

EHR: A Step to Quality Care

How will we know if EHRs are truly delivering?



Viewpoint Paper



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The electronic health record (EHR) holds promise to improve the quality of healthcare and lower care costs. To determine whether or not EHRs actually help meet these goals, providers and payers need the tools, particularly the right data, to measure success. HP and Mayo Clinic explore what it takes to get a true picture of EHR effectiveness.

Introduction

The healthcare industry is working to establish and gain agreement on appropriate metrics and standards for electronic health records. Although few best practices have emerged for implementing an EHR system, the concept of electronic health records is here to stay in the marketplace.

As the industry works toward standards and consensus regarding specific quality and cost metrics, it is important to understand the business and technical challenges of extracting information from existing structured and unstructured data sources. This capability will be a fundamental requirement for implementing the ultimate set of standards and guidelines.

In this viewpoint paper, HP and Mayo Clinic discuss issues related to implementing EHRs to improve care quality and lower cost, with a focus on the role of data. The paper will briefly discuss the nature of quality, the types of metrics under consideration, and the issues involved in determining the right set. This document will also examine methods and technologies for extracting and retrieving data in a format that can be used to compute EHR performance metrics, and offers steps organizations can take today as EHR development advances.

Defining quality

Quality has been the focus of dedicated groups within U.S. healthcare for decades. Today, a number of national organizations and governmental agencies are pursuing the cause of quality and patient safety.

Quality can be difficult to define comprehensively. At finer levels of detail, it is often just a matter of opinion.

At the intersection of healthcare and information technology—specifically electronic health records and health information exchanges—quality is determined by defined metrics. These metrics are collected, analyzed, and reported to drive improvements and decrease variation in healthcare delivery.

However quality is defined, a companion concept used to judge the usefulness of a product or service is “value.” Consumers use the cost-value equation in personal purchase decisions every day. “If I spend money to purchase this product (or service), is it worth what it will cost me?”

In assessing value and cost, a paradox constrains healthcare: Consumers and providers want the highest “quality” in care (no matter the cost), while payers, employers and other purchasers demand fiscal responsibility (often perceived as inhibiting quality). The ultimate value decision—Is it worth the cost?—is extraordinarily difficult in healthcare, as it deals with a human life.

Any discussion of the benefits and value of EHRs and health information exchanges in improving U.S. healthcare quality must address the concerns of patients, providers, payers, and ultimately the country as a whole. The formula for a standard quality-improvement process in healthcare organizations has long been to define the metrics, collect and analyze the data, and then report results. Defining the metrics is a challenging first step. Data collection then presents other difficulties.

Challenges in data collection

In the era of paper records, which persists today, data on defined metrics must be collected through chart abstraction. This involves time-consuming human review of records and recording data into a usable format (previously other paper formats, now electronic spreadsheets). Collection usually involves reading handwritten notes, interpreting the notes and converting them into usable data, and entering data into appropriate tools. Each of these steps contributes an element of error to the process and adds to personnel time and collection costs.

After the data are collected into a spreadsheet or database, analysis and reporting of results are relatively easy. But, as in any research, the results—information and knowledge—are only as good as the data.

The value of information on quality obtained using this classical method was often seen as marginal, because the cost to obtain the data was often excessive. This lower perceived value reduces the motivation to undertake the process and discounts the results.

On the other hand, if the metrics have been determined and the desired data are already in electronic format, as is possible in an EHR or a database, the error-prone steps of the historical method are eliminated. The data can even be auto-populated into the appropriate spreadsheet or analysis tool. This “real-time” data availability can result in “on-demand” information. Such information can be much more valuable to a quality improvement initiative, because intervention can occur proximate to the event being improved. In fact, decision support can be provided before an order is given or an act is performed.

Nearly all of the steps of the quality-improvement process can be facilitated by easier electronic access to healthcare data, and EHRs represent the best source of this data. Quality and patient safety improvement follow from this facilitated process. Therefore, implementing an EHR represents a core change necessary to effect this improvement.

Determining the right set of quality metrics

The healthcare industry is working to establish quality metrics. Notable examples include the National Quality Forum (NQF), a public-private partnership tasked to develop and implement a strategy for healthcare measurement and reporting to foster quality improvement. The NQF has undertaken the difficult first step in the quality journey—define the measurements. Completing and gaining consensus on measurements is fundamental to pursuing the next steps of collection, analysis, monitoring, and reporting.

As part of the effort to create standardized metrics, the Agency for Healthcare Research and Quality (AHRQ), in association with four other healthcare groups, has announced a landmark set of 26 standards the groups say should be part of all pay-for-performance initiatives. Although these recommendations are directed only at primary care, they represent a positive step toward consensus on how providers should practice medicine through agreed-upon, evidence-based quality measures.

Ideally, metrics should be easily collectable and include quantifiable, objective characteristics. They must be reliable, credible, and conveyable in electronic standard format whenever possible. Whereas quality metrics in other industries are often easily created to measure success, metrics in medicine often have to deal with complex patients with many illnesses and providers with multiple conflicting interests.

In creating a metric, an independent assessment is needed to protect against opportunistic performance measures. For example, if a cardiologist recommends screening echocardiograms for every patient after a myocardial infarction, is that physician motivated by sound medical judgment or by self-interested promotion? Also, this system might favor providers who refuse to treat the sickest individuals, closing their practice to vulnerable patient groups to maximize financial incentives.

If a payer is going to enforce a metric upon a practice, it is important to make sure what is implemented actually makes a difference in patients' lives. Generally, medicine has been practiced through consensus opinion of the right treatment. The last several years have seen a push for evidence-based medicine, which focuses on creating practice guidelines based on scientifically corroborated signs of care improvement.

But finding such signs is a challenge. For example, there are limitations to solely relying on office data capture to rate a practitioner.

Claims data often ignore missed appointments. So if information for a metric is based solely on claims, most of the medical story might be missed. One common quality metric is the recommendation of flu shots for patients with asthma. An office can call a

patient with asthma, make an appointment and send a reminder; however, that doesn't guarantee the patient will get the shot. Some patients may have a moral objection to flu shots, a fact perhaps not available from studying the data.

In short, office informational technology isn't universally accepted. So it shouldn't be used universally to quantify goals.

Statistical limitations also need to be considered when evaluating performance, as different practices might have different amounts of data. Is 50% compliance by two patients the same as 50% compliance by 2,000 patients? And should either practice be reimbursed more for the same numbers?

How electronic records can influence quality

Are electronic collection, storage, and display of healthcare data and information better than using paper? Does electronic collection do a better job of advancing healthcare quality and patient safety? If it can, at what cost? Such questions are at the forefront of deciding if, when, and how to implement an EHR information system in facilities, ambulatory settings, and other locations.

EHRs certainly hold promise. For example, they can be used to identify individuals in need of preventive services, the benefits of which can be substantial. One study found that increased influenza vaccinations could reduce U.S. healthcare costs between \$134 million and \$327 million, while avoiding 5,200 to 11,700 deaths. Colorectal cancer screening could save \$1.7 to \$7.2 billion and 17,000 to 38,000 lives.

To date, most U.S. hospitals have implemented (11%) or partially implemented (57%) an electronic medical record (EMR), a tool more narrowly focused on medical intervention than EHRs are envisioned to be. The EMR includes results retrieval, order entry, and decision support. In the ambulatory area, approximately 20% of physician offices have some form of EMR, including documentation and coding/billing functionality. Most of these inpatient and outpatient systems are stand-alone. Integration or interoperability between them is rudimentary at best.

An often-mentioned advantage of the EMR is that the electronic record is legible, whereas a handwritten record may be difficult to read. The illegibility of the paper record alone can cause errors, quality issues, and difficulty in obtaining data for analysis. Therefore, improving data collection and subsequent analysis are typically first steps in quality-improvement initiatives.

Along with legibility, improved information availability is a distinct advantage of electronic systems over paper records. Information in a paper record is usually available only as a single instance and is, therefore, “not available” to view other than at the current location of the record. For example, a nurse on the ward cannot see the record if it has been sent with the patient to another location in the hospital.

Conversely, an electronic record can exist in multiple instances simultaneously. For example, the nurse can view the record on the ward at the same time the doctor views it in his office and the radiology technician views it in the radiology suite. Making such information available to all appropriate personnel at all times provides quality and efficiency benefits.

The comprehensive nature of the electronic record is also a distinct advantage. With paper records, care providers often make notes in different locations. The doctor makes a note in a chart but sends different information in the form of a letter to the referring physician. Meanwhile, a physical therapist makes notes in a shadow record and another note in the actual hospital chart.

With the electronic record, on the other hand, collection can be the epitome of “enter once, use many times.” A care provider makes an entry, and can then access that entry as well as those of any other care providers at any time. Proper role-based access can even shield sensitive information while keeping it part of the comprehensive record.

This comprehensive nature of the electronic record leads to the next advantage: the ability to automatically collect metrics that can be used to track activities and quality and to facilitate performance improvement. Because all data pertinent to the patient is included in the electronic record, rules can be implemented to collect data designated to represent quality, performance, or cost factors.

In the paper world, such data would have to be manually extracted (abstracted) from the record and inserted into an automated tool prior to analysis. This manual process is cost intensive in time and personnel, which results in less data collection, less analysis, and slower or less-effective process and quality improvements.

With automated data collection, a reverse issue of “data overload” could arise; however, being able to select data for analysis from numerous data sets during a particular period is better than having less access.

Data available to the clinician in the electronic record at the time of order entry is difficult to duplicate in a paper record. Having this data on the same screen when placing orders is a key to preventing order errors, a decision aid much preferable to alerts presented only after the fact.

Although “before-the-fact” access to information that will influence decisions is helpful, it cannot always urge or direct proper quality order decisions. It is also more difficult to influence orders that go unfulfilled, such as when a patient neglects to have routine cholesterol checks.

Therefore, there is still a role for decision support driven by alerts displayed to the user. These alerts, which most often appear in an “after-the-fact” fashion through a pop-up screen, can prevent further action until addressed, altered, or bypassed. The automated collection of data, sound metrics, and the comprehensive nature of the electronic record all combine to make this functionality possible within an EHR.

“Automated quality monitoring” reports provide a function similar to automated alerts. These pre-designed standard reports most often use aggregated data from numerous patients to track particular aspects of the healthcare process, as represented by externally reporting measures such as AHRQ Quality Indicators and Healthcare Effectiveness Data and Information Set (HEDIS).

Manual extraction and collection of these data from paper record systems significantly strains administrative facilities. Thus, the ability to automate this data collection and submission process is a significant advantage of an EHR.

After the robust data sets are available from the system, a unique situation unfolds that can create novel approaches to quality and cost performance. For example, linkage of diverse databases and application of analytical algorithms can alert a clinician about a case of anthrax at a neighboring hospital, provide real-time notification of medication recalls with explanation and alternatives, or identify a common factor linking patients with nosocomial infections.

Data infrastructure—The foundation of performance measurement

Sound data structure forms the basis for individual or population health improvement efforts. These initiatives can include medical management, transparency reporting, and pay for performance.

Today, there is a preponderance of unstructured information in most U.S. practice settings. Most clinical documentation is stored as “free text” rather than as structured codified data. Free text, the end result of dictation and transcription, is a rich information source for medical professionals reading the health record.

When a single medical record needs to be reviewed, for example in caring for an individual patient, prose sentences and paragraphs are resources rather than obstacles. However, when hundreds or thousands of medical records must be reviewed to find specific facts (for example, for research, population-based care, or quality improvement), manual data abstraction from volumes of free text becomes time consuming. Manual data abstraction costs include reviewer time; chart logistics (such as availability, handling and storage); data identification, transcription and representation errors; sample size reductions; and study design impacts.

EHR systems that store free text begin to address these logistical problems, but they do little to make data available in a computer-usable form. What is needed is a way to automatically extract computer-usable information from free text.

Three basic methodologies exist to accomplish this:

- String matching
- Natural language processing
- Concept-based indexing

String matching, also called key word searching, is a simple, often effective approach to detect various medical terms. For example, simple key word searches for “trigger words” such as “complication,” “mental status” or “rash”, have been used with moderate success in the identification of adverse events.

However, string matching does not identify synonyms or closely related terms. For example, “myocardial infarction” and “heart attack” express the same underlying concept, but simple string searching could not identify both terms in a single search. Identifying and indexing underlying concepts is a much more complex process.

Natural language processing (NLP) uses computer programs capable of scanning text documents and applying syntactic and semantic rules to extract information. NLP attempts to address the complexity of reading and comprehension. NLP systems require a text parser, which segments a text into words and parts of speech, and domain knowledge rules, which link and combine extracted words and parts of speech to infer higher-level concepts.

Natural language processing techniques have been applied to areas such as imaging reports, discharge summaries, general medical texts, clinic-specific notes, pathology reports, adverse event detection, drug and gene data medical curriculum, and provider order entry. Natural language processing holds great promise, but has proved difficult to implement broadly in practice.

Concept-based indexing utilizes large-scale, organized collections of health concepts known as ontologies to identify and cluster similar findings within free text. One such ontology, SNOMED CT™, comprises a set of uniquely identified concepts, synonyms, hierarchical relations, and other facts that define and interrelate terms. In SNOMED CT, the concept “myocardial infarction” is identified by the code “22298006” and has the synonyms “heart attack,” “infarction of heart” and “cardiac infarction.”

Search engines such as the National Library of Medicine’s (NLM) PubMed use concept-based indexing to satisfy information requests. Concept-based indexing also has been applied to radiology reports, discharge summaries, health related websites, clinical diagnoses, and medical narratives.

Data extraction for quality measurement

Electronic quality (eQuality) monitoring solutions based on a core data infrastructure can equip healthcare organizations to understand in near-real time the quality of care they are providing. The ability to extract this data can underlie a continuous quality improvement program, in effect providing the basis

for a strategic approach to quality. Eventually, clinical reminders provided to clinicians based on analyzing past records or newly typed records can help clinicians improve their performance on established clinical quality-performance measures.

Coding data in ontologies such as SNOMED-CT enables coordination of data across quality improvement projects toward the goal of interoperability and data sharing. This important data infrastructure helps in determining which strategies can minimize the risk of a bad outcome (for example, a missed screening) or increased healthcare expenditure (for example, an increased hospital readmission rate), both of which are potential consequences of not following accepted healthcare quality criteria.

The increasing availability of quality metrics will create the need for systems to support information gathering from the clinical record to support the data gathering and analysis needs of quality researchers. Therefore, the eQuality data infrastructure should be built to easily incorporate new methodologies and data sources.

Implementing an automated eQuality methodology supports planning and implementation of broad-based solutions to monitor and support the quality management and improvement efforts of local and national healthcare organizations. In addition, patients want assurance that interventions are in place to help clinicians practice safe and effective medicine.

It is important to begin gathering a broad base of data encoded using the same underlying granular clinical reference terminology. This supports developing the data infrastructure necessary to ask questions of the record, in combination with specialized datasets to assess healthcare organizations' adherence to approved quality criteria. This data infrastructure supports the interventions needed to promote safer and more effective medical practice.

Automated eQuality evaluation is fast, requiring about a minute per record, and is less expensive than nurse abstraction. The availability of a fast and inexpensive mechanism for quality monitoring will greatly expand the ability to perform quality monitoring to improve healthcare quality.

To date, there are no reliable comprehensive automated methods for monitoring quality. HP proposes the creation and evaluation of a rule set for electronic quality monitoring.

The American Health Information Community (AHIC), led by Secretary of Health and Human Services Michael O. Leavitt, has developed a use case for electronic quality monitoring, and has asked the Health Information Technology Standards Panel to create eQuality interoperability specifications. This activity has been delegated to the Population Health Technical Committee, which is currently accepting comment. The specifications will be provided to the Certification Commission on Health Information Technology (CCHIT) as substrate mechanisms for certifying EHRs. The goal is to help improve clinical outcomes, improve safety in the practice of medicine, and reduce cost by eliminating unnecessary services.

Next steps to consider

If progress is to occur, organizations and individuals must be committed to change. This necessitates changes in both macro- and micro-environments.

Organizations need the ability to enforce, encourage, or facilitate change. Individuals must be willing to accept and implement change. Companies providing the required technology must be adept at developing EHR systems that incorporate previously difficult-to-obtain clinical information into a useful context that augments clinical workflow.

Physician practices, health maintenance organizations and other payer organizations, and governmental agencies must lead these changes. These groups own, contribute to, and use the information. Therefore, they should also be leading efforts to ensure this information is available to providers at the point of care—the right information to the right person at the right time in the right place.

Conclusion—Prepare now for EHRs

Medicine, healthcare, and information technology are elements of a world in which more and more office records and health information are being made available in electronic format. This trend opens the door to endless uses for information captured in EHRs—from biosurveillance to decision support to pay-for-performance systems. Organizations throughout the healthcare industry can benefit from understanding the role of metrics and the options for data extraction. Such knowledge will help equip them to implement a data infrastructure that supports the use of electronic information to improve patient care and lower costs.

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In a collaborative effort, members of the HP Electronic Health Record Centre of Excellence also contributed to this Viewpoint paper.



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