Quality Improvement with an Electronic Health Record: Achievable, but Not Automatic

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With 68% of all physician–patient encounters occurring in physician groups of 4 or fewer, improvements in small practices will be necessary to close the well-documented national gaps in consistent delivery of high-quality care. Many believe that adoption of electronic health records (EHRs) is the key to success, and that improvement will almost automatically follow. However, EHR adoption occurs today in an environment shaped by paper chart thinking, which may limit success. Having successfully implemented an EHR in their small practice, the author and his practice colleagues attempted to use it to support a simple project to improve their mammography rate. Although they achieved a real 10% improvement in their rate with only modest additional expense, their experience highlighted critical elements for success beyond the adoption of the EHR, including physician appreciation of structured data, the need for widespread adoption of standards, and a restructuring of the primary team with additional resources. An approach supporting EHR adoption along with these system changes could substantially affect public health.

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As physicians in small offices increasingly adopt electronic health records (EHRs), there are high expectations for how such records might be used to improve quality. Eighteen months after implementing a full-featured EHR in our 4-physician general internal medicine practice, we used it to support a project to improve mammography rates. We achieved a 10% absolute improvement at a modest but unreimbursed cost. Nonetheless, we encountered some barriers, including the complexity of acquiring structured data, difficulty in measuring our baseline rate, and the absence of support resources both within and outside our practice. Although we are only 1 small practice using 1 EHR product, our experience may inform other physicians implementing EHRs and those who seek improved health system performance.

Our Improvement Project

When we implemented our EHR, we had a deceptively simple goal: All information requisite to patient care would be available in electronic format. We hoped that, if we were consistent about recording all clinical data in the chart, the EHR would support efforts to measure and improve patient care. Beginning on our "go-live" date, we documented all of our care and filed all data received from outside the office in our EHR. Because much important information arrives on paper, we purchased a document imaging management system to incorporate scanned images of such documents as consulting letters and radiology reports in the electronic chart.

We have described the challenges associated with our implementation elsewhere (1). After 12 to 15 months, however, we were all comfortable using the EHR to do various patient care tasks in a much more efficient, less frustrating manner. We thought we could undertake a simple project to measure and improve our mammography rate using the Langley and Nolan model for improvement (2). Routine patient registration captured the age and sex of each patient, so we expected the computer to calculate the number of our female patients between 50 and 65 years of age as our denominator. Because we had electronically filed all mammography reports for the past 18 months, we assumed that the EHR could also readily tell us our numerator. From these data, we expected to calculate our practice mammography rate. We also expected that the computer could identify the records of women who had not had mammograms, which would facilitate a program of targeted active outreach and thereby improve our rate.

The Importance of Structured Data

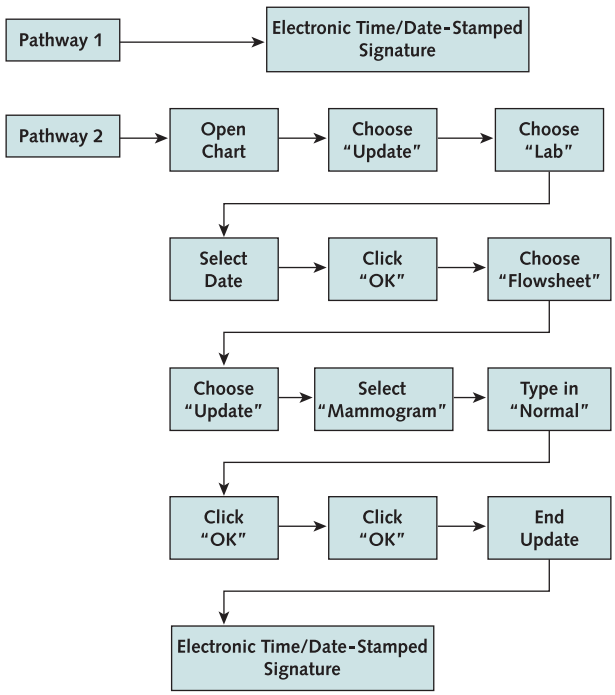
Our first problem in measuring performance arose from the way in which we input mammography data into our chart. Physicians unfamiliar with EHRs tend to think of them as electronic versions of paper charts. We electronically signed in documents when they arrived from outside the office, replicating a paper chart process; our electronic date- and time-stamped signature showed that we had seen and taken responsibility for the contents of the document. Unfortunately, our electronic signature did not transfer the contents of that document to the chart as data that a computer could conveniently manipulate. For that to happen, data must be entered into the chart in a structured format. In the case of mammograms, it took us 1 mouse click to sign them in and 13 clicks to enter them as structured data (**Figure 1**)—extra work that we did not always do.

At the beginning of our project, the computer took fewer than 10 seconds to give us the names of all of our female patients between the ages of 50 and 65 years who

See also:

Web-Only
Conversion of graphics into slides

Figure 1. **Algorithm for entering mammography data into an electronic health record.**



Algorithm showing the number of mouse clicks required for signing in a mammogram versus recording the data in a structured format.

had not had a mammogram in the past year; the list indicated that our mammography rate was approximately 50%. Fortunately, this was wrong: The computer could only tell us about mammograms recorded as structured data. It took 3 months to correct the numerator and denominator with additional information (**Figure 2**), but eventually we learned that our mammography rate was actually around 65%. Chasing poorly labeled or unavailable data, we had achieved a 15% improvement in our mammography rate without obtaining a single new mammogram.

The Work of Improvement

We used the EHR to support both outreach and automated reminders. Staff called all of the women listed as not having had a mammogram, because we believed using unoccupied staff time was cheaper than mailing letters (at an estimated cost of $800 in postage and supplies). The EHR also produced automated reminders, which we shared with patients at every visit. These reminders were critical to documenting and efficiently supporting our outreach and reminder activities.

As a result of our efforts, 141 women got new mammograms during the 6-month course of the project, raising our rate to around 75%—a 10% absolute improvement. Excluding EHR costs, our project cost approximately $4800, recognizing marginal staff and physician time of 80 and 10 hours, respectively, at cost and $200 in postage, for an additional cost of around $34 per new mammogram. To put that cost in perspective, Medicare pays $93.29 for a mammogram and $876.23 for breast magnetic resonance imaging in our area. Although generous funding is available for new screening technologies with marginally better diagnostic performance (3) and recently expanded indications (4), support is not available for efforts like ours that more consistently and reliably deliver existing technologies to patients.

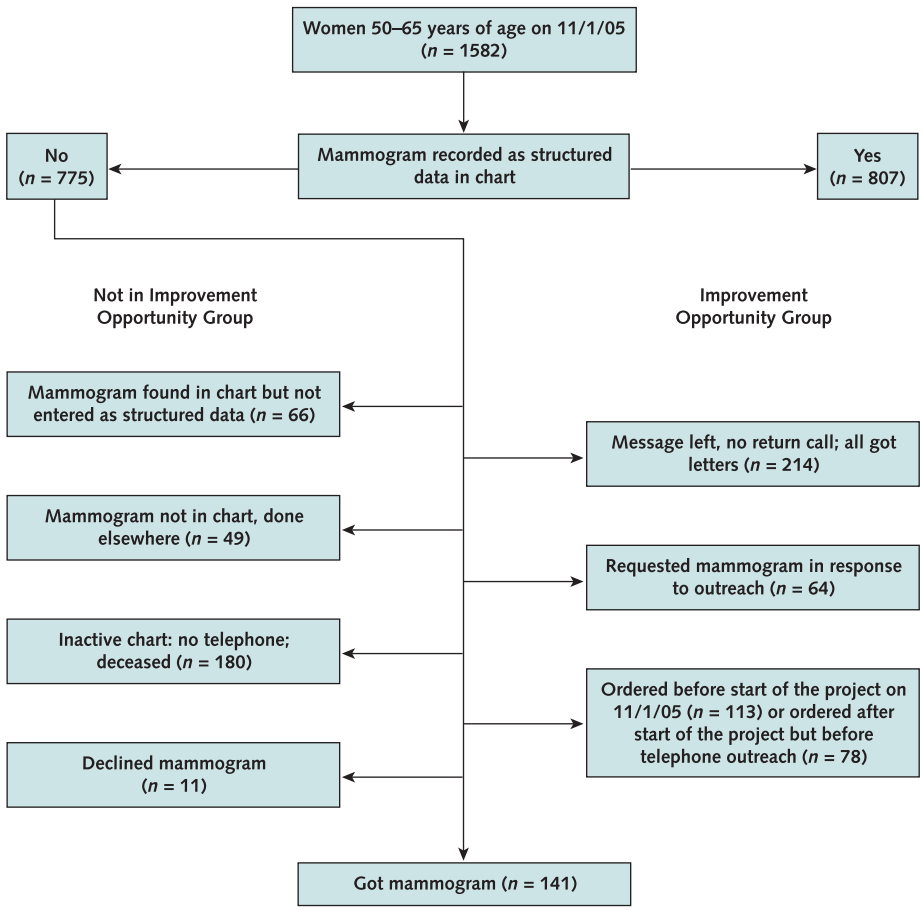
What Would It Take to Be Successful?

An EHR product can be considered something that stands between a clinician and a large, highly structured database. Because patients do not usually present themselves or their histories in a structured data format, EHR users must translate what they hear or read into a format that the computer can use. Although much information can be readily translated (for example, medication data), some of it cannot (for example, recording vacation destinations or preserving the patient's voice); this is why EHR products support data recording in both structured and unstructured formats. Electronic interfaces can automatically import certain data, such as quantitative laboratory results, into the chart in a structured format. However, interfaces may not be reliably available for many clinical data (including elements in the Ambulatory Care Quality Alliance Starter Set [5], such as eye examinations for diabetic patients or mammograms), are expensive to construct (we were quoted a price of $7500 from one national laboratory provider to connect to our national EHR product), need to be constructed separately for each data source (for example, every radiology group from which one receives mammograms), and can be difficult to maintain.

Of course, most clinical data in a chart are not generated by the physician who manages the chart; they are created by other health care providers and sent on paper. A colonoscopy can be reported in a letter, a procedure note, or a report produced by the colonoscope itself, and none of the reports is standardized. Standardization would ensure that those who create data do so in a form that would be automatically recognizable and structured on receipt. Payers demand standardized electronic billing—why is that not true for report generation? The Continuity of Care Record standard initiative (6) (resources available at www.ccrstandard.com) specifies both the format and primary care owner of any report in a way that could be recognized by an EHR. Although adopting standards adds cost for some, we pay a high price in health care for not having them (7); consistent standards governing data exchange would support improvement efforts like ours.

The surgeon who replaces a heart valve is supported by a team of professionals and customized technology. Our project also required us to create a team, but the resources

Figure 2. **Project flow diagram.**



available to a primary care practice provide little support for teams or technology. The benchmark staff support levels reported by the American College of Physicians' Practice Management Center (1.45 clinical and 1.85 full-time equivalent administrative support staff per physician) (American College of Physicians, oral communication, August 2007) are insufficient to institute continuous care improvement efforts across the broad spectrum of patients with chronic disease. Our EHR positions us well for this work, with the promise of progressively lower costs for any future efforts designed by our practice; sadly, our current staffing levels leave us drowning in a sea of unrealizable improvement opportunities.

New models of enhanced primary care support (8, 9; Milstein A. Redesigning primary care for breakthrough in health insurance affordability. Model I: the ambulatory intensive caring unit. Report to the California HealthCare Foundation, Mercer Human Resource Consulting [unpublished]) deserve serious policy consideration, as current organizational and reimbursement models for primary care will not deliver the results patients have the right to expect. The precarious state of primary care practice (10–12) suggests that increasing demands without increasing support is almost guaranteed to fail. Our results should encourage those who believe that modest investments in primary care—beginning with EHRs and extending to resources needed to follow up on the information they provide—is worthwhile; other countries following this strategy seem to achieve better results than we do on a variety of preventive care measures (13). With 68% of all physician–patient encounters happening in groups of 4 or fewer physicians (14), achieving a 10% improvement in quality care measures for the population served by these offices could have a substantial effect on public health. An EHR may not be sufficient, but our experience persuades us that it will be necessary.

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