Challenge Project Part 1 (Charter): Electronic Medical Record Usability Evaluation and Rating

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Despite the many widely publicized potential benefits of electronic medical records (EMR's), the adoption of these systems by physicians and hospitals has remained slow between 2001 and the present. Preliminary data from the 2011 National Ambulatory Medical Care Survey shows that about 57% of office-based physicians have made some use of electronic medical record/electronic health record technology and about 34% of physicians have an EMR system that meets the full criteria for a basic system (Hsaio et al., 2011). A 2009 study by Dr. David Blumenthal and colleagues from the Harvard Institute for Health Policy (Jha et al., 2009) showed that as of 2009 only 17% of U.S. hospitals surveyed had implemented computerized provider order entry for medications, only 7.6% had a basic electronic medical record in place, and only 1.5% had a functioning comprehensive EMR. The slow pace of adoption has been of great concern to national policymakers because it represents a major obstacle to achieving many of the healthcare improvement goals that can only be accomplished through the use of health information technology (Jha et al., 2009).

Studies of the barriers to EMR adoption (Boonstra et al., 2010; Castillo et al., 2010) frequently identified two major problems as the basis of such barriers. The first focused on financial issues such as the high initial investment required, the cost of ongoing maintenance, and uncertainty about whether there would be sufficient return on investment. The second focused on the poor usability of EMR products whose steep learning curves, poorly organized user interfaces, and lack of integration with clinician workflow caused significant decrease in the efficiency and productivity of the clinicians adopting them. To address the first problem, the HITECH section of the American Recovery and Reinvestment Act of 2009 established large financial incentives for providers to adopt and demonstrate Meaningful Use (MU) of EMR's. Although this policy succeeded in dramatically accelerating the pace of EMR adoption, the stage

I MU criteria were completely focused on functionality and utility and did not even mention much less attempt to evaluate usability (Brancato, 2010). This failure to address the usability problem soon demonstrated, in the words of the Health Information Management Systems Society (HIMSS) EHR Usability Task Force, "that usability is one of the major factors – possibly the most important factor – hindering the widespread adoption of EMR's (Belden et al., 2009)."

In addition, the rush to implement EMR's and receive meaningful use incentive funds caused many organizations to force their clinicians to use poorly designed information technology, revealing that poor usability can have profound negative effects such as increasing clinician fatigue and error rates as well as decreasing clinical productivity. A recent landmark study by the Institute of Medicine (IOM) Committee on Patient Safety and Health Information Technology concluded that, "designed and applied inappropriately, health IT can add an additional layer of complexity to the already complex delivery of healthcare which can lead to unintended adverse consequences" and "poor user interface design, poor workflow, and complex data interfaces are threats to patient safety (Warden et al., 2009)." Only recently has the accumulating data so eloquently summarized in the IOM report has finally started to influence policy at the Office of the National Coordinator for Health Information Technology (ONC) (Brancato, 2010). The stage II MU criteria are being revised to include usability evaluations. The HIMSS, the Agency for Healthcare Research and Quality (AHRQ), and others have published reports on the definition of usability and the ways it can be measured and evaluated (Belden et al., 2009; Rogers et al., 2009; Smelcer et al., 2009; Jaspers, 2009). The National Institute of Standards and Technology (NIST) recently published draft guidance on the technical evaluation, testing, and validation of the usability of electronic health records (Schumacher et al., 2011). Yet

the number of studies actually testing the usability of a full production EMR in its native clinical setting remains very small.

The fifth key area in the Startup America Policy Challenge is "unleashing market opportunities in industries like healthcare IT" and asking "the American public how to knock down barriers to innovation in healthcare IT." Regarding the usability barrier, the author proposes a low cost, customizable application for evaluating and rating the usability of office and hospital EMR products. Building on the research of HIMSS, AHRQ, NIST, and others the application will contain a substantial library of model patient data and common clinical scenarios. Experienced clinicians who have had introductory training in the EMR to be tested will be asked to work a set of scenarios under conditions where the time constraints and level of distractions reflect real world clinical settings. Data will be collected to evaluate key usability metrics identified by the HIMSS task force (Belden et al., 2009) including:

- Efficiency, the metric concerned with how fast the user can execute a particular set of instructions or accomplish a particular task.
- Effectiveness, the assessment of how accurately and completely the user completes defined task goals and the number of likely error points in the system.
- Ease of learning, which involves measuring the time and effort it takes for the user to reach a specified level of proficiency.
- Cognitive load, the system's ability to present precisely the information needed for the task at hand organized by meaningful relationships and optimized for clinician thought processes.
- User satisfaction, measured by questionnaires to determine the user’s subjective response to interaction with the system.

Details of the methods for measuring these parameters have been published elsewhere and are too lengthy to review here (Belden et al., 2009; Rogers et al., 2009; Smelcer et al., 2009; Jaspers, 2009; Schumacher et al., 2012). However the author is concerned that the majority of these methods involve long complex testing sessions which require a highly trained tester interacting with the clinician throughout the procedure. The NIST draft guidance criteria (Schumacher et al., 2011) are particularly lengthy and cumbersome. Such systems place a significant scheduling and work burden on the test subject and will likely deter participation by the busy clinicians whose input is most needed. Therefore another goal of the application will be to develop a testing presentation sufficiently straightforward and standardized to be presented as a website or on a laptop or tablet computer which can be used without the presence of a testing professional at a time convenient for the clinician. The application should automatically record each user session by webcam and collect the keyboard entries, mouse clicks, use of the back button, timing intervals, and other data needed to calculate the parameters under study. Satisfaction will be assessed by questionnaire at the completion of the scenarios. Just as we want our EMR's to be simple, natural, efficient, consistent, and forgiving (Belden et al., 2009), we also want the testing application to have excellent usability properties.

The author is a clinical physician with 30 years' experience and a long-standing interest in computers and information technology. In the last five years he has learned three different EMR systems and gained first-hand experience with many of the usability problems described in literature. Although now proficient with all three systems, he still finds his work slowed and impeded by poorly organized data-overloaded interfaces, inefficient workflows, and inconsistencies between systems. The constant effort to keep his work accurate, complete, and on schedule had raised concerns about how poorly designed health IT might compromise patient

safety even before the IOM report was published. Extensive discussion of these issues with his hospital administrators and EMR vendors has made very little progress toward producing any solutions. All health IT financial resources and staff efforts are consumed in implementing certified systems and achieving the stage I MU criteria before the deadline. The vendor does not believe usability is really a problem. The hospital administrators understand the problem but feel they have neither the resources nor enough influence with the vendor to make any progress.

This dilemma points out one of the most serious constraints on the process of developing a convenient, low cost usability testing application. At least some of the resources to support the effort would need to come from EMR vendors and healthcare organizations such as hospitals. Will these organizations be willing to devote limited resources to produce a product that could add significant additional complications and certifications to the EMR systems they are developing and implementing? The vendors may also argue that additional regulation in the area of usability will stifle innovation in user interface design. The author hopes that the potential benefits to clinicians and patients are sufficiently compelling that academic and government organizations will underwrite the effort. The second major constraint is the extent and technical complexity of the proposed application, but the author feels that a motivated team of clinicians, programmers, and usability experts can accomplish the task. The author would be happy to contribute his experience as a clinician and EMR user to such a development team.

Because this issue can dramatically affect patient safety, implementation of usability testing and certification will impact almost every stakeholder in healthcare system including physicians and nurses, allied health professionals who also use EMR systems (pharmacists, physical therapists, social workers), hospitals and clinics, and EMR vendors. As noted, some of the stakeholders will argue that we absolutely have to get first generation systems in place and

address these problems in future revisions and upgrades. Yet a number of studies have shown that solving such problems by correcting a finished system is anywhere from 10 to 100 times as expensive as solving them at the design stage (Staggers et al., 2011). It is widely believed that proper implementation of health IT will reduce medical errors and improve patient safety. EMR systems filled with hidden potential for unintended consequences that can actually lead to medical errors will not accomplish this goal. It is also widely accepted that health IT will reduce waste and duplication and decrease the overall cost of healthcare. EMR systems which degrade clinician efficiency and productivity are much less likely to improve the cost efficiency of the healthcare system. The usability problem represents one of the largest obstacles preventing health IT from reaching its full potential and accomplishing the goals we all desire.

A convenient relatively inexpensive application to evaluate, rate, and compare the usability of different EMR systems as they are developed and implemented will help to solve this problem. An application that is intuitive and comfortable enough to attract large numbers of real life clinicians to participate in the testing process will provide the critical mass of data necessary to improve EMR usability. As comparative usability ratings contribute to physician and hospital choices of which EMR product to purchase, vendors will have an incentive to improve their products in this area. The proposed application is summative and designed to evaluate finished EMR products. In the best case we would also develop tools to evaluate usability at the formative stage during EMR design and production, so that many of the problems have already been solved by the time of product release. However, testing a finished production system under real-life clinical conditions often still raises concerns not identified during development, and the two approaches will work best when used together.

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