The Electronic medical record: An overview

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Information technology is increasingly recognized as an important tool for improving patient safety and quality of care, especially by promoting the practice of evidence-based medicine. Among all the health information technology (IT) in current use, the electronic medical record (EMR) has the most wide-ranging capabilities and thus the greatest potential for improving quality. Research has demonstrated the quality benefits of electronic documentation and viewing, prescription and test ordering, care management reminders, and messaging, among other EMR functions.

The first attempts to improve care with electronic medical records began more than 20 years ago with the computerizing of guidelines for simple preventive care and for identifying abnormal test results and potential drug interactions. The automation of early guidelines through computers improved health care delivery and, occasionally, patient outcomes. Electronic medical records thus offer a way to efficiently improve and monitor the processes and outcomes of care.

The ability to implement practice guidelines using electronic medical record systems depends on having sufficient data. Comprehensive electronic medical record systems that can store long-term data and implement guidelines are still uncommon. However, as more processes in health care become computerized (for example, laboratories, pharmacies, and billing offices), more clinical data are being stored electronically. Emerging standards for data transmission and coding will augment the building of comprehensive data repositories from disparate data sources.

Advantages and disadvantages of electronic medical records

There are many advantages of EMR. They are seen as tools to improve quality of care, and reduce health care costs resulting from inefficiency, medical errors, and inappropriate care. In addition, they also contribute to increasing new forms of interaction and communication among physicians, nurses, and paramedical employees and encourage physicians to conduct more research and validate quality improvement and customer satisfaction. Electronic medical records reduce manual functions, eliminate paper charts, and reduce physician documentation time. They also have the ability to improve the coordination of care and information among hospitals, laboratory, physician offices and other ambulatory care providers through authorized exchange of health information. The EMR makes quality assurance practical and is more efficient in auditing patient problems, diagnoses, laboratory investigations, tests, medications, and procedure notes. The system can also detect physicians ordering an unusually high number of lab investigations, abnormally high rates of hospitalization or patient readmission.

The disadvantages of electronic medical record include fear of malfunction of the computer system, a concern for privacy, confidentiality, and security for computerized patient information because information can conceivably be accessed or destroyed by unauthorized person(s). In addition, the cost of the hardware, software, training, and maintenance with upgrade is seen as a barrier and disadvantage by some institutions.

Planning and implementation of electronic medical records

Implementation of an EMR requires a major organizational and financial commitment on the part of a health care organization. There are multiple resources to guide health organizations through the process. Experts agree that there is no "best" EMR product. The correct EMR is the one that works best for the organization and helps streamline work processes to reduce or eliminate the use of paper charts, log books, forms, check lists, and the like. There is agreement as to the best EMR format, however. According to many sources, Web-based products constitute a higher risk than an internally managed EMR because the "locus of control" for data management and security is shifted to an outside vendor, out of the direct control of the health organization. An internal product is preferred but requires additional resources for planning/implementation and to ensure proper security and backup. Also critical to successful implementation of an EMR is project oversight, usually by a multidisciplinary group of key stakeholders. Proper education and training of staff, internal and external

troubleshooting for users and a realistic rollout schedule are mentioned as pivot points for successful rollout and overall acceptance.

Making the transition form paper to electronic

Critical steps in the transition from paper records to the EMR involve populating the EMR with data from the paper records. Based on the experiences of a variety of experts and health organizations, a hybrid approach works best. This approach includes:

- Entering key data elements from paper charts and scanning past visit notes. This appears to be the most realistic strategy, allowing for indexing data and the ability to search for key elements.
- Planning and implementation of linkages with other providers. Linkages to external providers, such as pharmacy and laboratory, are critical to ensure the efficiency of the final EMR product.
- Work flow analysis that converts many manually performed tasks to an electronic format.

Data entry from paper charts

Considerations for conversion of current paper charts to EMR include:

- Entering information from some, but not all, charts. If so, what is selection process? How far back should data be entered (eg, 6 months, 1 year)?
- Using the EMR moving forward and maintaining paper charts.
- Scanning old documents as images. The advantage to this is that many pages can be scanned quickly; the disadvantage is that data are not as easily retrievable.
- Entering information records so that they are searchable and retrievable. This takes more time and money.

The most popular approach is a hybrid strategy of scanning of some data (eg, chart notes for 6 months) and manually entering key data, such as problem lists, medication lists, immunizations, and allergies.

Steps for a successful implementation and possible failure factors

Steps can be taken early in the process to ensure success and avoid failure. Success factors include:

- Holding a dry run before implementation, using staff members as patients while the provider practices entering data.
- Creating several "power users," who are highly experienced, highly proficient staff members who can assist others and answer questions quickly. This approach can avoid not only delays in the use of the electronic record but also unnecessary telephone calls with the vendor's technical support.

Failure factors include the following:

- Unsatisfactory project management and oversight.
- Lack of communication. Do not assume every potential user has embraced the EHR or understands the big picture.
- Incomplete goal specifications.
- Underestimation of project complexity.

Escalation of support concept

Escalation of support allows users to get answers when they need them in the fastest, most expeditious way possible. The most effective staff training will teach users how to use the system and how to get answers when they have questions.

Many sources note that providers need technical support during the implementation phase and on an ongoing basis. These sources-most of whom stress the importance of personal, in-house support for faster, more internally focused problem resolution-describe a hierarchy for support that minimizes the use of the vendor's dial-in support line. This hierarchy consists of:

- In-house IT staff.
- Key members of the implementation team.
- A more experienced colleague, or power user, as described above.
- The vendor's call-in line as a last option.

Generic preconditions for successful conversion

The following is a list of preconditions that apply to all linkages and that uses the clinical laboratory as an example. It assumes that:

- A network and policy infrastructure exists to enable consistent, appropriate, and accurate information exchange across clinical systems of care, data repositories, and other services. This includes, but is not limited to, methods that identify and authenticate users, identify and determine providers of care, enforce data access authorization policies, and correctly match patients across systems.
- Clinicians have secure access to laboratory test results.
- Procedures and practices are implemented to support required levels of patient privacy and security.
- Appropriate standards and protocols; patient identification methodology; consent; privacy and security procedures; coding, vocabulary, and normalization standards have been agreed to by all relevant participants.
- Legal and governance issues regarding data access authorizations, data ownership, and data use are in effect.

Linkages to other service providers: the harmonized use concept

The complete EMR will bring together multiple types of clinical information from a variety of sources and providers of service (eg, laboratory, pharmacy, radiology, subspecialty consultants, hospitals, emergency departments). So-called harmonized use cases are intended

to lead to integration of different components of the EMR. For example:

- Use cases are concepts/strategies that provide a common focus for different activities and help lead to specific requirements, architecture, standards, and policy discussions for the electronic record.
- Analysts typically develop use cases for specific business and clinical processes and indicate ways that systems should interact with users and with other systems to achieve specific goals.

-Harmonized use cases do not define policies and strive not to define technical approaches any more than is necessary.

Required Characteristics of Electronic Medical Records

Comprehensiveness

Because care is normally provided to a patient by different doctors, nurses, pharmacists, and ancillary providers, and, with the passage of time, by different institutions in different geographical areas, each provider must be able to know what others are currently doing and what has previously been done. Outpatient records should contain, at least, problem lists, procedures, allergies, medications, immunizations, history of visits, family medical history, test results, doctors' and nursing notes, referral and discharge summaries, patient-provider communications, and patient directives. The records must also span a lifetime, so that a patient's medical and treatment history is available as a baseline and for retrospective analysis.

Accessibility

Medical records may be needed on a predictable basis (as at a scheduled doctor's visit) or on the spur of the moment (as in an emergency). They may be needed at a patient's usual place of care or far from home. They may be needed when the patient can consent to their use or when he or she is unconscious and only personal or societal policy can dictate use. Ideally, the records would be with the patient at all times, but alternatively they could be universally available, such as on the World Wide Web.

Interoperability

Different computerized medical systems should be able to share records: they should be able to accept data (historical, radiological, laboratory, etc) from multiple sources, including doctors' offices, hospital computer systems, laboratories, and patients' personal computers. Without interoperability, even electronic medical records will remain fragmented.

Confidentiality

Patients should have the right to decide who can examine and alter what part of their medical records. In principle a patient might choose to allow no access to such records, though at the risk of receiving uninformed and thus inferior care. At the other extreme some might have no hesitation in making their records completely public. For most patients, the appropriate degree of confidentiality will fall in between and will be a compromise between privacy and the desire to receive informed help from medical practitioners. Because an individual may have different preferences about different aspects of his or her medical history, access to various parts of the record should be authorized independently. For example, psychiatric notes may deserve closer protection than immunization history. Further, patients should be able to grant different access rights to different providers, based either on their role or on the particular individual. Most patients will probably also choose to provide a confidentiality "override" policy that would allow an authenticated healthcare provider in an emergency to gain access to records that he or she would not normally be able to, though at the cost of triggering an automatic audit.

Accountability

Any access to or modification of a patient's record should be recorded and visible to the patient. Thus, data and judgments entered into the record must be identifiable by their source. Patients should be able to annotate and challenge interpretations in their records, though we believe they should not be able to delete or alter information entered by others. Patients should also be able to see who has accessed any parts of their record, under what circumstances, and for what purpose. Reliable authentication is essential to make this feasible. Appropriate laws can reinforce accountability built into the records system.

Flexibility

We believe that most people want to make data about themselves available to those genuinely trying to improve medical knowledge, the practice of medicine, the cost effectiveness of care, and the education of the next generation of healthcare providers. This altruism has limits, however, when patients feel the threat of exploitation, the risk to privacy, or the annoyance of unsolicited follow up contacts. Patients should therefore be able to grant or deny study access to selected personal medical data. This can be based on personal policies or decisions about specific studies. An example policy might say that any study may use data if they will be stored only in aggregated, non-identifiable form. Patients may also agree to more intrusive participation in specific studies. Whether patients are willing to be solicited on the basis of characteristics of their record should also be controllable. Patients could provide time limited keys to other parties to access a specified segment of their record. For example, they could permit hospitals to write to (but not read) the laboratory results section of their record. Or they could

provide public health authorities with access to their immunization history.

Challenges and limitations

No matter how sophisticated security systems become, people will always manage to defeat them. If by no other means, they may be able to exploit human weakness to subvert someone with legitimate access to the data. Fortunately, technical advances in security systems for electronic records should continue to be driven forward by the commercial interests of companies doing business over the internet. In fact, we may need considerable further evolution of accepted policies and laws so that patients are not coerced into signing away their privacy rights to obtain care or reimbursement.

No computer system has ever remained operational for the lifetime of a typical person; hence there is a need to develop procedures to migrate records to new computer systems and architectures. The contentious issue of how patients may be uniquely identified might entangle our design choices and desire for a distributed system of records. There is also a need to develop acceptable procedures for backing up data, anticipating recovery in case of disasters, agreeing on whether emergency overrides of patient's policies are ever acceptable, whether it is possible to retract access to data once it has been given, who is trusted to conduct audits and what rights they have to sanction violators of policy, and many other procedures.

Key surface barriers to EMR use included high initial financial costs, slow and uncertain financial payoffs, and high initial physician time costs. Underlying barriers included difficulties with technology, complementary changes and support, electronic data exchange, financial incentives, and physicians' attitudes.

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

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

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

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

Difficult complementary changes and inadequate support. EMR hardware and software cannot simply be used "out of the box." Instead, physician practices must carry out many complex, costly, and time-consuming activities to "complement" the EMR product. Across industries, such complementary changes have been found to be critical for generating benefits from new technology. These complementary changes exact a great deal of time from physicians for months or even years after implementation. All physicians spent substantial time customizing their own visitor disease-specific electronic forms and documentation shortcuts to speed visit documentation. Moreover, physicians had to redesign their workflow (how they worked in the exam room) and office workflow (who did what tasks).

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

Lack of incentives. EMR use could be increased through financial rewards for quality improvement and for public reporting of multiple measures of quality performance.

Physicians' attitudes. Many physicians would be unwilling to bear financial and time costs in order to implement EMRs.

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

complete data exchange, many physicians interviewed in the US used only a fraction of available EMR capabilities and generated only a fraction of potential quality and financial benefits.

Possible approaches to overcome challenges and barriers faced with EMRs

Challenges are being addressed in three problem areas: (1) the understandability of data, (2) the facilitation of data entry, and (3) the improvement of data presentation.

1) How to enhance the understandability of data?

Natural prose is the typical way to express ones observations and thoughts. It does not guarantee, however, that the reader will understand this information exactly as it was meant by the author. The only way to reach unambiguous understandability of medical narratives is to store them as controlled expressions, with the help of a controlled vocabulary. The advantages of unambiguous understandability have been emphasized repeatedly. It would facilitate the exchange of medical data between health-care providers, enable context-dependent decision support, make the medical record accessible for statistical analyses, etc... On the other hand, coding medical narratives has also an associated cost: the inevitable loss of nuance and of the ability to deal with the unexpected. This makes fully coded medical narratives less flexible and expressive than free-text narratives, a limitation that is most felt when supporting medical reasoning at the point of care.

2) How to facilitate the entry of data?

Some years ago, the reluctance of physicians to record medical narratives in direct interaction with the computer was recognized as a major impediment for the acceptance and use of EMR-systems. Future technical solutions were suggested, e.g., the use of hand-held computers and input devices other than keyboard, such as techniques for voice recognition. The entry of medical narratives for storage as controlled expressions faces some specific problems. The challenge here is, how to trade-off maximal control (to assure the quality of input) against maximal flexibility (to accommodate the individual patient case). Three methods have been employed. The oldest method is to guide data entry by the use of static, predefined encounter-forms, either on paper or on screen. This way of data entry is suitable for restricted, well-defined medical sub-domains with a predictable, patient-independent, pattern of information needs (e.g., nephrology, orthopedic surgery). In other medical domains, the pattern of data entry is less predictable beforehand (e.g., general internal medicine). This requires a more dynamic type of data entry in which the context of previously recorded information has to determine the options for further data entry. Such support is realized by providing accommodative entry forms or menu options, displaying only those terms that make sensible expressions in combination with previous input. The combination of free-text data entry and natural language processing for obtaining controlled expressions is the most flexible solution. Medical narratives are stored provisionally as free text, while the conversion to controlled expressions is postponed to a later phase. The experience with this method is growing rapidly and the quality of generated data is carefully monitored. However, as long as the conversion into controlled expressions does not take place immediately or soon after data entry, it is not possible to generate and use on-line reminders and alerts.

3) How to improve the presentation of data?

The entry and storage of medical narratives cannot be a goal as such. It is a necessary prerequisite for the many uses of these data. The primary function of the medical record is to support direct medical practice, which requires that the physician should be able to access all the information required quickly. We encountered only a few studies of the presentation of information medical narratives. From the description of many systems, three types of measures were taken to improve the accessibility of medical narratives:

(a) Presentation of medical narratives as fluent prose to facilitate reading. Many EMR-systems present their narratives in fluent prose, even if they have to generate it from coded data.

(b) Optimization of the screen design by the use of fixed-position cues. Few studies have indicated the added value of fixed-position cues to guide the physician when searching through the mass of data. The user-interface should support paging rather than scrolling panels, static rather than dynamic (context-sensitive) selections of options and data items, and linearly structured text rather than a labyrinth of hypertext links. In short, for presenting medical narratives the interface should be simple and stable. It should be noted, that the need for fixed-position cues seems contrary to the need for accommodative forms and menus, which are used to support dynamic data entry.

(c) Imposing a searching structure on medical narratives. Important principles for the organization of medical narratives were proposed in the problem-oriented and time-oriented medical records. Although these principles also affect the entry and storage of data, their primary purpose was to facilitate the retrieval of information. In the problem-oriented record, the progress report is divided into problem-related sections, and each progress note is partitioned into SOAP-sections. In the time-oriented record, medical history and physical examination are partitioned into paragraphs corresponding with separate observations

and the evolution of medical data over time is displayed in flow sheets. Progress notes, in this case, do not contain observations any more but only assessment and plan. A combination of problem- and time-oriented principles has been realized in a problem-oriented flow sheet, which displays the evolution of problem-related data over time, and which is commonly used in most operational, `classical', systems. The searching structure of medical narratives has two aspects: the granularity of the paragraphs in which these parts are divided and the way in which these paragraphs are related to one another, i.e., the perspectives from which these paragraphs can be accessed.

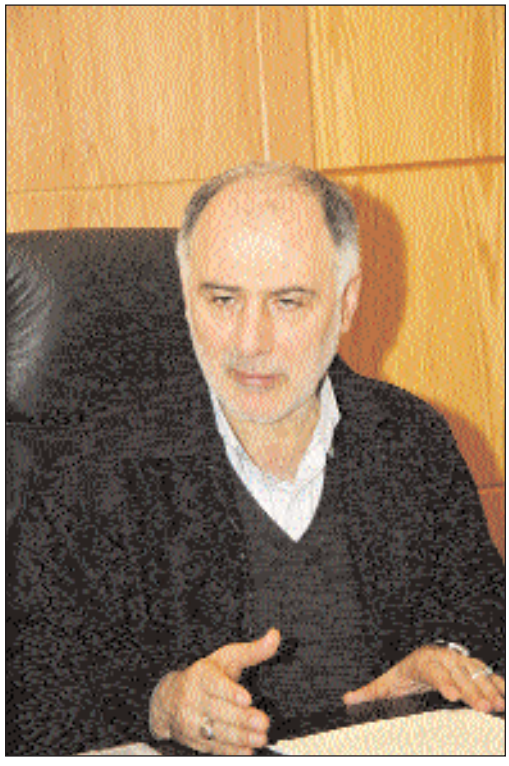
Conclusion

Although the adoption of EMR is not low-cost or easy to implement, EMRs have been found to contribute to a reduction in mortality, medical complications, and costs. In addition, they are important sources of data for medical and public health research.

Proper implementation of EMR has the following major requirements:

1. The ability to capture all physician gathered information in order to have a complete comprehensive medical record
2. The identification of a minimum number of variables required to assess quality and outcome of care.
3. Adequate training of healthcare providers on the EMR system.
4. Securing confidentiality and privacy of the patients' data.

FNEISH: Establishing the facultative insurance plan was a hasty not well studied decision.



The Minister of labor declared that there is a decision taken by the government not to allow the use of the funds allocated to one branch in the NSSF to pay the debt of another branch. According to him, establishing the facultative Insurance Plan was not based on any scientific data. Consequently, it was not a surprise seeing this branch in great debt. This branch has to close as quickly as possible and to transfer its beneficiaries to the Ministry of Public health. Any other approach would be only a temporary solution. His Excellency defended the project law on Retirement and Social Security. At the same time, he did not deny the presence of corruption in the management of the NSSF like in many administrations in the government, employees practice a lot of manipulations and show laziness in fulfilling their jobs. He supported the request of the hospitals to raise the fees of medical services stressing on the need to reorganize and reactivate the NSSF.