Electronic Health Records (EHR)

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ABSTRACT

Electronic Health Records are electronic versions of patients' healthcare records. An electronic health record gathers, creates, and stores the health record electronically. The electronic health record has been slow to be adopted by healthcare providers. The federal government has recently passed legislation requiring the use of electronic records or face monetary penalties. The electronic health record will improve clinical documentation, quality, healthcare utilization tracking, billing and coding, and make health records portable. The core components of an electronic health record include administrative functions, computerized physician order entry, lab systems, radiology systems, pharmacy systems, and clinical documentation. HL7 is the standard communication protocol technology that an electronic health record utilizes. Implementation of software, hardware, and IT networks are important for a successful electronic health record project. The benefits of an electronic health record include a gain in healthcare efficiencies, large gains in quality and safety, and lower healthcare costs for consumers. Electronic health record challenges include costly software packages, system security, patient confidentiality, and unknown future government regulations. Future technologies for electronic health records include bar coding, radio-frequency identification, and speech recognition.

Keywords: Electronic; Health Records; Bar Coding; Speech Recognition; Patient Confidentiality

INTRODUCTION

The United States Healthcare system is a very complex mix of federal and state laws, regulations, and rules. Combine this with thousands of private insurance companies that all have their own rules and regulations, and healthcare records get complicated. Needless to say, managers in today's healthcare system are inundated with very complex external rules, not to mention the pressures from competition and the ability to deliver quality healthcare for their patients. This volatile healthcare environment has brought to the forefront the importance of Electronic Health Records.

Electronic Health Records (EHR's) are poised to change and revolutionize the current healthcare system in the United States. The adoption of Electronic Health Records has been slow to catch on with healthcare providers, but the United States government has recently passed legislation that requires all healthcare providers to adopt and use Electronic Health Records by 2015.

DEFINITION OF AN ELECTRONIC HEALTH RECORD

Electronic Health Records (EHR's) are also widely known as Electronic Medical Records (EMR's) and many people use the term interchangeably (Torrey, 2011). An EHR is an electronic version of a patient's health record that was historically created, used, and stored in a paper chart. A patient EHR is created, managed, and held by a healthcare organization (Roman, 2009). Only healthcare professionals who are involved in a patient's care can access and use an electronic health record (Roman, 2009). A Personal Health Record (PHR) is a health record that a patient controls and can change (Roman, 2009). EHR's are protected under a federal law called Health Insurance Portability and Accountability Act (HIPAA); PHR's are not covered under HIPAA (Roman, 2011).

In a 2006 National Institute of Health report, the Health Information Management Systems Society (HIMSS) adopted this official definition of an EHR:

The Electronic Health Record (EHR) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. The EHR automates and streamlines the clinician's workflow. The EHR has the ability to generate a complete record of a clinical patient encounter, as well as supporting other care-related activities directly or indirectly via interface, including evidence-based decision support, quality management, and outcome's reporting. (p. 1)

This EHR is created and used by physicians in their clinics and by hospitals and other healthcare facilities (History of the Electronic Medical Record System, 2012).

HISTORY OF ELECTRONIC HEALTH RECORDS

Medical records have been around since the advent of healthcare. In the very early days, the medical record was used to record the disease and the probable cause of that disease (National Institutes of Health, 2006). In the early part of the twentieth-century, medical records were kept on three by five cards (Hufford, 1999). The 1960's and 1970's saw a rapidly changing era in healthcare when the federal government passed legislation that established Medicare (Hufford, 1999). At the same time, other third-party payers entered the healthcare market, healthcare lawsuits starting immerging, healthcare quality became important, and the government passed more stringent laws regulating the industry (Hufford, 1999). This is the time frame when medical records really became a necessity in healthcare, and the first electronic health record appeared (History of the Electronic Medical Record, n.d.)

The use of electronic health records was slow to catch on with physicians and healthcare providers. It was estimated in 2009 that less than 8% of hospitals had an electronic health record (Ford, Menachemi, Huerta, Yu, 2010). Some of the reasons for the slow adoption of EHR's are the immense cost of the systems, lack of national standards, and because healthcare providers spend an immense amount of time and money complying with government regulations and patient privacy requirements (Morissette, 2011).

In 2005, President Bush gave a speech at the National Institutes of Health, and he said this about today's healthcare system: "We've got a 21st century medical practice but a 19thcentury paperwork system." He also went on to add, "Electronic medical records are going to be one of the great innovations in medicine" (ehrCentralHome, 2012).

In 2009, Congress passed the American Recovery and Investment Act of 2009. In this act, the US government offers incentives to all healthcare providers to implement Electronic Health Records (EHR) to replace paper based systems. Healthcare systems that successfully implement an EHR system will make their facilities eligible for bonus incentive payments and penalizes facilities that do not implement EHRtechnology (Information Week, 2009).Under this law, hospitals and physicians will get incentive payments from Medicare and Medicaid if they become meaningful users of health information by 2014 (AHA News, 2010). The federal government plans to spend $27 billion in incentive payments to help get hospitals and physicians using and sharing EHR's (cms.gov, 2010). The meaningful use requirements are core criteria that are to be implemented in three stages. This meaningful use is the standards that the government has spelled out as a minimum for healthcare providers to be able to receive incentive payments (Jarousse, 2010). The meaningful use criteria require that the EHR must meet fourteen core requirements and an additional five objectives from a list of ten (Jarousse, 2010). The requirements include quality data reporting, computerized physician order entry, and electronic pharmacy orders. Healthcare providers must also be able to share the EHR with other healthcare providers electronically.

CLINICAL AND ADMINISTRATIVE NEED FOR AN HER

There are many clinical and administrative needs that a hospital or a physician's office requires an EHR to be able to perform. The EHR will be the central data base of information that will drive patient documentation, billing, quality, and clinical decision support.

Patient Documentation

The EHR must be able to document the complete face-to-face encounter between a doctor and patient (Hufford, 1999). This documentation process must be easy and fast as a doctor's time is valuable and the physician generally has a lot of patients to see. Items that are included in the patient EHR documentation are doctor's notes, patient history, pharmacy prescriptions, physician orders, laboratory results, x-rays and radiography reports, and other medical interventions (Hufford, 1999).

Quality Assurance

The EHR will enable hospitals and physicians the ability to track the information they need to be in compliance with insurance companies and federal regulations (Hufford, 1999). The EHR serves as a central data base where physician orders for lab, x-rays, and other tests are stored. This information can be tracked to see if the physician is ordering appropriate tests for the patient's condition (Hufford, 1999). It also allows healthcare providers to report quality data to the federal government.

Track Patient Utilization and Healthcare Costs

Healthcare facilities spend a great deal of time tracking patient statistics and utilization such as days of care, number of tests, number of patient visits, and almost every service that is available in a hospital. This data is used to track utilization trends, financial reporting and for budgeting and resource allocation. An EHR can streamline these processes and supply accurate and real-time data. These utilization statistics, when paired with financial data, can be used to track healthcare costs and improve efficiencies (Hufford, 1999).

Health Record Portability

Currently, almost all health records are paper based in charts. This makes the transfer of a patient's chart a burdensome undertaking. When a patient move or sees another healthcare physician, a patient must have their chart sent to the new location. This is a large undertaking as the chart has to be photocopied and sent to the new place and is oftentimes incomplete (Hufford, 1999). The original chart is the property of the hospital and has to remain in their custody. An EHR takes care of this problem as the patient record can be sent anywhere the patient may be.

Billing and Coding

Accurate billing and coding are very important in healthcare today. Medicare and other commercial insurance companies require accurate documentation of the patient encounter (Hufford, 1999). Proper medical coding accurately describes the health problem of the patient. The medical coding drives the patient bill. So inaccurate coding equals inaccurate billing. These inaccuracies can leave a healthcare provider facing compliance problems with insurance companies and Medicare, which could lead to fines for fraud (Hufford, 1999). EHR technology helps with proper documentation and has diagnosis databases built in to assist coders and billers to produce accurate healthcare claims.

Patient Confidentiality

In healthcare, patient confidentiality is at the forefront of everything that is done. The Health Insurance Portability and Accountability Act (HIPAA) is a very strict law that requires healthcare providers to protect patient's confidentiality and security of their patient medical record or face stiff federal penalties. EHR's must have in depth security systems built in to them to protect unauthorized access to a patient's medical record. EHR's utilize passwords, bio-metrics, and network firewall security; this protects unauthorized access to a patient's record. It is hotly debated whether electronic health records or paper records are more secure (Hufford, 1999). With an electronic health record, auditors can see if an unauthorized employee accessed the chart as most EHR's time and date stamp the record whenever an employee accesses a record. Paper records are not able to be audited in this fashion.

ELECTRONIC HEALTH RECORDS APPLICATIONS

Administrative Applications

Electronic Health Records all have to have some level of administrative applications. The administrative application is the part of the EHR that includes patient registration (Electronic Health Records Overview, 2006). The patient registration is where the patient demographics are recorded on the health record and this includes name, age, sex, address, contact information, insurance information, employer, and patient's chief complaint (Electronic Health Records Overview, 2006). The registration system assigns the patient a unique patient ID number that is only used by a particular healthcare provider.

Computerized Physician Order Entry

A requirement for all EHR's is the application called computerized physician order entry or CPOE. CPOE is an application used by physicians to order laboratory, pharmacy, radiology services, and other physician orders (Electronic Health Records Overview, 2006). CPOE holds great advantages to healthcare providers by allowing physicians to electronically order tests without having to write these orders on paper forms. This ensures accuracy of the orders and notifies the appropriate area that the patient will be arriving. It also lets healthcare professionals know what tests need to be performed. CPOE functions are also a provision of the government's meaningful use requirements (Jarousse, 2010).

Laboratory Systems

Most laboratories in healthcare settings already use lab information systems (LIS), which are usually interfaced into the EHR for patient data and testing results exchange. Almost all the lab analyzers and lab testing equipment interface into the LIS. Lab information systems also contain lab orders, lab results, schedules, and other administrative functions (Electronic Health Records Overview, 2006).

Radiology Systems

Radiology information systems (RIS) are another department with information systems that interface with the EHR. Radiology information systems, like lab systems, contain patient information, the radiology orders, test results, schedules and image tracking. Radiology information systems also are used with picture archiving communications systems (PACS). This is the system that manages and stores the digital radiography image (Electronic Health Records Overview, 2006). Digital radiology images are able to be shared and viewed within the EHR application.

Clinical Documentation

Clinical documentation is a large part of an EHR, as physicians, nurses, and other healthcare professionals document an immense amount of information on a patient. This information ranges from clinical note's clinical reports, assessments, and medication administration records (MAR) (Electronic Health Records Overview, 2006). Other components of clinical documentation include vital signs, discharge summaries, transcription documents, and utilization management (Electronic Health Records Overview, 2006).

Pharmacy Systems

Pharmacies in large hospitals are highly automated, using robots to fill prescriptions and use electronically integrated med carts (Helton, Langabeer, DelliFraine, Hsu, 2012). These standalone pharmacy systems are another system that is interfaced with an EHR. Hospital pharmacies also utilize bar coding on medications and patients to ensure right dose, right patient, right time, drug administration. It is vitally important that pharmacy systems interface into the EHR as this is where drug interactions and drug allergies are tracked within an EHR. Drug errors in healthcare are the leading cause of medical errors that cause patient harm. An important component of EHR's pharmacy applications is e-prescribing (Roman, 2009). One source of medication errors is doctor's sloppy

handwriting on prescriptions and drug orders. E-prescribing eliminates this problem by sending the prescription electronically to the retail pharmacy or the hospital's pharmacy. EHR's are a great tool to help reduce or eliminate drug errors.

Other Applications

Many EHR's contain other applications that help make a more complete record. An important application is clinical decision support (Helton, Langabeer, DelliFraine, Hsu, 2012). Clinical decision support systems help physicians, and nurses choose the correct course of action on a particular patient and his/her condition. Another important application that is part of the meaningful use rules is quality management systems (Helton, Langabeer, DelliFraine, Hsu, 2012). Quality management systems track patient outcomes and give healthcare providers tools to report the data to federal entities.

HEALTHCARE EHR STANDARDS

One major reason that EHR's were slow to be adopted by healthcare was the lack of industry standards. The health information systems had a difficult time communicating with one another. The federal government helped this along by setting the EHR messaging standard in the United States as Health Level 7 or HL7 (Electronic Health Records Overview, 2006). This HL7 standard allows clinical information systems to communicate with one another using encoded data exchange (Electronic Health Records Overview, 2006). HL7 will also be the standard for healthcare providers to share patient records via the electronic health information exchanges with other healthcare entities (HL7 Standards Product Brief, 2012).

Other common standards that are integrated into EHR's are Current Procedure Terminology (CPT), International Classification of Disease (ICD), and Diagnosis-Related Groups (DRG) (Electronic Health Records Overview, 2006). These are medical coding standards and are used for billing and are contained within databases in the EHR. EHR's help healthcare workers properly select the appropriate codes to be billed on the patient encounter. These codes will also be used to capture utilization statistics on patient encounters to help measure quality.

EHR SOFTWARE STRATEGIES

There are a couple of software strategies for implementing an EHR in a healthcare setting. The first strategy is to have a hospital's IT staff develop and write their own EMR software systems. Many hospitals have proprietary hospital information legacy systems that were developed on their own. This strategy takes a lot of IT personnel and expertise to accomplish. The second strategy is to purchase off-the-shelf software packages and customize it to fit the healthcare provider's needs (Ford, Menachemi, Huerta, Yu, 2010).

When purchasing off-the-shelf software packages for EHR implementation, there are three strategies that healthcare providers have taken. The first strategy is for a healthcare provider to choose a single EHR vendor and install a company enterprise system (Ford, Menachemi, Huerta, Yu, 2010). This single vendor strategy is a very effective strategy that replaces all legacy systems with a new information system that shares company wide data and includes financial, billing, human resources, and material management systems as well (Ford, Menachemi, Huerta, Yu, 2010). This strategy is one of the easier EHR systems to install and implement, but it is also the most expensive route.

The second software strategy is called a best-of-breed strategy (Ford, Menachemi, Huerta, Yu, 2010). Best-of-breed strategy analyzes many software vendors and picks the best components from many vendors and may include some legacy systems (Ford, Menachemi, Huerta, Yu, 2010). This strategy ensures that the very best information system software components are used to build a quality system and create a competitive advantage (Ford, Menachemi, Huerta, Yu, 2010). This may be a great strategy to ensure the healthcare provider has the best systems available; it is also very labor-intensive to interface all the different software programs into an enterprise EHR.

The third software strategy is called a best-of-suite strategy (Ford, Menachemi, Huerta, Yu, 2010). This is a combination of the two previous strategies. In this strategy, the healthcare organization uses the EHR software as the core and interfaces and integrates other software and legacy systems into the EHR (Ford, Menachemi, Huerta, Yu, 2010). Some of these existing systems include human-resource systems, finance and billing, lab information systems, radiology information systems, and admission systems. One advantage of this strategy is the total cost of ownership is oftentimes less than the other strategies (Ford, Menachemi, Huerta, Yu, 2010).

Whatever software strategy a healthcare organization takes, it is imperative to implement the new EHR in a well-planned out manner. The first step would be to plan the project thoroughly and utilize Gantt charts and PERT charts to help manage the project and keep it on track and on budget. It is important to involve end users in the customization of the software as they are the ultimate users of the software. By involving the end users, it also builds buy in when it is time to go-live with the EHR. Testing of the EHR system is also very important to ensure that the system is working as expected (Ames, Ciotti, Mathis, 2011). It is also important for a healthcare organization to take their time to plan and implement the project correctly. Rushing the implementation could result in billing disruptions and problems with patient data (Ames, Ciotti, Mathis, 2011).

Other strategies for a successful EHR implementation include thorough testing of the software before going live (Ames, Ciotti, Mathis, 2011). Furthermore, all interfaces have to be tested to ensure data is flowing across the different information systems correctly. As the software is being readied for implementation, it is a good time to be training all end users on the new software applications (Ames, Ciotti, Mathis, 2011). This helps ensure a smoother go-live and project success.

HARDWARE AND NETWORKING

Network

Hardware and networking considerations are important when implementing an EHR. The majority of EHR software runs on Microsoft OS servers or Linux/Unix systems (Underwood, 2011). The servers should utilize virtualization so that older legacy applications and the newer EHR software applications can run on the same server. The local area network (LAN) should be a combination of wired and wireless. The network should be secured using a firewall to keep intruders from hacking into the network. The LAN should also utilize priority data switches. These data switches prioritize data and improve network bandwidth performance by giving priority to certain data streams that are more important than other non-essential data streams. Remote or offsite locations would use high-speed Internet connections such as DSL, cable, fiber, or a dedicated T1 to connect to the LAN and the internet (Underwood, 2011).

It is important to have high-speed Internet as one of the provisions of the meaningful use requirement is that healthcare providers must be able to share a patient's EHR data among other providers and users. This exchange of data is done by having encrypted files sent to health information exchanges (Freeman, 2011). These health information exchanges are set up regionally and connect to all the area healthcare providers. This allows healthcare providers to share health information securely and efficiently (Underwood, 2011).

Hardware

Hardware requirements for running the EHR applications are largely dependent on the particular software vendor (Underwood, 2011). Some strategies are to place lap tops or desktops in every patient room (Underwood, 2011). This strategy concerns some physicians as they feel it interrupts the physician-patient interaction, and the patient may feel the doctor is more interested in the computer then listening to their concerns (Underwood, 2011). Other popular hardware devices include netbooks, convertible laptops, and mobile devices such as iPads or other tablet computers (Underwood, 2011). A strategy that some healthcare providers take for hardware needs is called COW's or computer on wheels. These COW's can be pushed from location to location. Another popular route for physicians is the ability to view the EHR on their smart phone (Underwood, 2011). Some popular smart phones that work well with EHR's are the iPhone and Blackberry devices.

BENEFITS OF AN HER

The benefits of a properly implemented EHR are numerous. The Institute of Medicine reported in November (2011): "When designed and used appropriately, health IT is expected to help improve the performance of health professionals, reduce operation/administrative costs and enhance patient safety" (Wiedemann, 2012). Other benefits include improved efficiencies, improved accuracy of health records, and records that are timely and available (Electronic Health Records Overview, 2006).

EHR's will also improve healthcare productivity. This is accomplished by efficiencies gained by the healthcare provider who will lower staffing levels and lower healthcare costs (Helton, Langabeer, DelliFraine, Hsu, 2012). EHR's allow clinical work processes to be re-engineered to make the work process more efficient. The other labor saving area in healthcare is that EHR's almost eliminate the need for medical transcriptionists (Alexis, 2012).

EHR's improve healthcare quality by reducing medical errors. The Society of Actuaries found in a 2008 study that: "measurable medical errors cost the U.S. $19.5 billion" (Wiedemann, 2012). EHR's, through better medical documentation and clinical decision support systems, can lower medical errors and reduce the cost of healthcare overall. E-prescribing also will help eliminate medical drug errors. The other great savings that will be gained by EHR's are the elimination of duplicate testing and exams done on patients (Golden, 2011).

Other benefits include the elimination of huge amounts of paper generated in creating and sharing of paper documents (Alexis, 2012). The use of EHR's will enable patients to have better access to their information and this will help get patients more involved in taking charge of their own healthcare (Golden, 2011).

EHR CHALLENGES

With all the benefits that EHR's bring to healthcare, there remain some challenges that must be addressed and overcome. The first challenge of an EHR is the immense cost of EHR systems (Gordon, 2012). EHR systems in large hospitals can run into the $15 million to $30 million range (Hufford, 1999). If a small hospital is not aligned with a larger hospital, the costs can be staggering and eat up a whole year's capital budget (Gordon, 2012).

The second challenge is, depending on the EHR system chosen, the EHR can lead to increased clinician documentation time. Some physicians and nurses are going to be resistant to change and will want to revert back to the old paper based systems (Hufford, 1999). Failure to change clinical processes while implementing an EHR can ruin any efficiency hoped to be gained by the investment.

Other challenges EHR system face include slow systems, either due to the software or to poor networking speeds, and system crashes that will stop all clinicians from being able to perform their work. Backup and redundancy systems have to be developed.

EHR system security is a large challenge that has to be addressed. Electronic medical records could become a huge target for hackers as medical records are rich in personal information (Featherly, 2011). Medical identity theft is becoming a bigger problem and the introduction of EHR's will perpetuate this issue (Featherly, 2011). EHR security and patient confidentiality are also covered under HIPAA rules and regulations and a whole host of precautions must be under taken to meet these privacy and security laws.

The last major challenge, for EHR's is the ability to meet the government's meaningful use rules. The meaningful use rules are substantial (Ford, Menachemi, Huerta, Yu, 2010). Stage one meaningful use rules include fourteen core requirements and a choice of five of ten optional measures (Jarousse, 2010). Stage two and stage three meaningful use rules have yet to be published by the federal government. This poses a huge unknown risk for healthcare providers because failure to meet the meaningful use criteria will result in reduced Medicare and Medicaid payments.

FUTURE OF EHR TECHNOLOGIES

The future of EHR technology is bright and there are already new technologies and uses of EHR data on the horizon. In time, when all healthcare providers have EHR technologies installed, in use, and are sharing data, the possibilities to improve care through better data collection and analysis will evolve. Health data will be able to be data-mined, and this will open up new opportunities to improve healthcare and lower costs (Miliard, 21012). Some healthcare experts agree that health data-mining will be used to predict potential patients who could develop chronic diseases (Fox, 2012). Another important use of health data collected in EHR's, is the federal government plans to collect health data and compare the best treatment options in order to develop best practices in the treatment of conditions and diseases (Fox, 2012). This collection of health data is called comparative effectiveness, and the government believes that this will reduce healthcare costs through the use of data mining and data analysis. Once EHR's become widely used, interoperability will increase and health data will be able to be shared across the healthcare continuum.

New technologies also are coming to the forefront and will enable healthcare providers to improve practice work flows and offer the opportunity to gain more efficiency. Bar coding is one technology that is used widely in healthcare today, mostly in larger facilities. The bar coding opportunities and uses will continue to grow. Some future applications include bar codes on patient wrist bands, medications, specimen collections, blood administration, and supplies (Zebra Technologies, 2010). Bar coding will help with patient tracking, will accurately identify the patient with clinical tests, and ensure safety in drug administration. Another technology that will someday come into use in healthcare is RFID (radio-frequency identification frequency identification) (Zebra Technologies, 2010). RFID technology will be used to track supplies and medical equipment within the healthcare setting. It can also be used to track patients as they maneuver through the healthcare setting, seeing physicians and getting testing completed (Zebra Technologies, 2010). RFID technology can also be used in surgical applications to ensure right patient, right procedure, right location, and at the right time (Zebra Technologies, 2010).

Speech recognition technology, when refined and becomes more accurate, will be a major tool for healthcare physicians and nurses to document clinical encounters (Chavis, 2011). This technology stands to gain huge efficiencies in the healthcare setting.

CONCLUSION

The healthcare industry stands at the threshold of one of the biggest revolutionary changes in healthcare practice in modern times. EHR technologies stand to transform healthcare for the better. If EHR technologies are embraced and the proper software, hardware and IT infrastructure are put in place, the healthcare industry will stand to benefit greatly. It will increase patient quality and patient health outcomes. It can increase the healthcare facility's bottom line and bend the cost curve of the rising national cost of healthcare.

Healthcare has been slow to embrace EHR technologies, but with the passage of the American Recovery and Investment Act of 2009, healthcare entities will have little choice but to adopt EHR technologies. In an age of shrinking Medicare, Medicaid, and third-party payer reimbursement, gaining efficiencies through EHR technology is imperative. The survival of healthcare organizations depends on who develops the best EHR and IT systems. Those who do not will fail and will have to close their operations (Miliard, 2012). The future of healthcare will remain to be challenging but, at the same time, the improvements in care and quality are exciting. The future of healthcare, and the ability of the American people to be able to afford healthcare, are depending on the healthcare industry to make EHR technologies a successful venture.

AUTHOR INFORMATION

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