

Impact of an Electronic Medical Record System on Community-Based Primary Care Practices

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Background: Although primary care physicians are increasingly interested in adopting electronic medical record (EMR) systems, few use such systems in practice. This study explores the organizational impact of an EMR system on community-based practices that have overcome the initial barriers and are experienced EMR users.

Methods: Five primary care practices that are members of a national research network participated in this study. Using qualitative methods, including semistructured interviews and observations, we assessed the impact of an EMR system on the work lives of various user groups.

Results: Physicians and staff indicated that the EMR system has changed not only how they manage patient records but also how they communicate with each other, provide patient care services, and perform job responsibilities. The EMR is also perceived by its users to have an impact on practice costs. Although in most practices physicians and staff were unaware of actual expenses and cost savings associated with the EMR, those in practices that have eliminated duplicate paper-based systems believe they have realized cost savings.

Conclusions: Several important themes emerged. The organizational context in which the system is implemented is important. Effective leadership, the presence of a system champion, availability of technical training and support, and adequate resources are essential elements to the success of the EMR. (J Am Board Fam Pract 2000;13:338-48.)

A growing but still limited number of primary care physicians have begun to look to electronic medical record (EMR) systems as a means to manage more effectively their growing volume of patient information.¹⁻¹⁵ The reluctance to implement EMR systems in practice has been related to a host of factors: cost, unavailability of true-tested systems, data entry obstacles, lack of uniform standards, inexperienced vendors, patient confidentiality and security concerns, and legal issues.^{3,9,16-21} The relatively few practices that have implemented EMR systems have found that the gains for physicians

and patients have more than overcome the problems created by the obstacles.^{8,12-15}

This study is based on the premise that it is important to explore the impact of the EMR on the physician practices that, having overcome barriers, use the EMR as an integral part of patient care. Most system evaluation studies to date have focused on technical performance. We believe EMR systems in primary care practice should be examined from at least two additional perspectives: the organizational and the economic. Technical performance alone does not ensure the EMR will be accepted and used by physicians. Anderson and colleagues²² argue that the success of EMR implementation and utilization depends on the integration of the system into an often complex organizational setting.

To assess the organizational impact of an EMR system, we recognized that we needed to design a system evaluation based on multiple perspectives. To do so required approaching the research using qualitative methods, rather than conventional quantitative methods, to gain insight from users of the system. We recognized that qualitative research methodology provides rich, meaningful informa-

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tion specific to a particular phenomenon and is not intended to be generalizable.²³ We believed, however, that any insights gained from this study could then be used in a subsequent quantitative study designed to obtain more objective, generalizable results.

This study was built on a technical performance study conducted by Wager et al² of the use of Practice Partner Patient Record, the EMR system developed by Physician Micro Systems, within primary care practices. In this earlier study, members of the Practice Partner Research Network (PPRNet), a group of Practice Partner Patient Record physician users, were found to be satisfied with the technical performance and functionality of the system. The current study drew participants from the same group to examine the equally important organizational impact. We incorporated multiple stakeholders' perspectives, including those of physicians, physician assistants, nurses, and support staff, to gain a comprehensive understanding of the impact this system has on primary care practices.²⁴

Methods

We used a qualitative research design with interviews and observations in the informants' own practice sites. The semistructured interviews encouraged informants to discuss any aspect they believed to be important of using the EMR system. The study explored changes that occurred in the work lives of the informants and the reasons they thought the changes occurred. As new insights developed, the interview questions were adapted to explore this new knowledge.

Selection of Participants

Because 3 authors (KW, FL, SO) were familiar with the Practice Partner product through their affiliation with PPRNet, we believed this particular EMR system offered us the most feasible access to users of an EMR system. PPRNet is a research network of 57 community-based practices that use the Practice Partner Patient Records system.²⁵ Its purpose is to promote practice-level research among physician practices that use the EMR. Although 3 authors had an ongoing relation with PPRNet, the selection process was conducted solely under the direction of the lead author (KW). No one affiliated with Physician Micro Systems participated in the selection of the practice sites.

We initially chose 17 community-based practices from the PPRNet that might provide knowledgeable informants for the study. These practices had used the EMR system for at least 2 years and had a record of good-quality data. We eliminated 12 practices that had either never used paper records or were using duplicate record systems. The remaining 5 sites were willing to have a researcher visit and have practice personnel respond to questions posed in interviews. Four of these 5 remaining sites were family medicine practices, and 1 was a primary care internal medicine practice.

Instrumentation and Data Collection

The lead author (KW) made 2-day visits to each of the practices in the summer of 1998. Interviews were held either one-on-one or in small groups. These interviews were audiotaped and later transcribed by a professional transcriptionist. Informants were assured that their responses would be confidential. Questions were asked regarding informants' experience in using the EMR, its perceived advantages and disadvantages, and impact on their work lives; however, the interviews were conducted in an interactive, informal manner permitting further exploration of areas of interest.

During each site visit observations were made of at least 1 physician or physician assistant using the EMR system with patients in the examination rooms. Field notes were made describing how the care provider used the EMR in practice.

Data Processing and Analysis

The analyses were based on the approach described by Guba.²³ The lead author read each interview transcript while listening to the accompanying tape and began selecting key terms or phrases the informants used to describe their impressions or experiences with the EMR system. She then grouped the data into natural categories.

To ensure trustworthiness of the data, member checking was done by mailing an individual summary of the interview to each interviewee. Two participants had minor clarifications in the summary reports. A final summary preliminary report was then prepared and sent to each medical director.

A final step in analyzing the data was to code each of the individual summary reports by the participant's practice, primary job title, and perceived advantages and disadvantages. Any emerging themes that related to the organizational impact of

Table 1. Summary Characteristics of Participating Practices.

Description	Practice A	Practice B	Practice C	Practice D	Practice E
Practice type	Solo Internal medicine	Group Family practice	Group Family practice	Group Family practice	Group Family practice
Staff size, number					
Physicians	1	1	7	4	1
Physician assistants	0	1	2	1	0
Nurses	1	2	8	5	2
Support staff	4	5	17	15	2
Total	6	9	34	25	5
Patient population	Primarily Medicare and self-paying; small percent with no insurance	Primarily managed care, private insurance, or self-paying; 20% Medicare	Primarily Medicare, Medicaid, and managed care; 10% self-paying	Primarily managed care and Medicare; small percent with no insurance	Primarily managed care and Medicare
Geographic location	Urban Southeast	Urban Northeast	Urban Midwest	Urban West	Rural Northeast

the EMR on the practice were then coded. Other themes related to the factors that lead to the perceived success or failure of EMRs were also defined and coded.

Independently, 2 coauthors (FL, AW) listened to the interview tapes, reviewed the original transcripts, and categorized the data, picking out major themes. This peer debriefing process helped ensure that the original interpretation of "emerging themes" was reasonable, consistent, and appropriate. Themes found by these coauthors were then compared with those themes determined by the lead author. Remarkable consistency in the common themes emerged.

Results

Description of the Study Participants

The study practices ranged in size from a solo practice to a large-group practice. They encompassed a variety of geographic settings as well (Table 1).

Fifty-one formal interviews were conducted, representing the views of 12 physicians, 3 physician assistants, 11 nurses, and 25 support staff. Another 15 informal interviews (not audiotaped) were conducted with nurses and support staff at practice C. Every member of the staff in practices A, B, and E was interviewed. The lead author met with 27 of the 34 practice members at practice C and 19 of the 25 members at practice D.

Use of the EMR in Practice

Each of the five participating practices implemented the EMR between 1993 and 1995. All reported that they were "paperless." After visiting these practices, we learned that in some cases the practices had different interpretations of the concept of paperless. We had initially defined paperless as meaning that the practice was using the EMR for the primary form of patient information retrieval and that the only paper records were those received from external sources. On arrival at the sites, we found that the practices ran the gamut from having a true paperless system to maintaining a complete paper backup of all documentation (Figure 1).

Two of the practices (A and E) maintained a complete paper backup system. Practice D met the initial paperless definition, but filed so many outside reports that they continued to maintain and pull a supplemental paper record for most patient visits. The other two practices (B and C) were

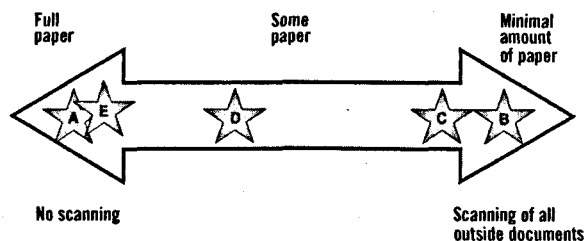


Figure 1. Relative quantity of paper records maintained by each practice.

essentially paperless except for the few documents they were unable to scan and old paper records. Practice D had an operational laboratory interface; the others had laboratory data entered into the EMR by a data entry clerk.

Perceived Benefits and Limitations to the EMR System

We asked participants to describe the advantages and disadvantages to using the EMR in practice. During the interview process we became aware that

participants were not distinguishing between advantages and disadvantages that are attributable to using any EMR system and those attributable to Practice Partner in particular. Both types of advantages and disadvantages are included in Tables 2 and 3. The items are arranged in the tables according to those having the most agreement among the practice personnel to those having the least agreement.

The informants' impressions of the advantages were remarkably consistent. The most frequently

Table 2. Perceived Advantages to Using the Practice Partner System, by Practice.

Benefits of Electronic Medical Record (EMR)	Practice A	Practice B	Practice C	Practice D	Practice E
Increased access and availability of patient information to multiple users	●	●	●	●	●
Ability to query or search system (eg, find all patients on recalled medication)	●	●	●	●	●
Improved overall quality of patient record (eg, better organized, legible, can easily print)	●	●	●	●	●
Improved quality of documentation (eg, complete, accurate)	●	●	●	♣*	●
Increased efficiency (eg, less staff time searching for charts; time saver)	●	●	●	♣*	●
Facilitated cross-training of staff, thus enabling office staff to answer some patient questions	●	●	●	●	NK
Use of e-mail system to serve as tickler or reminder system	●	●	●	NK	●
Improved communication within practice using e-mail messaging system	●	●	●	♣*	Not used with staff
Ability to respond to patient questions promptly (eg, refills on prescriptions can be done quickly)	●	●	●	♣*	●
Belief that patients' attitudes toward EMR are generally positive	●	●	●	♣*	●
Improved quality of patient care services through use of features (eg, health maintenance, prescription writer, drug interactions, templates)	●	●	●	♣†	●
Perception that EMR benefits exceed costs	●	●	●	♣†	●
Perception that practice has realized cost savings using EMR	♣†	●	●	○	○
Ease of use (eg, easy to learn and use)	●	●	●	♣*	♣‡
Revenue enhancement capabilities through use of health maintenance feature and searching functions	●	●	●	NK	Not used for this purpose

Note: Practices A and E are maintained dual systems—electronic and paper.

Legend: ● = Consistent response within practice.

♣ = Mixed response within practice.

○ = Not realized.

NK = Not known whether benefit has been realized.

*Support staff agreed; nurses and physicians did not.

†Some physicians and nurses agree, others did not.

‡Physician agreed; office manager did not.

§Physicians agreed; support staff and nurses did not.

Table 3. Perceived Disadvantages to Using the Practice Partner System, by Practice.

Electronic Medical Record (EMR) Limitations	Practice A	Practice B	Practice C	Practice D	Practice E
Inability of system to capture easily all data including graphics	●	●	●	●	●
Frequency of downtime	‡*	‡*	‡†	●	‡
Time necessary to develop customized templates	●	●	NK	●	●
Cumbersome nature of system (eg, too many steps to perform simple task)	‡†	‡*	‡*	●	‡*
Difficulty in using templates with patients who have multiple problems	○	Not used	‡*	●	○
Problems associated with scanning (eg, time, quality)	Not used	○	●	●	Not used
Difficulty in searching text without standard terminology	‡*	NK	‡*	‡*	NL
Difficulty in learning to use system	○	○	‡*	●	‡*

Note: Practices A and E maintained dual systems—electronic and paper.

Legend: ● = Consistent response within practice.

‡ = Mixed response within practice.

○ = Not realized.

NK - Not known whether benefit has been realized.

*Some physicians and nurses agreed, others did not.

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cited advantages of the EMR system can be found in Table 2. Participants reported they believed the EMR enabled multiple users to have access to records that were organized, legible, and complete. They also believed the querying functions enabled them to perform searches that would be nearly impossible to do with paper records. As a result, many providers believed the quality of patient care services had improved considerably since they adopted the EMR.

Some practices did not reach consensus concerning a specific EMR benefit. The overall response for the practice on these items was coded as "mixed response" to indicate different opinions as to whether an item was perceived as an overall advantage. For example, the support staff in practice D believed the EMR improved the quality of documentation, increased efficiency, and improved communication, yet the physicians and nurses did not share these same views. Support staff believed the EMR provided them with easy access to patient information without having to spend time hunting for charts or tracking down clinicians. Physicians and nurses within the same practice expressed frustration with the software program and believed it took too many steps to enter basic patient information. Two physicians believed the system was not intuitive and made their work life more difficult; 1

physician described the EMR as "an expensive word processor." This particular physician did not think that the system developers were "in tune" with the user needs.

In two other cases inconsistent responses related to ease of use and whether the practice perceived it had realized cost savings by using the EMR. In practice E, the physician and 1 nurse found the EMR to be easy to learn and use. The other nurses and the 2 office staff members, however, believed they needed additional training. Mixed reviews within practice A also related to whether the practice perceived it had realized cost savings by using the EMR. Because the practice maintained a duplicate record, the physician believed the cost savings were not yet realized. He did believe, however, that he would not have been able to stay in solo practice had it not been for the EMR. "There is no question in my mind that . . . the EMR . . . has enabled me not only to provide high-quality care but also to generate additional revenue through patient reminders."

When asked what they perceived as the disadvantages or limitations to using the EMR, most participants responded that downtime was the biggest limitation or concern. The clinicians and support staff indicated that they relied heavily on the EMR and found work extremely frustrating when the system was down because of power outages,

time needed to run backups, or hardware problems. One physician assistant said, "Everything comes to a screeching halt when the system is down. You have to, all of a sudden, remember how to hand-write prescriptions."

Questions designed to elicit the actual percentage of time the system was down per day or week resulted in varying responses within the same practices. In one practice the responses ranged from several minutes to 30 minutes per week. Participants generally spoke to the effect of the downtime on their work rather than the actual amount of time spent without the system working. What emerged was the sense that downtime of even a very short duration was a frustration to those who had come to rely on the system to accomplish their work. In two practices the clinicians thought the system was down much more often than did the support staff working in the same practice. In these cases, a "few minutes seemed like eternity" to the clinician who was in the examination room with a patient when the system went down. Although downtime seemed to be less a concern in some practices, it was described as an important issue for all participants.

Other limitations to using the EMR system are summarized in Table 3. Although most staff had confidence in the electronic backup, some physicians and office staff believed a paper backup is currently necessary. A recurring sentiment among participants within the practices maintaining paper files was that computers were not trustworthy. In fact, one practice had lost more than a year's worth of patient data when a hurricane hit the area. There was confusion about proper backup procedures. A solo practitioner described the loss as similar to "a divorce or death in the family and a horrendous thing to live down." He admitted that he was not willing to "let go of paper" until the system was without error. Other staff simply did not feel comfortable letting go of the paper record.

Those who had been successful in eliminating the paper record scanned outside reports into the system. Of the three practices using scanning (B, C, and D), practice B had the most experience. In fact, they were pleased to have perfected the process. The other two larger practices (C and D) were still working to improve this process. Their major concerns with scanning were accuracy and turnaround time from when the document was received in the practice until the time that it was available in the EMR.

Organizational Impact of EMR on Practice

When participants were asked what impact, if any, the EMR has had on their work lives, several major themes emerged. Physicians and staff clearly believed that the EMR had changed not only how they managed patient records but also how they communicated with each other, provided patient care services, and performed their jobs. They also reported that the EMR had a positive impact on the overall work environment. Most physicians and staff believed that the office environment was more organized, quieter, less chaotic. Even though most practices seemed unaware of actual expenses and cost savings associated with the EMR, those that had eliminated duplicate paper-based systems believed they had realized cost savings.

Many participants found that the EMR had facilitated communication among clinicians and support staff within the practice. In particular, the e-mail messaging function enabled support staff to record patient telephone calls and messages directly into the EMR and forward them to the appropriate person. One physician remarked, "I recall that when we were using paper charts, the secretaries would camp outside the examination room door when they had an important message to discuss with us. It was a terrible waste of their time. It wasn't bad enough to disturb us immediately and it wasn't minor enough to let it go until lunch. Now they e-mail us. I check my messages between patients . . . it's wonderful. We don't use sticky notes anymore."

Most of the staff who used e-mail agreed that it was a great timesaver. In fact, many nurses indicated that it saved them hours each day. One nurse said, "If I had to pull the charts, flip through them to find the information, and possibly ask the doctor for clarification on his handwriting, it would take a lot of time. With the EMR, the information is right there. I don't have to hunt for the chart or information anymore." They found there were far fewer interruptions and they were better able to track telephone messages. Because the e-mail messages became a permanent part of the patient's record, the physicians believed that the feature had a positive impact on patient care.

A related theme that emerged was the perceived positive impact of the EMR on the quality of care and services provided. Physicians and care providers believed that the quality of documentation was unsurpassed – the records were complete, accurate,

legible, and organized. One physician commented, "If you look at the quality of my record, my problem list, my medication list, and my allergy list – they are far, far better than they ever were when I was using paper charts. That impacts care. Plus, I can work more efficiently because I know that I have up-to-date, reliable data." Several physicians also pointed out that many of the EMR features, such as the prescription writer, health maintenance reminders, drug interaction function, and templates, were extremely useful in providing high-quality care. Being able to query the system, for example, enabled the physicians to notify quickly any patients who were taking a drug that had been recalled. One physician commented that when he went on vacation, he would "run a search on patients taking certain medications to make sure that they wouldn't run out of their prescriptions" while he was out of town.

Many providers also believed that the patients' perceptions of the EMR were positive. Several physicians mentioned they were sensitive to how patients would respond to the EMR, and 1 physician admitted to asking patients throughout the day what they thought of the system. "Nearly 100% of my patients said positive things about it; . . . in fact, most patients felt that I was a modern doctor and up to date on things." These findings were supported by the lead author's on-site observations of the patient-provider interaction within the examination room.

The EMR also had a positive impact on the staff's job functions and productivity, particularly within the practices that had eliminated paper records. The providers who entered their notes directly into the EMR believed they were more productive, whereas those who continued to dictate their notes did not find that the EMR saved them much time. Most physicians believed the EMR has improved the quality of time with their patients and the quality of documentation in the records. One physician reported that he saw 5 patients an hour, about the same number as before the EMR, but admitted, "I feel less pressure. When I saw 5 patients an hour with paper records, I got bogged down in paperwork. It just wasn't fun. It's a good bit easier now."

The EMR also seemed to have had a positive impact on the overall work environment, primarily in practices that had eliminated duplicate paper systems. These offices were more organized, neater, and quieter; the records were also more

readily available. The staff at these practices seemed less stressed and more satisfied with the system. According to one office manager, "Adding the EMR and eliminating the paper has enabled our office to operate far more efficiently." In three practices (two solo and one large-group practice), however, a great amount of paper was still scattered throughout the office. Although the paperwork seemed manageable in the solo practices, the physicians and staff in the large-group practice were overwhelmed by the amount of paper. One physician indicated that until all the physicians in the community decide to use the EMR, he did not foresee that his practice could "go paperless." Despite some negative views, no one wanted to return to paper medical records. Several participants said, "there is no going back." They believed the EMR has enormous potential and their challenge was to figure out the best way to use it.

The two practices (B and C) that had eliminated paper systems believed they had realized several substantial cost savings, particularly staff savings. Even though most of the physicians and physician assistants in these practices continued to dictate notes, they found transcriptionists were able to spend more time transcribing and less time performing such functions as searching for charts and filing reports. The physicians and office managers in these two practices believed the support staff has been far more productive since the introduction of the EMR. For example, one practice added a second provider with little change in staff. As expected, the practices that continued to maintain a dual system did not believe they had realized cost savings as a result of the EMR. When the solo practitioners were asked whether they believed the EMR benefits exceed the costs, however, both said "absolutely." In fact, they both agreed that the EMR led to a less stressful life.

Evaluation of EMR Implementation Process

We asked physicians, nurses, and support staff at each of the practices to describe and evaluate both the EMR implementation process and the lessons learned. Staff at several practices spoke about problems they encountered – inadequate training, lack of local technical support, and not having ready access to help within the practice when they were having problems. Others were frustrated by downtime and technical difficulties. In at least three practices (A, D, and E), participants reported the

initial training provided by the distributor was inadequate or poor. Staff in practice D probably had the most negative implementation experience as they simultaneously converted their billing, scheduling, and patient record systems. The distributor encountered so many problems in changing the old billing system to the new one that much of his time was spent handling technical conversion problems and little was devoted to staff training. In addition, when participants in practice D encountered training and hardware problems, they did not have local technical staff available to help them overcome these difficulties. Although staff in practice A experienced similar problems, the physician in this practice took the initiative to learn the intricacies of the software and was able to train and assist the staff. He admitted that he did not have the technical expertise to fix hardware problems and found it very difficult to find qualified consultants locally to assist them. Many of the implementation problems described by the participants were product specific and attributed to the particular distributors involved.

Practices B and C reported fairly smooth implementations. In both cases, the staff described at least one person within the practice who knew the software well enough to provide individualized assistance as needed. Staff reported that the lead physicians in these practices assumed an active role in training. They provided ample time for users to get comfortable with the computers and the software before introducing new features. Staff from both practices said they were introduced to the system "a little at a time" beginning with basic features. Both physician leaders were recognized for their commitment to the EMR system and their strong computer skills.

Discussion

It was not until the lead author arrived at the fourth site, practice D, that we began an in-depth exploration of factors that might have contributed to EMR success within the other practices (A, B, and C). Up to this point, the physicians and staff seemed satisfied with the EMR. Within practice D, however, both physicians and nurses had negative views toward the system and were seriously looking to replace it. Practice D was larger than A and B, but smaller than C. All four practices were in urban settings with similar types of patients. We began to question why the same EMR system in a compar-

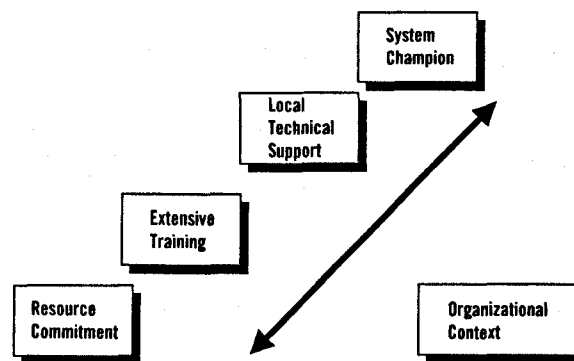


Figure 2. Electronic medical record success criteria.

ble setting would be viewed so differently by its users. We began to explore the less obvious organizational factors and characteristics that seemed to lead to EMR success or failure. Our analysis of similarities and dissimilarities of organizational characteristics within the practices continued through completion of the site visit to practice E and is summarized in the following paragraphs.

We discovered that the organizational context was an important component in understanding the impact of an EMR on the practices. Kaplan²⁶ refers to context as one of the four Cs (communication, care, control, context) of system evaluation. That is, to what extent does the impact of an EMR depend on the practice setting? Within these five practices, the perceived success or failure of the EMR system appeared to be related to organizational factors that were present before or during system implementation. We call these organizational factors critical success factors – leadership, whether there was a champion of the system, availability of technical training and support, resources, and the degree to which staff had the opportunity to overcome their fears and gain confidence in using the system (Figure 2).

The practices that viewed the EMR system as an overall success (A, B, C, E) had a system champion. In each case, the champion was a physician who clearly served as a major advocate. He or she was instrumental in gaining acceptance among the various user groups and in helping staff overcome their fears and apprehensions. This person was also viewed as a leader in the practice – someone who was well respected, knowledgeable, committed to the system's success, and powerful enough to make things happen. Generally, the system champion took the initiative to learn the intricacies of the EMR and offered assistance to others.

A second critical success factor was the availability of local technical support – someone available, preferably within the practice – who knew the intricacies of the software and who was able to handle hardware and network problems. Even those who had no technical computer background were able to work with the vendor and others to find solutions to system problems.

Downtime was overwhelmingly the biggest concern expressed by the staff. Many staff described work life when the system was down as “dreadful,” “awful,” and “extremely frustrating.” One physician used the analogy of imagining that you are reading a book and that the book is pulled out from underneath you – “now try to continue to read.” Because downtime was such a critical problem, staff believed that local technical support must be more than one designated person. The practice should also ensure it has the hardware and network infrastructure to support the system.

A third critical success factor was training, both initial and ongoing. Staff who reported that the initial training was poor or less than adequate expressed many frustrations. Those who were pleased with their training had time to become comfortable using computers. In one practice, the staff was allowed to play games on the computer months before the system went live. They reported it was helpful to begin by learning some basic functions and skills, and once they mastered these skills, they were introduced to new concepts or functions. The staff also had access to self-learning programs designed to teach typing skills. In another practice, the staff learned “a little at a time,” and new functions were introduced only after everyone was at the same level. In addition to being given an opportunity to get comfortable with computers and learn to type, many staff indicated that it was important to have intensive training just before the system went live so that concepts were fresh in their minds. They spoke of the need for a trainer who can “talk to the level of the novice user.” Even though the initial training provided by the vendor was believed to be an important introduction for the staff, ongoing training, once the vendor left, was equally important.

A final key critical success factor was adequate resource commitment. The resources allocated or committed to the EMR included not only the upfront investment in hardware and software, but also the time and manpower needed to support it. The

staff viewed the EMR as a success in those practices that allocated sufficient time for planning, training, and system implementation (B and C). These same practices ensured that technical support staff was available to handle problems, assist users, and provide training as needed.

The physician champions within practices B and C had realistic expectations of the system and discovered that converting from paper records to the EMR was a process that took time. They believed the true benefits of using the EMR might not be realized immediately, but they viewed the system as a long-term investment. In other words, they allocated the resources needed to build an infrastructure able to support the system and its users over time. They made certain that all staff had adequate time to learn the system and to adapt to the change. In the process, a few staff members left the practices, but most of the staff remained, learned the system, and now want to learn how to enhance its use in practice.

Impact of Maintaining Dual Medical Record Systems

Another factor that seemed to contribute the success of the EMR and satisfaction with its use within some practices was the extent to which the practice continues to maintain a paper medical record system after the EMR implementation. Although having a paper medical record system did not necessarily lead to dissatisfaction with the EMR system, it did seem to influence whether the users perceived cost savings.

The amount of paper maintained in the five practices falls on a continuum ranging from maintaining a full paper backup to maintaining very little paper (Figure 2). Practices A and E maintained a complete paper backup system, yet both had a favorable view of the impact of the EMR system, perhaps because the practices were solo practices with a limited number of records compared with the practices with multiple providers. In both practices the decision to maintain paper records was deliberate, and the practices never expected to be paperless. One practice, in fact, thought that they had to maintain paper for legal reasons.

Practice D had a much different view of their paper records. Practice D had expected to get rid of paper records altogether when they implemented the EMR. This practice was larger with multiple practitioners and a great many outside reports

coming into the practice. During our observations, we noticed many paper medical records in use throughout the office. Because of the volume of outside reports, patients' paper records were pulled for each visit. The staff, nurses, and physicians complained about the dual system and its cost in time and money. They complained about the lack of one central, complete record. They had to access both the paper and the computer to get the full picture. They expressed the belief, however, that there was no viable alternative for them. This practice had not been successful in implementing a scanning system. Although they had a functional laboratory interface, the practitioners preferred to use the paper report because they liked the format on paper better than the Practice Partner report. The lead physician stated that he did not believe the practice could be paperless until all the other practices in the community also adopted an EMR system.

The remaining practices (B and C) were essentially paperless. The personnel within these practices believed it was important that they get rid of the paper. They did not want the extra expense or hassle of maintaining a dual system and consequently developed procedures for scanning outside documents and entering laboratory results. Neither practice had a fully functional laboratory interface.

Study Limitations

There are two limitations to this study. One limitation was due to the nature of qualitative research. As is the case in most qualitative studies, this study required a great deal of time and labor to gather the data, and additional quantitative studies might be needed to explore the themes that emerged before the findings are generalizable. The boundaries of the study were initially set to include only participants who used the Practice Partner system and then were further narrowed to five primary care practices that met the conditions for participation. Because the research focused on the same vendor system, our findings are intended to offer insight and user perspective rather than to be generalizable. Many of the observations could have been specific to distribution or the product. Participants did not differentiate between their impressions of using an EMR generally and using the Practice Partner system. There was not sufficient funding or theory generation to broaden the scope of the study at this time. We believe that the insights offered by

these study participants could be transferable to other practice settings using an EMR system.

A second limitation was that of the five practices that indicated they used a "paperless" record system, two of these practices did not interpret the concept of paperless record as did the researchers, and they continued to maintain a duplicate paper system. Despite these practices not being able to realize some of the benefits and cost savings associated with a paperless office, they did affirm their satisfaction with the impact of the system on patient care, communication, and productivity.

Conclusions

This findings of this study suggest that although no simple formula will ensure EMR success, several factors can help ensure a smooth transition from paper to EMRs. The organizational context in which the system is implemented is critical. The perceived success or failure of an EMR in a practice appears to be related to such factors as leadership, the presence of a system champion, the availability of technical training and support, and adequate resources. Although the results of this study are not generalizable, the insights gained from these participants might be transferable to other practice settings. A natural follow-up to this study would be to conduct additional quantitative studies of the extent to which these factors influence or predict EMR success in practice. Our challenge, therefore, is to learn from the experiences of those who participated in this study and related studies and to create a research agenda that includes exploration of different vendor systems, different user groups, and different practice settings. We must define organizational factors that can lead to system success and discover new ways to optimize EMR use in health care if the goals of the EMR are to be realized.

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