
<tr>
<td>2nd Generation</td>
<td>Real-time or near–real-time simple rules</td>
</tr>
<tr>
<td>The Documentor</td>
<td>Example: drug-drug or drug-allergy checking</td>
</tr>
<tr>
<td>(1997–2008)</td>
<td></td>
</tr>
<tr>
<td>3rd Generation</td>
<td>Pathways or guidelines on request</td>
</tr>
<tr>
<td>The Helper</td>
<td>More advanced alerts/reminders</td>
</tr>
<tr>
<td>(2001–2013)</td>
<td>Backward and forward chain logic</td>
</tr>
<tr>
<td>4th Generation</td>
<td>Clinical documentation, data capture, clinical</td>
</tr>
<tr>
<td>The Colleague</td>
<td>workflow (including orders), and clinical</td>
</tr>
<tr>
<td>(2001–2013)</td>
<td>decision support (CDS) becomes seamless and</td>
</tr>
<tr>
<td>5th Generation</td>
<td>Complex information automatically visualized</td>
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<tr>
<td>The Mentor</td>
<td>Population-specific cohort data</td>
</tr>
<tr>
<td>(????)</td>
<td>Diagnostic support</td>
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performed. The majority of those without follow-up LFTs were among those who discontinued statin therapy due to adverse reaction or side effects. Again, we have no pre-implementation data for these measures, as the previous system did not capture the reasons why patients refuse or defer treatment. Knowing why patients are reluctant to try treatment allows us to intervene in the process, either by improving acceptance or providing alternatives.

Discussion
Practices that implement EMRs hoping to enhance clinical performance and reduce medical errors will not see the improvements they desire if they use the EMR as an expensive note generator with an evaluation and management checker. However, by implementing an EMR with evidence-based guideline-assisted CDS applications, providers may improve their ability to achieve and document quality outcomes. The quality data derived from such a system is far more useful for disease management as compared with the more widely available retrospective, claims-based data generated for employers to compare managed care plans.

Gartner, a consulting and research group that promotes the effective use of information technology, describes 5 generations of the EMR (Table) [4]. According to this group, the EMR must be at least 3rd generation to significantly influence outcomes. In 2001, they said that EMRs were at best 2nd generation. The forms we developed had 3rd-generation functionality from the start. Most EMRs now have 4th-generation attributes with seamless integration of clinical documentation, data capture, clinical workflow (including order entry) and CDS capabilities.

There are limitations to the outcomes data presented. One could argue that just reviewing the evidence-based guidelines and addressing workflow issues alone could have accounted for at least some of the noted improvements. However, we had reviewed the guidelines and clinical workflows years prior to the development of the CDS forms, but the impact on our clinical outcomes at that time was not as great. In addition, our group was small, with 2 physicians and 4 nurse practitioners and just over 7200 active patients, which made it much easier to reach consensus to move forward and use the CDS forms. We were also highly motivated to improve quality and clinical workflows.

Finally, the issue of usability needs to be addressed. None of the CDS forms and applications developed to date will automatically improve outcomes or quality. Providers need to be trained in how to use the forms (navigate) and apply them to clinical workflow. Currently, 2 randomized studies are underway to examine whether our CDS forms integrated into the EMR improve outcomes.

Conclusion
Our practice implemented Logician® EMR and supplemented it with evidence-based guideline-assisted CDS applications and documented an improvement in quality. Until providers use the EMR as a clinical decision support tool instead of a note generator and storage system, the number of practices using an EMR will remain low and success in making significant leaps to improve the health care system will continue to elude us.

Financial disclosure: Dr. Janas is President/CEO of Clinical Content Consultants, LLC, a company that develops and implements EMR clinical content.

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References