

## **A Long Way to Go for EMR Usability**

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### **Topic Overview & Introduction:**

With the ever increasing implementation of Electronic Medical and Health Records (EMR and EHR) systems into hospitals, ACOs, private practices, and insurance providers, the system design continues to garner attention and speculation. EMR design specialists wonder if the current systems disrupt clinical workflow and create safety concerns for patients being treated by EMR-wielding healthcare providers.

### **Recent Updates:**

The driving force behind many providers switching to an EMR has been the CMS Meaningful Use incentives. In order to be eligible for these incentives, the provider must have a certified EMR system. However, there is currently no usability criterion for an EMR to become certified. In February 2012, the Office of the National Coordinator for Health Information Technology (ONC) proposed a new rule that adds usability as a criterion to become certified. This has launched extensive research on how to test and eventually improve EMR usability by the National Institute of Standard and Technology (NIST) (Fiegl, 2012).

The majority of NIST's research suggests that current EMRs are not extremely usable and must be improved in a variety of ways. They have identified two main thrusts that must be taken in order to improve EMR usability. The first thrust is designing EMRs with human factors in mind. This means placing icons for maximum efficiency, easy readability, and easy input mechanisms. The other major change is designing EMRs to anticipate and correct entry and readability mistakes with more accuracy.

### **Analysis & Trends:**

If an EMR is unusable, physicians will use paper records instead. But, as we all know, the potential for information exchange between physicians facilitated by EMR systems is extremely important for CMS, who continually strives to lower the cost of healthcare. But they also strive to increase quality of healthcare. This illuminates the first major issue with EMR usability: when EMRs are unusable, the poor interaction between the physician and the system can cause harmful and even deadly outcomes for the patients, lowering the quality of healthcare in the United States. In order to improve these interactions, Matthew Weinger, M.D. (2012) with the Vanderbilt University Medical Center suggests that an EMR should be designed to fit the human experience of the physician as they would normally enter and read a paper record. The second major issue with EMR usability is the imperfection of their ability to correct these human mistakes. Researchers from NIST suggest that EMR warning signs must be foolproof in their design as well as impossible to miss or ignore in their display ("Formative usability testing methods," 2012).

NIST supported research has found that human-EMR interactions are poor and this results in harmful consequences for patients. The less usable an EMR system is, the longer it will take for a physician to enter data. This means that the physician will be working from memory to enter data while they are fumbling with the illogical design of the EMR. By the time

a physician has reached the screen into which they must enter the patient's data, they have already exhausted an enormous amount of mental energy getting there, which can make their memory suffer. This means that a physician might enter the wrong patient data merely because they cannot easily move from one icon to the next in the EMR system. When incorrect data is entered into the system, a patient can be given a faulty diagnosis, the wrong medication, or the record can show that they are healthy when in fact they may have serious health issues (Weinhaus, 2012).

In addition to physicians working off of memory, labels for medical data can be displayed in many different ways. Differences in EMR systems might not be apparent to the physician causing them to enter incorrect data to a specified label because the EMR system is designed counter-intuitively. According to NIST, there are countless ways to list blood pressure in a medical record. Whichever way the EMR design asks the physician to enter the blood pressure must be intuitive to the physician. Otherwise the records may show that the patient is at risk for a heart attack when they are not or vice versa (Brick, 2012).

Another example of poor human-EMR interactions resulting in negative patient outcome is in pediatric record systems. Throughout their research, NIST found that pediatric patients have special needs in terms of EMRs. This is because there are certain things that are only relevant to pediatric patients that can be very sensitive, difficult to display in an electronic system, and potentially extremely dangerous, although easy to mess up if it is in a system designed mostly for adult care. These special needs include growth charts, mg/kg dosing, vaccines, age-related normal values, privacy, newborn issues, radiology issues, patient identification. Growth charts are difficult to display on computer screens and must have a normalized display size. Dosing is different for infants and can sometime switch in between mg and kg measurements. The EMR must be able to switch between the two easily as well as identify when the doctor or nurse has entered or read the information incorrectly. If an EMR cannot recognize mistakes like this, an infant can be given deadly doses of medication. (Brick, 2012).

Finding the right way to design an EMR is not always easy. The intuitive way to enter blood pressure to one physician might be completely illogical to another physician. According to M. Chris Gibbons, M.D. (2012) of Johns Hopkins University, one of the first things to note when analyzing the human factors of working with an EMR is that every person using it will have different technological abilities and varying medical backgrounds. From nurses to doctors to insurance specialists, there will be wide economic disparity, which indicates that some users will not have very much experience working with technological systems or be familiar with all variations of blood pressure notation. Furthermore, in the future more and more patients will have access to their own records, widening the disparity even further. With paper, a physician could enter data how they saw fit because the actual record did not constrain them in any way with the labels it gives to different parts of the record. But, with an electronic system that takes a lot of time and money to design, the vendors cannot make a one-size-fits-all EMR, no matter how hard they try. EMR design and training must have the ability to be used and learned easily, taking advantage of intuitive moves that more technologically and medically advanced users might have, as well as have the ability to generate such intuitions in new users. No system will be completely usable to every user, but designers and vendors must do the best they can to make their systems flexible (Gibbons, 2012).

However, assuming that no matter how flexible and usable an EMR becomes there will still be human errors, all EMRs are equipped with warning signals. Even the warning signals

must be designed for maximum efficiency and positive patient outcome. If a physician is warned every time they order medication for a patient, they will learn to ignore it. The warning signs must be unavoidable to the physician, say exactly what is wrong and how bad it is. In order for a system to do this however, it must have the human kind of knowledge associated with being able to compile patient data and well-known medical facts to come to a conclusion. The EMR system must be able to tell when a physician has ordered an inordinate amount of medication for a child because it is labeled *kg* instead of *mg* (“Formative usability,” 2012).

Right now, warning signs are intact in EMRs, but they are not fool proof. If physicians become reliant on the technology to catch all of their mistakes and if the EMR system’s warning signals are imperfect, patients can undergo great harm for many things that a human eye could have potentially fixed. If EMRs have warning systems, physicians will become reliant on them, this can be dangerous if the warning system is not yet perfected.

This was the case in October 2010 when an infant died of an overdose of 60 times the appropriate medication amount. Among many other problems that day at Advocate Lutheran General Hospital, no physician double-checked to make sure they were administering the correct dosage amount to the infant because their EMR system was set up to warn the physicians of problems such as this one. Because Advocate Lutheran has reached stage 6 on the HIMSS Analytics EMR Adoption Model, its Cerner EMR was required to have Computerized Physician Order Entry (CPOE) which should have been able to catch the potential overdose. However, this medication was prepared by an automated compounding system that was not yet connected to the main CPOE (Versel, 2011). Since then, the hospital has added electronic alerts to its IV compounders.

Lesson learned. This case launched the revitalization of effort to improve EMR safety and usability. Weinger recommended that standardization is one key element to making EMR systems more usable and safer. This not only applies to the standardization of the visible screen and the standardization of warning signs, but also to standardization of setup in a workplace dependent upon EMRs. As new devices are added to the system, they must all undergo a standardized setup, although the money required can be off-putting to healthcare providers (Weinger, 2012).

Even for those already invested in the full use of a standardized EMR system, the cost may still be growing. More than 1,700 products have passed previous certification standards for the meaningful use program. If the new rule requiring an EMR to pass a usability test in order to gain certification comes into effect, undoubtedly some of those EMR systems already being used for the meaningful use program will not pass the test. When this happens, many providers will lose their meaningful use incentive and may have to invest in an entirely new EMR system in order to gain the incentive back (Fiegl, 2012). Some EMR vendors, such as Bizmatics, have gotten a head start on this problem by trying to improve their usability before the policy change comes into effect and allowing NIST to test their systems in order to create the standard. However, if changes need to be made to systems already in place, early adaptability will not stop the need of healthcare providers to spend additional money improving their systems (Murphy, 2012).

## **Conclusions & Recommendations:**

Gibbons (2012) argues that EMRs are too expensive and time consuming to merely be an electronic version of a paper record. They must truly improve the clinical workflow without

bringing harm to the patient. This means that EMRs should in the end make hospitals more efficient and productive—seeing more patients while gaining a higher success rate in treating those patients. At the current moment, however, neither is true. Adoption of EMRs can slow efficiency rates as well as decrease the success rate of patient treatment. The healthcare industry must understand what’s causing these system glitches. As Dr. Mark Frisse, professor of biomedical informatics at Vanderbilt University Medical Center's Center for Better Health, says, “In the paper-based world, the inability of humans to communicate with each other was far more severe.” Dr. Frisse hopes that poor outcomes now will lead to a better future in the healthcare industry, “Society has a simple choice,” Frisse said. “We can take technology that is everyday saving lives and make it better, or we can return to the days when errors were more commonplace and were not reported ... I can assure you that that the latter course will lead to more deaths with less documentation.”

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