

Electronic Health Records: Just around the Corner? Or over the Cliff?

Richard J. Baron, MD; Elizabeth L. Fabens, MD; Melissa Schiffman, MD; and Erica Wolf, MD

We recently implemented a full-featured electronic health record in our independent, 4-internist, community-based practice of general internal medicine. We encountered various challenges, some unexpected, in moving from paper to computer. This article describes the effects that use of electronic health records has had on our finances, work flow, and office environment. Its financial impact is not clearly positive; work flows were substantially disrupted; and the quality of the office environment initially deteriorated greatly for staff, physicians, and patients. That said, none of us would go back to paper health records, and all of us find that the technology helps us to better meet patient expectations, expedites many tedious work processes (such as prescription writ-

ing and creation of chart notes), and creates new ways in which we can improve the health of our patients. Five broad issues must be addressed to promote successful implementation of electronic health records in a small office: financing; interoperability, standardization, and connectivity of clinical information systems; help with redesign of work flow; technical support and training; and help with change management. We hope that sharing our experience can better prepare others who plan to implement electronic health records and inform policymakers on the strategies needed for success in the small practice environment.

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For author affiliations, see end of text.

Policymakers and physician leaders are counting on electronic health records to improve quality of health care and revitalize practice (1-4), and a recent report forecasts that widespread use of electronic health records will save the health care system \$77.8 billion annually—5% of total health care expenditures in the United States (5). It is difficult to get an accurate figure for use of electronic health records by primary care physicians, but estimates range from 5% to 13% (6, 7). Seventy-eight percent of physicians in the United States practice in groups of 8 or fewer; therefore, understanding and overcoming the obstacles faced by small practices will be essential to successful use of electronic health records.

Although the experience of small physician practices that implemented electronic health records has been usefully described (8), more work is needed. Our independent, community-based, 4-internist primary care medical practice went live with an electronic health record system on 14 July 2004. We report on our experience.

Our medical practice, Greenhouse Internists, has operated in Philadelphia since 1989. We serve an economically and ethnically diverse urban and suburban population. We derive approximately 60% of our revenue from capitated managed care and participate in Medicaid (through 2 Medicaid health maintenance organizations) and Medicare (fee-for-service and capitated managed care). We handle more than 16 000 patients encounters yearly, and our focus is comprehensive ambulatory care.

We have 1 registered nurse who handles clinical and administrative contact with insurers, forms, telephone triage, and routine prescription refills; a front desk staff that handles reception, referrals, and telephone calls; and medical assistants who handle chief symptoms, vital signs, phlebotomy, and electrocardiography. We have no mid-level practitioners. Before we instituted electronic health records, we used computers for scheduling and billing only.

When our malpractice carrier stopped offering “occurrence” coverage and we had to accept “claims made” cov-

erage, we used the 2-year savings window to invest in an electronic health records system. Our motivation was complex: We hoped it would automate frustrating repetitive processes (such as prescription refills) and minimize some of the ways in which we routinely failed to meet patient expectations (such as one of us not knowing what another had said the previous day to a patient on the telephone). We hoped that the system might pay for itself, but we were not at all confident that it would. We made a leap of faith that “pay for performance” was coming and that this investment would eventually position us for greater success. Like many of our colleagues, we believed that we would have to implement an electronic health record system sooner or later, and the one-time cash surplus made it possible for us to do so sooner. One of us had experience in managed care and population health and was hoping to use those insights at the practice level.

We chose our system on the basis of recommendations of colleagues and because it was offered by a large national company. We hoped that the latter attribute would make it more likely that we could count on long-term support. We did not interview multiple vendors because we believed that all full-featured products would have unanticipated advantages and disadvantages.

To support our electronic health records system, we needed to change the practice management system that was in place for scheduling and billing. To minimize the impact on physician-patient interaction, we opted for an encrypted wireless network with Tablet personal computers (Hewlett Packard, Palo Alto, California), which we purchased from a different vendor. None of the physicians was

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especially computer-literate. The total quoted cost of our system, including hardware, software, training, and 1 year of support, was approximately \$140 000, which is within the range that other investigators have reported on a cost-per-physician basis (7).

STAFF AND PHYSICIAN TRAINING

"Training" meant different things to different team members. None of the physicians had previously used a Tablet PC with a Windows XP operating system (Microsoft Corp., Redmond, Washington), and we needed training on the device as well as on the new system. Some staff members had never used a mouse (our previous practice management system was not Windows-based). The medical assistants, who had previously made notes by hand, were now asked to use wireless-equipped laptops with mouse pads or track-ball pointers.

For the system itself, 2 types of training were given. "Super users" were taught how to set up and administer the record (and therefore were enabled to make some structural changes to the system). Regular users were trained in basic system operation but were not given administrative training and privileges to make changes to the system. Super users were charged with customizing the system for our particular practice environment and developing work flows, which were clearly defined and documented steps to guide everyone on how to use the new system to accomplish the work of the office. After 2 rounds of planning meetings and 2 days of on-site training, we "went live," meaning that we committed to using our electronic health record to document clinical care from that time forward.

Training requires organizational redundancy or reserve; in a busy physician practice, neither is present. Our business manager incurred an injury that kept her out of work for 1 month before we went live; during that month, much of our focus became covering her core functions (payroll, billing, scheduling, and staff management) rather than training. For the first 3 days of live operation, we reduced our appointment schedule by 50%; thereafter, we attempted to maintain our schedule at two thirds for 2 weeks, but ongoing demand for appointments made this impossible.

HARDWARE AND PERFORMANCE

We had put in place a complex computer network that none of us knew how to support, maintain, or operate. Shortly after we implemented the practice management system, we experienced a virus attack that crashed our system. After the virus was removed, we experienced several lengthy losses of both telephone and data service. Identifying the cause of each of these system failures was a diagnostic problem well beyond our skills, with several possible corporate culprits. Before we went live, we had had a limited, inexpensive relationship with a small local computer support company; because we were paying annual support

fees to both hardware and software vendors, we thought we would not need these local services after implementation. We were wrong. In fact, our relationship with the local company expanded rapidly in time, importance, and cost after implementation. Because we now rely on our system for core clinical functions (prescriptions, telephone calls, and accessing records), small technical malfunctions create major operational problems. Our expanded relationship with the local computer company now costs an unbudgeted \$2000 per month, and the response time of our technical support is often inadequate.

REDESIGN OF OFFICE WORK FLOW

A well-run primary care office is a complex interdependent operation with well-defined work flows. General principles that guide the design of work flows in our office include simplicity and accessibility for patients, safety, comprehensive documentation, and delegation. We operate under the assumption that the physician is the most skilled, and most expensive, person in the office and should only do what no one other than a physician could do. Our entire office meets monthly for 1 hour, and weekly meetings of staff teams are held to adjust work flows as conditions or demands change. Responding to a request for a prescription refill, for example, requires 3 or 4 people performing interrelated but distinct tasks to deliver it safely, reliably, and promptly; we average 30 to 40 such requests daily. The collective integrated operation of our office thus represents 15 years of weekly and monthly staff meetings that constructed our functional systems piece by piece over time.

On 14 July 2004, we had to redesign every office system we had in place. Our commitment that "going live" would mean that documentation of clinical care on or after that date would be created and found in the electronic health record seemed simple, but "clinical care" included not only office visits but telephone calls, prescription refills, handling of laboratory results, and other functions. Each of these tasks had a work flow, and all work flows had to be redesigned more or less simultaneously. A clear go-live date was desirable because, as a matter of patient safety, we needed to know where to look for information, and the longer we ran parallel paper and electronic systems, the harder that would be.

The process of radically redesigning 15 years of accumulated work flow in a short interval was extremely stressful. The system we chose is designed for flexible application in a variety of settings, ranging from large integrated delivery systems to smaller practices. Although the vendor urged us to think through and document the new work flows in advance, we found ourselves making innumerable decisions about how we would use the system before we really understood how it worked, and our vendor did not know enough about how our office worked to help us. We were forced rapidly to adjust our work flows during imple-

mentation, which seemed akin to redesigning an airplane in flight.

DECREASED COMPETENCE AND INCREASED EFFORT

Going live rendered everyone in the office incompetent to do their core jobs. The front desk had to use new on-screen forms to record telephone messages; pairing electronic messages with paper charts required the file clerks to follow a new work flow; physicians had to find telephone messages on their computer desktop rather than neatly piled in a physical telephone message bin. The medical assistants had to record vital signs and chief symptoms in the computer and had to learn how to record results of a tuberculosis skin test, visual acuity test, or urinalysis. Everyone in the office simultaneously experienced pervasive anxiety and unhappiness. Waiting time for patients dramatically increased. In short, people were miserable at work.

We began to have weekly full staff meetings and weekly physician meetings, all of which were more acrimonious than they had ever been. Variations in clinical style and work flow among the physicians—which had seemed acceptable if unnoticed before—now became a subject of group scrutiny. What did we have to change, and what could we hang on to? What did the physicians have to do the same way, and where could we tolerate difference? All these issues had to be renegotiated at a time of enormous stress on the practice. We observed that a “culture of blame” set in: Things were not going well, and it had to be someone’s fault. Several staff members complained that the work environment was less collegial, and they often felt criticized, as one put it, “by everyone.” They did not associate these feelings with the electronic health record and, at least initially, neither did we.

Coincident with our shared frustration came a dramatic increase in workload, especially for the physicians. Even when we had reached the point where we could competently use the new system, every patient represented a “new patient” to the electronic health record, and the old paper chart had to be abstracted and data moved into the electronic chart. Some aspects of chart abstraction could perhaps have been delegated (for example, entering medication lists or immunization histories), but we worried that our staff—who have only limited clinical training—might make mistakes, and decisions about what data to abstract require the clinical judgment of a physician. At first, the system shut down daily at midnight for backup and maintenance; backup was later moved to 2:00 a.m. to accommodate 2 of the doctors who were trying to work from home in the evening.

The stress level in our office remained high for about 3 months, by which time we had seen most of our complex patients and entered their long medication and problem lists into the system. We had now begun to realize some of the benefits of computerization, including computer-gen-

erated prescriptions, faster access to specialist correspondence, real-time access to charts anywhere in the office, the ability to “message” or “route” information and tasks electronically in the office, and the ability for the same “chart” to appear on multiple “desktops.” Within 4 to 6 months, waiting time had improved and staff were more excited and confident.

PATIENT ACCEPTANCE

Patients have been impressed and pleased to see their prescriptions appearing on wireless-enabled printers sitting unconnected to our Tablets. They have also enthusiastically benefited from occasional use of the Internet or such tools as the National Cholesterol Education Program Risk Calculator (9) during their visit. Some patients, however, found the increased waiting time during the early phase of implementation unacceptable, and many left our practice because of it. At a time when everyone in the office was stressed, our customer service skills were not at their best. Several patients have asked a version of a question posed by a supportive, long-established patient: “Doctor, do you find you are spending more time interacting with the computer than with your patients?” For a while, the answer was clearly yes.

FINANCIAL IMPACT

Our total annual budget for technology support before implementation was approximately \$10 000, which comprised maintenance and support of our previous practice management system and limited network. Our postimplementation annual budget will be \$40 000, which includes annual support payments to hardware and software vendors and our local computer support vendor. We will have \$24 000 in annual carrying costs for the financing of our system purchase over the next 5 years. The clearest savings we have seen was from the elimination of \$45 000 in annual transcription costs. Although the file clerks no longer do filing, they now scan and “name” correspondence (see the following description), and we have been able to eliminate only 1 staff position for an additional annual savings of \$20 000. We expect savings on chart supplies to be offset by increased costs of toner and printer maintenance, technical support, and replacement of equipment. At best, we see the expense side as a wash.

On the revenue side, we accrue no additional revenue from any current payer for having an electronic health record. We had already “maxed out” on most quality incentives for which we were eligible when we were using well-organized paper charts and office systems. The electronic health record may enable us to see more patients in the same time or offload physician work more reliably and safely because the system provides clear, timely, legible documentation to support expanded clinical team activities, but this reallocation will require substantial staff retraining. Within 1 year of implementation, we expect to

free up our current file room space and perhaps make it clinically productive and revenue-generating.

As an offset to these potential gains, it is possible (although unlikely) that physicians will be less productive because the electronic health record generates more work for them. For example, whereas the physicians used to dictate notes, they must now type them. Physicians must also participate more in "filing." Our electronic system offers us 24 "document types" (for example, consultation or laboratory report), and each document must be assigned a "type" and given a "name." Because accurate labeling and data entry are essential both to take advantage of the information retrieval capability of the system and to find anything once it is filed, the physicians must oversee and modify the categorization and manual input of key data elements. As a result, we often feel like data input drones. No wonder one of us described the new work flow as a "physician speed-up."

Computerization in a world without established standards that link medical data systems is inefficient. When we have a working interface, as we do with our main outside clinical laboratory (which handles about 80% of our laboratory testing volume), the reports come "named," and the individual laboratory results automatically populate flow sheets and letters to patients. Results can be efficiently retrieved and graphed, and trends can be analyzed. Unfortunately, most of the information we receive (such as radiology reports, consultations, and procedure reports) does not come to us in a format that the system can recognize electronically. Our colleagues in integrated delivery systems and the Veterans Administration do not face this problem because most of their clinical data are generated within their system and the interfaces already exist. National standards on the interoperability of medical data systems would be a big step forward for small practices. For now, we may switch referral patterns to hospitals and specialists who will give us information in a form that flows most easily into our system.

LESSONS LEARNED

It is naive to assume that small practices will move to electronic health records without a variety of supports, one of which is certainly financing. None of the many beneficiaries of our investment—patients, insurance companies, our specialist colleagues, health plans, our liability carrier—have directly shared in the cost of implementing an electronic health record system. Enhanced reimbursement models will be needed for wider adoption. This could be achieved through performance incentives tied to implementation of such systems in capitated contracts or through a common procedural terminology code for "data transfer" to reflect the one-time increased effort and cost of moving data from paper to electronic format. A recent report estimates incentives of \$12 000 to \$24 000 per full-time physician per year would be needed to make the business case for immediate adoption of electronic health

records, with those incentives transferring to performance-based incentives over time (7). Any of these incentive models would work for us and make adoption easier in other small practices.

Although some predict that vendors will shift their focus to the small practice market (5), it is difficult to see how vendors will support implementation of an electronic health record in the small practice setting while keeping prices affordable. Small practices need much more training and support from vendors than do large groups. The support provided by our large national vendor presupposed the existence of dedicated information technology staff and an administrative layer that could plan work flow and train staff. Neither of these infrastructures are present in a small office, and both are critical to success. In addition, small practices need structured assistance to develop their capacity to manage organizational change. Models of shared local training and support must be developed if small offices are to be successful in implementation.

Perhaps the most important asset we could have used to ease the pain of implementation was more clinical capacity. A decline in productivity after implementation of an electronic health record seems inevitable, and if a practice is already straining to meet patient demand, an absence of reserve magnifies the stress of implementation. For us, the financial stress of acquiring the electronic health record precluded simultaneous addition of a new mid-level practitioner or physician, which argues even more strongly for the need for financial support.

Patients want and expect their physician, especially their primary care physician, to have a comprehensive grasp of what is going on with them medically and to be able to respond to such questions as, "How much weight have I lost?" or "What was my cholesterol level last time?" Clearly, aggregating comprehensive clinical information at the point of care is a basic function of excellent primary care. Why is it that every academic health center and hospital acquires state-of-the-art cardiac imaging tools promptly, but primary care offices and residency training programs are still using paper records? Given their experience with other "customer service" operations, such as retail, banking, or travel, patients assume a level of information technology infrastructure that most of us in health care simply do not have. Unsupported by technologies now taken for granted almost everywhere else, we in health care regularly fail to meet basic patient expectations.

A major factor that prompted us to adopt an electronic health record was the hope, now at least partially fulfilled, that it would improve our ability to meet patient expectations and improve our job satisfaction. Despite the difficulties and expense of implementing the electronic health record, none of us would go back to paper. We find ourselves able to be better physicians: We communicate more quickly and clearly with patients on the telephone and by letter, transmit important clinical information (albeit on paper produced automatically by our system) more effi-

ciently to specialists, and spend less time paging through charts to find out what the previous cholesterol values (for example) had been. Practicing with a computer in hand allows us to access current health information for ourselves and our patients without having to leave the room or interrupt the flow of a patient encounter. We have already caught a glimpse of population health possibilities when, on the same day as the withdrawal of valdecoxib from the market, we were able to identify and send letters about the withdrawal to the 16 patients in our practice who were taking the drug. We expect soon to produce a list of patients with diabetes so that we can audit their care and see how well we meet our care standards. We also plan to use our electronic health record to provide each of these patients with an individualized report on services for which they appear to be overdue.

If the United States is to realize the benefits of information technology in health care, substantial investments will be needed to shepherd small offices through what is an arduous process. We believe that many practices will examine the current environment and defer a decision to adopt an electronic health record, and given our experience, it would be hard to disagree with them. All the hoped-for benefits to the overall delivery system and to patients will only accrue if small offices, which are the access points to health care for most patients in the United States, successfully adopt information technology. We believe that new models are urgently needed to deliver both financial and administrative support to those who would accept the challenge.

From Greenhouse Internists, P.C., Philadelphia, Pennsylvania.

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Requests for Single Reprints: Richard J. Baron, MD, Greenhouse Internists, P.C., 345 East Mt. Airy Avenue, Philadelphia, PA 19119; e-mail, rbaron@greenhouseinternists.com.

Current author addresses are available at www.annals.org.

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