Physicians' Use Of Electronic Medical Records: Barriers And Solutions

A survey of physician practices shows slow but steady progress in adopting this new technology.

by Robert H. Miller and Ida Sim

ABSTRACT: The electronic medical record (EMR) is an enabling technology that allows physician practices to pursue more powerful quality improvement programs than is possible with paper-based records. However, achieving quality improvement through EMR use is neither low-cost nor easy. Based on a qualitative study of physician practices that had implemented an EMR, we found that quality improvement depends heavily on physicians' use of the EMR—and not paper—for most of their daily tasks. We identified key barriers to physicians' use of EMRs. We then suggest policy interventions to overcome these barriers, including providing work/practice support systems, improving electronic clinical data exchange, and providing financial rewards for quality improvement.

INFORMATION TECHNOLOGY IS INCREASINGLY RECOGNIZED as an important tool for improving patient safety and quality of care, especially by promoting the practice of evidence-based medicine.[1] Of all the health information technology (IT) in current use, the electronic medical record (EMR) has the most wide-ranging capabilities and thus the greatest potential for improving quality. Research has demonstrated the quality benefits of electronic documentation and viewing, prescription and test ordering, care management reminders, and messaging, among other EMR functions.[2]

Despite this potential for quality improvement, however, few physician practices use EMRs. Nevertheless, interest in EMRs is substantial.[3] In a survey of 1,200 mostly solo/small physician groups, less than 13 percent of respondents said that their practice had EMRs; 32 percent expressed interest in EMRs, and half of these were "very interested."[4] Clearly, the EMR is of growing importance for many physician practices.

In this paper we present key results of our qualitative study on the opportuni-

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ties and barriers that ambulatory physician practices encounter when using EMRs for quality improvement. Based on insights from this study, we then suggest policy interventions that can promote opportunities for and lower barriers to using EMRs for quality improvement.

Methods

We conducted nearly ninety interviews between mid-2000 and the end of 2002 with EMR managers and physician champions in thirty physician organizations that had implemented an EMR. The organizations were purposefully selected for their diversity in sizes, EMR used, duration of EMR use, affiliations, and extent of capitated payment. Studied organizations included nine large medical groups of more than seventy physicians each, eighteen solo/small-group practices of ten or fewer physicians, and three medium-size groups. Most of the small groups were primary care only, while eight of the large groups were multispecialty; we focused primarily on EMR use by primary care physicians. Some data were obtained from the same organization at several points in time.

The physicians and managers that we interviewed were likely more positive than their colleagues about the promise of EMRs, and practices participating in the study were likely more successful than nonparticipating practices. Nevertheless, as the findings suggest, interviewees tended to be open about the challenges of using EMRs. We also interviewed representatives from EMR vendors, professional medical associations, and IT consulting firms.

The interview questionnaire was semistructured, allowing interviewees to respond in their own words. We taped the interviews and coded the transcripts using qualitative research software (QSR Nvivo), to organize and summarize data by concept (for example, EMR costs, financial benefits, and market environment). Our analysis methods included pattern-matching and explanation-building techniques often used in qualitative research.[5] From the analyzed interviews, we identified persistent and important themes and patterns. We then constructed a typology of barriers to adopting EMRs for quality improvement.

Study Results

■ **EMR use and potential benefits.** An EMR can provide the electronic infrastructure for eight types of clinical and administrative activities normally conducted in physician practices. Commercial EMR systems vary in their capabilities for each type of activity, while practices and physicians vary greatly in how extensively they use available EMR capabilities.

Here we summarize our findings on how physician practices used and generated clinical benefits from each type of EMR capability and on the major barriers these practices encountered. Our key insight with policy implications is that the path to quality improvement and financial benefits lies in getting the greatest number of physicians to use the EMR (and not paper) for as many of their daily

tasks as possible. The key obstacle in this path to quality is the extra time it takes physicians to learn to use the EMR effectively for their daily tasks.

Viewing. All practices used EMR viewing capabilities, which improve chart availability, data organization, and legibility. Quality benefits depended on the amount of viewable clinical data. The amount of initially viewable data depended on efforts to type in existing paper-based medical record data and to electronically import data from lab, billing, and other systems. As patient data accumulated over time, financial savings accrued from less staff time spent finding, pulling, and filing charts and less physician time spent locating information.

Documentation and care management. We identified a consistent relationship between greater electronic documentation by physicians and greater quality improvement and financial benefits. Just as computerized physician order entry (CPOE) appears central to generating benefits in hospital settings, physician electronic documentation appears central to generating benefits in ambulatory care settings.

Although most clinicians maintained electronic problem and allergy lists, physicians varied greatly in how they documented progress notes. Basic EMR users had their dictated notes transcribed and imported into the EMR, or they typed their own progress notes into unstructured text boxes. More advanced users typed data into templates (electronic forms) that included physical exam and documentation prompts.

Basic use of the EMR improved the legibility and accessibility of progress notes and increased the availability of electronic problem and allergy lists. More advanced use of documentation templates led to greater opportunities for improving quality of care. For example, problem-specific templates (such as a sore throat template) with embedded prompts reminded clinicians to ask about particular symptoms, order particular tests and prescriptions, or perform preventive or disease management activities. Also, templates that help clinicians enter data in coded rather than free-text form facilitated more advanced computer-based decision support for such tasks as care coordination and chronic disease management.

In most practices the bulk of EMR-related financial benefits came from reductions in medical records and transcription staff as physicians moved from dictation to typing their own notes. Some practices increased billing revenue through more complete capture of services and decreased undercoding of services provided.

Ordering. Basic use of electronic ordering typically consisted of physicians' typing in prescription orders, responding to drug interactions and drug allergy alerts, and printing out prescriptions. All but three practices we studied used electronic prescribing. In large practices, basic ordering often also included electronic ordering of referrals and laboratory and radiology tests. More advanced ordering capabilities included additional decision support, electronic transmission of orders to pharmacies and laboratories, and better tracking of test-order status and test re-

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sults, all of which can improve quality and decrease errors.

Messaging. Basic use of electronic messaging among providers improved the availability, timeliness, and accuracy of messages and increased completeness of documentation, thus potentially reducing "dropped balls" and safety problems. Much less common was advanced messaging, which included messaging with outside providers (to improve care coordination) and with patients (to improve patient satisfaction and, potentially, patient self-care and compliance).

Analysis and reporting. Few practices initially used physician performance monitoring and feedback capabilities to improve quality and efficiency. Over time, some practices—especially larger ones—used reporting capabilities more widely: For example, some practices generated reports to physicians on diabetic patients with hemoglobin A1C levels greater than 8 percent and on the percentage of a physician's patients having such levels.

Patient-directed functionality. Most practices had limited or nonexistent practice Web sites for patients. A few large-practice Web sites enabled patients to schedule visits, send secure e-mail messages to providers, receive e-mail reminders, order medications, access their charts, and obtain more individualized educational patient care information—all of which have the potential to improve quality.[6]

Billing. Increased integration between billing and EMR software, combined with electronic documentation, can yield financial benefits through more complete capture of services provided, more defensible Medicare coding at higher coding levels, and reductions in data-entry staff.

■ **Barriers to EMR use.** Key surface barriers to EMR use that emerged as persistent themes from our interview data included high initial financial costs, slow and uncertain financial payoffs, and high initial physician time costs. Underlying barriers included difficulties with technology, complementary changes and support, electronic data exchange, financial incentives, and physicians' attitudes. These barriers were most acute for physicians in solo/small-group practice, a mode in which a substantial majority of U.S. physicians practice.[7]

High initial cost and uncertain financial benefits. The high up-front financial costs of implementing EMRs is a primary barrier to their adoption. This barrier is compounded by uncertainty over the size of any financial benefits that may accrue over time. In most practices we studied, up-front costs ranged from $16,000 to $36,000 per physician. Some practices incurred additional costs (in the form of decreased revenue) from seeing fewer patients during the EMR transition period.[8] Financial benefits varied greatly, from none in practices that made few work practice changes and retained paper processes to more than $20,000 per physician per year in the few practices that eliminated most paper processes.

High initial physician time costs. Interviewees reported that most physicians using EMRs spent more time per patient for a period of months or even years after EMR implementation. The increased time costs resulted in longer workdays or fewer patients seen, or both, during that initial period.

Three underlying barriers—difficulties with technology, complementary changes and support, and electronic data exchange—increased physicians' initial time costs and reduced physicians' EMR use, financial benefits, and quality improvement.

Technology. Most respondents or their colleagues considered even highly regarded, industry-leading EMRs to be challenging to use because of the multiplicity of screens, options, and navigational aids. Problems with EMR usability—especially for documenting progress notes—caused physicians to spend extra work time to learn effective ways to use the EMR. These substantial initial time costs are an important barrier to obtaining benefits, as greater burdens on physicians' time decrease their use of EMRs, which lowers the potential for achieving quality improvement.

Although vendors are slowly improving EMR usability, most vendor interviewees doubted that any "silver bullet" technology (for example, voice recognition, tablet computers, or mobile computing) will dramatically simplify EMR usage. Designing easy-to-use software for knowledge workers is a challenge that spans the software industry beyond health care.[9]

Difficult complementary changes and inadequate support. EMR hardware and software cannot simply be used "out of the box." Instead, physician practices must carry out many complex, costly, and time-consuming activities to "complement" the EMR product. Across industries, such complementary changes have been found to be critical for generating benefits from new technology.[10]

These complementary changes exact a great deal of time from physicians—especially physician EMR champions in solo/small-group practices—for months or even years after implementation. In our study, EMR champions in small practices spent much time arranging for EMR installation, receiving and assisting with EMR training, and encouraging EMR use among their colleagues and staff. These physician champions also had to patch together and deploy technical support from the various software, hardware, networking, and service vendors when technical glitches occurred. Both champion and nonchampion physicians had to work with their staffs to summarize and enter patient data from existing paper charts into the EMR. All physicians spent substantial time customizing their own visit- or disease-specific electronic forms and documentation shortcuts to speed visit documentation. Moreover, physicians had to redesign their workflow (how they worked in the exam room) and office workflow (who did what tasks).

As a general rule, larger physician groups could implement complementary changes more easily than smaller groups could because large groups tended to have stronger organizational resources such as management expertise, experience

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with past process changes, financial resources, leadership, and information systems support staff.[11] As a result, large groups provided more internal technical and personnel support for complementary changes. Despite these advantages, interviewees from large groups reported that many of their physicians still had to invest substantial additional time to make needed changes. For solo/small-group practices that lacked much internal support, physicians bore a much greater time burden after initial EMR implementation.

Inadequate electronic data exchange. Another barrier to EMR use was the lack of adequate electronic data exchange between the EMR and other clinical data systems (such as lab, radiology, and referral systems). Having parallel electronic and paper-based systems forced physicians to switch between systems, thereby slowing workflow, requiring more time to manually enter data from external systems, and increasing physicians' resistance to EMR use. Furthermore, with fewer data in the EMR, there was less opportunity for intervening electronically to improve quality, and reduced ability to perform internal analyses or to report performance externally for quality report cards or performance incentive programs.[12]

Lack of electronic data exchange was most problematic for solo/small-group physicians. For example, physicians in nine of the eighteen solo/small-group practices we studied could not view any electronic lab results within their EMR, seventeen could not view hospital data, and nine had EMRs that could not exchange any data with their practice management system. Some labs or hospitals refused to set up data exchange; less often, the practice failed to make necessary programming changes in its own EMR because vendor or internal IT support was lacking. In contrast, larger groups tended to have in-house lab and practice management systems that exchanged data with their EMRs, and had the leverage to obtain the cooperation of hospitals and other external data producers for electronic data exchange. Large groups also had the IT staff to program any necessary data exchange interfaces.

Lack of incentives. EMR use could be increased through financial rewards for quality improvement and for public reporting of multiple measures of quality performance. Yet few interviewees reported any financial incentives for quality, and none reported public reporting of their quality performance compared with that of other physician practices. The lone practice that operated under substantial financial incentives for quality improvement intensified its use of the EMR and reaped sizable financial rewards.

Physicians' attitudes. Most interviewees were EMR champions who had positive, "can-do" attitudes toward solving EMR-related problems and who were vital to getting other physicians to use EMRs. These physicians—innovation "early adopt-

ers"—were willing to bear initial financial and time costs to generate benefits.[13] In contrast, nonchampion physicians tended to be less positive toward EMRs and more easily discouraged by usability problems. Without exhortation and support from physician champions, these physicians tended to remain as lower-level EMR users. As a result, practices without physician EMR champions may flounder in their efforts to generate quality or financial benefits from EMRs.

In summary, the greatest financial and quality benefits are to be had when most physicians use EMR capabilities for most of their daily tasks. However, especially in smaller practices, the initial physician time burden can be onerous given current obstacles, resulting in piecemeal and less effective use of EMR capabilities and fewer financial and quality benefits. Even in large groups, despite the availability of better organizational support and more complete data exchange, many physicians used only a fraction of available EMR capabilities and generated only a fraction of potential quality and financial benefits.

In the face of these barriers to using EMRs for quality improvement, one hopeful theme that emerged is that improvements in electronic data exchange, quality performance incentives, and support can over time help transform many physicians from inefficient, low-level EMR users to efficient, advanced users, thereby increasing the likelihood of generating quality and financial benefits. Our policy suggestions below center on facilitating such improvements.

Potential Solutions

We believe that public and private policy interventions can effectively counter several of the barriers we identified to ambulatory EMR adoption and use for quality improvement. Indeed, such interventions are essential for solo/small-group practices that lack the organizational resources of large groups. Each policy intervention suggested below either decreases EMR time costs to physicians or increases financial benefits, thereby increasing the attractiveness of EMR use to physicians.

■ **Communitywide data exchange.** Ubiquitous, secure electronic exchange of clinical data among providers would help lessen the disruption from parallel electronic and paper-based medical record systems, thereby decreasing physician time costs and increasing financial benefits.

Market developments are increasing the amount of data exchange to some extent. Some hospitals and laboratories are proffering electronic data exchange as a marketing tool to gain the allegiance of small EMR-using practices. RxHub and SureScripts—consortia of pharmacy benefit managers (PBMs) and pharmacies, respectively—are competing to provide electronic prescribing connectivity among physicians, pharmacies, and PBMs.[14] Moreover, several market and regulatory developments are setting the stage for even greater future data exchange: Data-producing organizations are increasingly using data exchange standards such as HL7 and LOINC; implementation of the Health Insurance Portability and

Accountability Act (HIPAA) provisions has cleared the way for vendors to provide private and secure data exchange in regulatory compliance; and substantial efforts to implement common safeguards for privacy and security have already been made.[15]

To take advantage of these developments and to stimulate additional improvements in clinical data exchange, policies should hasten the creation of communitywide data exchange systems that allow clinicians to view all of their patients' data, regardless of provider and care site. These systems can build upon data exchange models being developed in Santa Barbara, Seattle, Indianapolis, and elsewhere, which are addressing technology, governance, business model, and privacy issues.[16] A 2002 Institute of Medicine (IOM) report called for government to fund large-scale demonstration projects for such communitywide data exchange efforts, preceded by the creation of local data exchange governance structures and followed by EMR-focused demonstrations.[17]

Government agencies, foundations, and purchasers—especially employers and the Centers for Medicare and Medicaid Services (CMS)—could play an important role in convening the numerous relevant health care entities to begin creating plans and governance structures for communitywide data exchange. A prime beneficiary of these initiatives will be solo/small-group practices that otherwise lack the leverage and resources to establish ubiquitous data exchange.

■ **Performance incentives and mandates.** Financial payback to practices for achieving quality improvement or mandates for IT use would also increase the adoption and use of EMRs for quality improvement. In a highly positive development, a small but growing number of purchasers, health plans, and employers are initiating quality-based reimbursement programs, rewarding practices for publishing performance reports, mandating specific quality improvement actions or use of specific IT applications, and even rewarding consumers for choosing higher-quality providers on the basis of these performance reports.[18] For example, in the California "pay-for-performance" initiative that started in 2003, health plans are measuring and rewarding some aspects of quality, patient satisfaction, and IT use in ambulatory care.[19] Adoption of pay-for-performance programs by both Medicare and private payers could have a powerful effect on accelerating EMR adoption and use.

The specific design of Medicare or private performance-incentive or -mandate programs can directly affect the nature and pace of IT adoption. For example, incentive programs that reward performance gains on multiple clinical indices encourage the use of full-fledged EMRs to both achieve and document widespread gains. Alternatively, programs may selectively promote particular IT capabilities, such as the Leapfrog Group's mandate for hospital electronic order entry.[20] Many questions remain about how performance-incentive programs should be designed to encourage EMR use for quality improvement, including questions about the type and size of incentives that are needed to induce physicians to improve quality of care or to entice non-EMR-using practices to adopt EMRs.

Even as incentive and mandate programs influence IT uptake, however, these programs should avoid micromanaging how clinical change must occur. For example, mandating "pop-up" reminders may work in some practices but backfire in other practices where such reminders are considered intrusive. Also, these programs should avoid setting arbitrarily short deadlines for full EMR use, which may be counterproductive for some physicians. Rather, full EMR use might be better achieved via a graduated approach in which only basic EMR use (for example, viewing, problem list management, and prescription ordering) is expected initially, with use of advanced EMR capabilities such as decision support and care management expected only after basic use has been solidified. Practices may respond to such graded expectations by focusing their early efforts on demonstrating quality and financial benefits from basic use by EMR-receptive physicians or sites, which could then encourage greater and more advanced EMR use even among the practices' less EMR-receptive physicians.

Government or other funders may not need to directly subsidize the cost of acquiring EMRs, since our study suggests that most practices can secure capital for purchasing the technology. Policy funds could be better used for rewarding quality improvement, for example, than for replacing available sources of capital. Furthermore, the nascent application service provider (ASP) model promises to offer EMRs at lower initial cost: ASPs are firms that remotely host, support, and essentially lease EMR software and hardware.[21]

■ **Support for complementary changes.** Physician practices, especially solo/small-group practices, require support to carry out the time-consuming workflow and other complementary changes needed to generate financial and quality benefits from "out-of-the-box" EMRs. Both established EMR vendors and current ASP firms, however, tend to provide only technical support for their products.

From a policy perspective, providing support for complementary changes is crucial but challenging and will require much experimentation. We suggest that funding agencies support the demonstration and evaluation of various models for providing comprehensive EMR support services to solo/small-group practices to catalyze the development of such services in the market. In addition, funders should support comparative evaluations of existing support services, to intensify competitive pressure for their development.

■ **Information for those using and considering EMRs.** Across industries, innovations such as IT diffuse more slowly the greater the uncertainty about the costs, implementation, use, and consequences of the technology.[22] For EMRs, uncertainty is especially high because of the relative dearth of objective data on costs, use, and comparative features (such as a *Consumer Reports*–type rating of EMRs). Government and private funding agencies could fund both comprehensive product comparisons of EMRs and research characterizing the range of financial, time, and quality outcomes experienced by various types of EMR-using practices.

Demonstration and evaluation projects can help determine how best to encour-

age physicians to adopt and use EMRs to improve quality of care. Such projects can help provide answers about the ideal design of pay-for-performance incentives, for example. The most instructive demonstrations might be those that evaluate combinations of the policy interventions suggested above: communitywide electronic data exchange, enhanced incentives for quality, and comprehensive support services.

We believe that funding agencies and policymakers should generally avoid funding initiatives that aim to directly lower technology or physician-attitude barriers to EMR use. Vendors already have strong market incentives for developing easy-to-use EMRs, while physicians' attitudes toward health IT and the EMR are already on a favorable trajectory with increasing use of personal digital assistants (PDAs) and the Internet by physicians.[23] Both technology development and physicians' attitudes are unlikely to be changed by policies separate from those discussed above.

THE EMR IS AN ENABLING TECHNOLOGY for physician practices to pursue quality improvement in potentially powerful ways. Our research finds, however, that systematic quality improvement using EMRs is neither low-cost nor easy. There is no simple solution to accelerating EMR adoption and use for quality improvement. Given the multifaceted nature of the barriers, a range of policy interventions is needed to spur successful EMR-driven quality improvement. These policy interventions center on improving data exchange among health care entities, providing financial rewards for quality improvement, and providing work/practice support. This package of policy interventions, in combination with ongoing trends, should hasten adoption of EMRs and their use for quality improvement in ambulatory care.

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