

Position Paper ■

Factors and Forces Affecting EHR System Adoption: Report of a 2004 ACMI Discussion

JOAN S. ASH, PhD, DAVID W. BATES, MD, MSc

Abstract After the first session of the American College of Medical Informatics 2004 retreat, during which the history of electronic health records was reviewed, the second session served as a forum for discussion about the state of the art of EHR adoption. Adoption and diffusion rates for both inpatient and outpatient EHRs are low for a myriad of reasons ranging from personal physician concerns about workflow to broad environmental issues. Initial recommendations for addressing these issues include providing communication and education to both providers and consumers and alignment of incentives for clinicians.

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This report explores the gap between where we are now concerning adoption of the electronic health record (EHR), where American College of Medical Informatics (ACMI) members believe we should be, why the gap exists, and what can be done about it. The factors and forces influencing electronic health record adoption in the United States differ between the inpatient and outpatient setting, but the differences represent variations in the strength of the forces rather than the type. Adoption rates are low in both settings, except for specific sectors. Furthermore, diffusion rates appear to be low. We explore the reasons for this in depth, and present possible strategies for decreasing the inhibiting factors and strengthening the facilitating forces.

Adoption

Several studies of EHR adoption in the inpatient setting describe rates less than 10%¹⁻³ if computerized physician order entry is used as a proxy for the electronic health record. Usage of systems that display laboratory or radiology results seems to be much more widespread. It could be debated whether CPOE is a reasonable proxy since obviously the EHR exists in many hospitals without CPOE having been implemented and vice versa. However, one might argue that the full advantage of an EHR, which includes decision support, cannot be gained without CPOE. If the decision maker is not the one entering the orders (if, for example, an intermediary like a ward clerk does it) then timely alerts and reminders at the point of care are not possible. For this reason, the EHR with CPOE will be discussed here, and we consider the EHR to also include physician and nursing documentation.

Affiliations of the authors: Department of Medical Informatics and Clinical Epidemiology, School of Medicine, Oregon Health & Science University, Portland, OR (JSA); Division of General Internal Medicine, Brigham and Women's Hospital, Partners Healthcare and Harvard Medical School, Boston, MA (DWB).

Correspondence and reprints: Joan S. Ash, PhD, Department of Medical Informatics and Clinical Epidemiology, School of Medicine, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, Portland, OR 97201-3098; e-mail: <ash@ohsu.edu>.

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The results of a 2002 survey¹ indicate that 83.7 percent of the hospitals in the United States do not have anything resembling CPOE. The study was a random survey of approximately 1,000 hospitals of the nearly 6,000 listed in the American Hospital Association Guide⁴ with a 65% response rate. A total of 9.6% responded that they had CPOE fully available, and 6.5% indicated that it was partially available. Since the survey was published, the authors have looked more closely at the kinds of hospitals having full CPOE available, and one third of them are either Veterans Affairs or military hospitals. Therefore, if these government-funded facilities are excluded, approximately 6% of other hospitals have fully implemented CPOE. It is important to include them when discussing CPOE, however, because they are providing models for CPOE implementation that are applicable to other types of sites. Notably, however, a more in depth follow-up study of the same sample of hospitals has indicated that 74% of the hospitals that have not yet implemented CPOE do plan to do so within the next five years.⁵ In general, smaller hospitals appear less likely to adopt than larger hospitals.

Adoption of EHRs, with or without CPOE, is equally low in the outpatient setting, although a comprehensive national survey with a high response rate is not available. The rate seems to be somewhere between 5% and 39% (D. J. Brailer, personal communication, 2003) with a predicted increase of 15% to 30% per year over the current level of adoption. It should be noted that most data in this study were from industry sources, which may have vested interests in this prediction, and different definitions of the EHR were used. Data from HIMSS concerning the adoption gap indicate differences in adoption among different kinds of practices: the rates cited range from 10% for pediatric practices to more than 40% for internal medicine practices.⁶ Furthermore, small practices are much less likely to adopt than larger ones.

One large difference between inpatient EHRs with CPOE and ambulatory EHRs is that there is considerable international experience with ambulatory EHRs from which those in the United States can learn a significant amount. Countries like Sweden, the Netherlands, and Australia have more than half of their primary care physicians using the EHR. In Sweden, 90% of primary care physicians use it, in Denmark

the figure is 62%, and in Australia it is 55%.⁷ In these countries, the first uses of the EHR tend to be documenting the clinical encounter and writing prescriptions. The situation seems to be different with specialties other than with primary care, and it should be noted that while systems are in widespread use, they tend to serve local practices and typically do not share information with other sites. In contrast, other countries seem to be behind the United States with respect to adoption of inpatient EHRs.

Where We Should Be

We should strive to have a national system of EHRs that can share information on any patient in any health care setting. From the point of view of the patient, he or she should be able to enter any health care setting and see a clinician who has comprehensive access to information about that patient. From the health care provider's perspective, this access should be fast, the information should be easy to find, and the process should help rather than hinder the workflow. Health care will be safer for the patient and more satisfying for the clinician, who would now be able to provide far better care and feel more secure in his or her decision making.

Why We Are Not There Yet

In studies in both the inpatient and outpatient settings, the factors shown to be important for success tended to be environmental, organizational, personal, and technical.

Environmental trends, those that are putting pressure on hospitals and outpatient practices to implement EHRs, concern mainly financial and safety issues. On the financial side, both hospitals and physician practices are struggling, with practices perhaps doing worse. When hospitals make an investment in an EHR or CPOE and when the implementation is successful, they recover much of that investment, although the payers and purchasers also benefit. For outpatient practices, on the other hand, approximately 90% of the financial benefit accrues to payers and purchasers,⁸ though physicians must make the investment. This misalignment of incentives represents perhaps the single most important barrier to moving ahead and is especially problematic in the outpatient sector.

Health care safety has emerged as a major national concern and an important environmental force. Information technology has been touted widely as a tool that can improve the quality and safety of patient care.⁹ The forces of competition in health care may be providing pressure as well, as more patients become aware of the potential of health care information systems. Hospitals can improve their image by being on the cutting edge of technology, and this can be promoted through the media. The trend toward mergers of hospitals might have a negative influence if energy is shifted toward the organizational angst such mergers create. On the other hand, they may enable investment in EHRs by increasing purchasing power with vendors. Finally, there is a social trend toward patient empowerment, toward patients becoming more involved in their own care, and at the same time systems can assist them by allowing access to parts of their records. Most of these environmental trends are strong facilitating forces that should be capable of moving along the adoption rate and filling the adoption gap.

In addition, there are organizational trends that pose significant barriers. For the inpatient settings, the hospitals, the deci-

sion to purchase and implement an EHR with CPOE is a large and risky one. It may be the single biggest capital investment the hospital will make over a five-year period at a time when in a recent year approximately two thirds of U.S. hospitals lost money. The investment is great both initially and on an ongoing basis, and the return on investment case cannot always be made clearly. In addition to the financial risk, there are great social and behavioral risks. Once the organization adopts a system, the users need to adopt it. There have been several highly publicized failures of CPOE implementations in hospitals in which physicians refused to use CPOE for a variety of reasons reflecting underlying problems.

The organizational culture must be ready to support adoption by the individuals within it. There has been a period when clinicians have not experienced a sense of collaboration and trust between them and hospital administration. Consequently, if clinicians believe the administration wants to force them to use CPOE, for example, they may dig in their heels. They may be more resistant to arguments based on safety and patient care benefit if the level of trust is not there. On the other hand, if the impetus comes from the clinical staff, other clinicians may be more apt to adopt sooner, and readiness will be at a higher level. One gauge of readiness is the extent to which certain categories of people hold positions within the organization. In particular, administrators at the highest level must offer both moral and financial support and demonstrate that they really believe in the patient care benefits of the systems. There must be clinical leaders, including a chief medical information officer if at all possible, who understand the fine points of implementation strategies, and opinion leaders among the clinical staff members. In addition, there need to be sufficiently skilled implementation, training, and support coordinators who understand both clinical and technical issues.

If systems are to be used by individual clinicians, a number of important personal issues must be considered. It must be understood that physicians are not resistant to technology; they have embraced many new medical technologies with no hesitation. They are embracing use of personal digital assistants (PDAs) for clinical purposes with amazing speed. In contrast, however, they are reluctant to adopt new ways of doing things that interfere with their workflow and that they perceive take time away from their patient care work. There is debate about whether CPOE is significantly slower than hand-writing orders, and indeed with some systems the time may be quite similar, but the widespread perception is that it is slower, and this is probably true, at least at first. In addition, an inferior CPOE system could even upset the workflow of clinicians to such a degree that it endangers patients, although we are not aware of published studies demonstrating that this has occurred. Overall, when clinicians have access to larger amounts of information with which to make decisions, and when the system fits their workflow, they tend to use it.

There are significant technical issues, both positive and negative. There are many definitions of CPOE and the EHR at numerous levels of sophistication and functionality. When one contemplates the highest levels, however, the ability of systems to interoperate with one another is paramount. CPOE should certainly interoperate with systems that are on the receiving end of ordering such as laboratory, pharmacy, and

radiology systems. The EHR is a system of interoperating systems. Interoperability is a significant problem; many individual applications do not communicate with one another. In the outpatient setting, for example, most EHRs do not communicate well with practice management systems currently in use, and communication between inpatient and outpatient systems is also infrequent. At its most sophisticated or most infused level, the EHR becomes a hub of all activity, something that permeates every element of the workflow and of work life. It can be like an umbilical cord or spinal cord, depending on which analogy one likes best, but it can only achieve that level of importance if all systems work with one another. This level of "hubness" exists in a few places, and it indeed permeates organizational work life.

In the future, more organizations will hopefully share clinical data, dramatically increasing the level of interoperability. Issues related to interoperability and sharing from a technical vantage point are large and difficult. There is a sense that the clinical vocabulary issue is being addressed positively and with vigor, and a number of problems have been overcome, although there is still much work to be done. The issue of standards is also receiving increasing attention, and progress is being made. It stands to reason that there are business and political issues involved as well since it may not be in the best interest of vendors to develop systems that easily share data with those of other vendors. The standards issue was discussed in greater depth during the third ACMI discussion session.¹⁰ One overarching issue, perhaps outside the purview of the informatics community, is that of individual unique identifiers for each possible patient in the United States. There are arguments on the positive side for the ability to generate medical records so that everyone arriving in an emergency room, for example, could receive appropriate care based on adequate knowledge about them; in addition, the costs of implementing data interchange would be substantially lower. On the negative side, there are privacy issues of immense importance, and implementation of a unique patient identifier would be politically difficult.

In one important respect the technology offers clinicians something that facilitates patient care enormously—the ability to enter orders and review results remotely. In the inpatient setting, this means that the clinician can be anywhere in the hospital when writing orders. Even better, the clinician can do hospital work while in an office, at home, or while between locations. Some hospitals with EHRs have hesitated to offer remote access to physicians because of concerns about legal liability and privacy issues, but these concerns may not be warranted.

A study of outpatient EHR adoption done by the Massachusetts Medical Society in the spring of 2003 evaluated the attitudes of physicians toward their use and the use of information technology in general. The study has not been published in a peer reviewed journal and in fact the response rate was very low, but it was discussed at the retreat because the results are intriguing. The study found that the majority of respondents agreed that computers can significantly improve the quality of care and that doctors should computerize the writing of their prescriptions, yet almost half did not intend to do so.¹¹ There is a large disconnect here between their belief in the value of EHRs and their intentions to use them

themselves. Physicians believe the systems can make a difference, but they are not yet ready to make the commitment.

The reasons offered by respondents in this survey were first, that the systems are too expensive for them to purchase; second, that they take too much time; third, that they may not be secure; and fourth, that they are expensive to maintain. These concerns on the part of physicians are quite different from those seen in the inpatient setting. In hospitals, clinicians are not concerned about initial and ongoing costs because systems are purchased and maintained at the expense of the hospital and not the clinicians, and as noted earlier, the financial incentives are much better aligned. Physicians in hospitals are not as concerned about security either, since the information technology departments generally monitor that. For the individual physician in the inpatient setting, the paramount issue is physician time, and this is also very important outside the hospital.

Filling the Gap

ACMI might play a number of roles in supporting a nationwide effort to accelerate EHR adoption. This includes implementation at the local level, but to realize the benefit of increased adoption of EHRs, a monumental effort will be needed to promote the exchange of information across settings. In addition, there are many ways in which the informatics community can help make the EHR better. In the sections below, major points are illustrated by quotes from ACMI participants to give readers a sense of the discussion. Bracketed words have been added for clarity. Recommendations concerning market incentives, standards, national policy, and public education and marketing were further developed during the third ACMI discussion.¹⁰

Time Perception, Motivation, and Incentives

People differ in the amount of time it takes for them to learn to use the EHR. They also differ in their perspectives about response time. As one participant said, "with the electronic medical record, some people are going to be very good and save time, and some are never going to be good enough to be using the [complete functionality of] the record." Concerning time perception, one said "it takes two to three times longer per order using the CPOE system than not, but basically, you get the time back through other things like being able to review the orders without having to use note cards or whatever." Someone else said: "we know psychologically that people's perception of how long it takes them to do something is related to how much attention they have to put on the task and how much problem-solving they have to do to do the task."

We need to determine what the motivating factors are that will get some people to make this transition from paper to electronic records. For example, in one organization, the desire was to put medication lists in the clinical information system; users were not motivated to type in a medication list but were highly motivated to do electronic prescribing and "it has taken the clinics by storm... it is two button clicks and they can print out fifteen prescriptions, and that is a huge time-saver once they get over that hump. They are very strongly motivated because of that payback."

Communication and Training

There needs to be communication that helps the users understand that while it may take longer to enter an individual

order, there will be impressive payoffs downstream. It also needs to impart an understanding that the system is not just replacing a paper system; there will be a fundamental change in workflow that will help users do their work better. It also needs to be honestly admitted that there may be difficulties for a while, but that places that have implemented such systems in the past claim they would never go back to paper. From an organizational perspective, the use of social learning and diffusion theory concepts for encouraging opinion leaders/informal clinical leaders to diffuse information greatly assists the communication effort. There are tactics that can be used to “convince the curmudgeon” as well, such as one-on-one communication and training, and since there are many varieties of curmudgeons, there needs to be a variety of strategies. In addition, it needs to be clear to patients and decision makers as well that privacy and security issues can be managed; some hospitals with EHRs refuse to allow remote access, citing security concerns, although this would be a great motivator for adoption.

Training can take many forms. There is some debate about whether group training or even one-on-one training is ideal in all circumstances. Some places have succeeded by offering support more than training so that information can be given at the exact time it is needed. There is also debate about whether these systems can ever be easy to use because they are, by definition, complex. We should recognize that using these systems can be stressful and difficult, so user skepticism may be warranted. One way this can be addressed is to build flexibility into the systems, such as providing multiple avenues for arriving at a result.

The role of the patient is paramount, both as an informed consumer of health care and as a driver of the effort to have complete information available to the provider. The public is aware of the health care safety issues, but the role technology can play in addressing those issues is not as visible. ACMI can help with this communication and education effort.

Medical and Nursing Education

If students never learn to use a paper record, they will not build an attachment to it. Their computer skills should be at a reasonable level even before they begin clinical training so that they can more readily use the EHR once they begin seeing patients. Fortunately, for physicians, experience at a VA hospital during their training is likely, and this exposure has converted many regarding the benefits of EHRs. The VA's system has been thoughtfully designed in close collaboration with clinicians so that it truly assists them in their work. One ACMI fellow stated: “we haven't viewed using the EHR as sort of part of the professional armamentarium for which we are trained and held accountable... making it integral to our performance as clinicians,” but perhaps that is changing. A fundamental purpose for these systems is to provide a decision-making environment that offers the best evidence available, and in many ways educational components are built in. For example, “if you don't remember about heparin in thrombocytopenia, there is a monograph [available electronically] that a local expert wrote.”

Alignment of Goals

There is agreement that “It is systems like this that our literature already shows can make the difference between doing what is right and what is wrong, and providing a better level

of care,” yet “there are multiple stakeholders at play who all have to come to the same threshold even to warrant action.” Access to capital is a large issue. As the Massachusetts survey indicates, clinicians may believe that these systems make a positive difference but given their financial position do not feel capable of making the leap to EHRs. This hesitation may be because they lack capital and because they fear that they will choose an unsuccessful vendor. The greatest barrier overall by far in this setting is that physicians and practices have to make the initial investment, but only about 10% of the benefit accrues to them.^{12,13} If the greatest financial rewards will be reaped by payers, liability carriers, health care systems, and patients, then these entities need to provide an incentive for the clinicians financially. One problem is that small practices do not have the purchasing power to negotiate prices with vendors. A solution would be purchasing at a state or regional level. A model for collaborative purchase and sharing of information systems in the outpatient setting is the Massachusetts American College of Physicians effort. This is a partnership of key stakeholders, including major insurers, which will provide financial incentives for physicians in the state to start using EHRs over the next five years. Providers who use EHRs will be provided a premium. There are efforts at the national policy level to provide funding incentives as well, in particular from the Center for Medicare and Medicaid Services. Not only would such programs benefit providers and ultimately patients, but they would also provide an indirect incentive to vendors of EHR systems. Knowing that sales will increase, vendors might strive more vigorously to improve the systems and perhaps decrease costs.

One of the greatest incentives will be reaching a critical mass of information sharing. Like the first few people with telephones or electronic mail, investors in health care information technology are by and large dealing with internal information systems unable to interact with outside systems. The VA, whose efforts are possibly furthest along in this regard, has shown the value of being able to treat patients in multiple facilities with shared information.

Many perceive the need for additional careful cost-benefit analyses of the EHR. While increasing data are available,⁹ many—especially in the payer community—would like to see more. The studies that have been done to date have depended in part on expert opinion; more information for areas for which there is uncertainty would be helpful, and data on the overall impact of EHR adoption a year or two after implementation, particularly in small office settings, would be especially welcome.

In the U.S. health care system, physicians generally work in office practice settings and admit patients to hospitals that are not owned by them. If the office practice has an incentive to implement an EHR, once the clinicians are accepting of it, they will be more apt to accept using it in the hospital. The two are mutually beneficial if the physician can be in her own office and order medications for her inpatients in the hospital or deal with clinic matters while in the hospital. Incentives for the inpatient setting naturally must be offered to hospitals, but hospitals should develop plans to provide incentives to individual providers to use their systems as well. Today, the Stark laws, which make it unlawful to give providers “kickbacks,” make this difficult. For example, if

a network gave its providers, who were not paid by the network, computers or software, this would represent a violation. While the Stark laws have likely been beneficial overall, implementation of a “safe harbor” for this specific area—which has been discussed at both state and national levels—would be beneficial. A reward structure that includes such things as CME for system training, encouragement of social interaction about system concerns, and awards for innovative uses of information technology is just a beginning.

Elsewhere in the world, health care systems use more information technology than in the United States, especially outside hospitals. However, even in a country like Sweden, the disparate systems do not typically communicate with one another. Given enough attention and focus and with the right policy changes—especially those leading to a well-designed national health information infrastructure—the United States could become one of the world leaders in this important area, which promises to transform the delivery of health care.

References ■

1. Ash JS, Gorman PN, Seshadri V, Hersh WR. Computerized physician order entry in U.S. hospitals: results of a 2002 survey. *J Am Med Inform Assoc.* 2004;11:95–9.
2. Ringold Schneider PJ. ASHP national survey of pharmacy practice in acute care settings: dispensing and administration—1999. *Am J Health Syst Pharm.* 2000;57:1759–75.
3. Leapfrog Group. www.leapfroggroup.org/LeapfrogRelease101403.pdf. Accessed October 17, 2003.
4. American Hospital Association. *AHA guide to computerized physician order-entry systems*. Chicago: AHA, 2000.
5. Dorr V. Prevalence and characteristics of computerized provider order entry systems in the U.S. [M.S. thesis]. Tuscon, AZ: The University of Arizona, 2003.
6. Healthcare Information and Management Systems Society. *HIMSS hot topics survey*. Atlanta: Annual HIMSS Conference and Exhibition, 2002.
7. Taylor H, Leitman R (eds). European physicians especially in Sweden, Netherlands, and Denmark, lead in use of electronic medical records. *Harris Interactive Health Care News.* 2002; 2(16):1–3. Available at: http://www.harrisinteractive.com/news/newsletters/healthnews/HI_HealthCareNews2002vol2_Iss16.pdf. Accessed Nov 2, 2004.
8. Johnson D, Pan E, Middleton B, Walker J, Bates DW. The value of computerized provider order entry in ambulatory settings: executive preview. Available at: http://www.citl.org/research/ACPOE_Executive_Preview.pdf. Accessed May 22, 2004.
9. Bates DW, Gawande AA. Improving safety with information technology. *N Engl J Med.* 2003;348:2526–34.
10. Middleton B, Hammond WE, Brennan PF, Cooper GF. Accelerating U.S. EHR adoption: How to get there from here. Recommendations from the 2004 ACMI retreat. *J Am Med Inform Assoc.* 2005;12:13–9.
11. Computers in Clinical Practice Study, Massachusetts Medical Society. Available at: http://www.massmed.org/pages/120203pr_hongkong.asp. Accessed May 22, 2004.
12. Johnston J, Pan E, Walker JD, Bates DW, Middleton B. The value of computerized provider order entry in ambulatory settings. Boston, MA: Center for Information Technology Leadership, 2003.
13. Wang SJ, Middleton B, Prosser LA, et al. A cost-benefit analysis of electronic medical records in primary care. *Am J Med.* 2003; 114:397–403.