Electronic Medical Records: Usability Challenges and Opportunities

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Electronic Medical Records (EMRs) have begun to transform healthcare worldwide. Some small countries like Denmark, the Netherlands, and Israel have built effective systems based on national standards, while in the U.S. dozens of diverse systems are competing for market share. In developing nations local projects can have huge effects, but the trade-offs in spending for medical facilities versus computing resources may require painfully difficult decisions. In all cases, meeting ambitious goals while maintaining high-quality care and realizing anticipated cost savings will require solving a host of problems, many of which are not yet well understood.

Despite the many uncertainties, the critical importance of usability to the success of these goals is clear. Numerous studies and extensive clinical experience testify to the difficulties associated with poor usability. Systems designed by software architects who expect clinicians to adapt their workflows to meet the needs of the computers are subject to workarounds that subvert system goals and reduce the value of the electronic records. Computerized decision-support systems that pester users with over-abundant or irrelevant alarms are ignored, and systems that place high cognitive loads on time-stressed doctors and nurses lead to increased medical errors.

Designing effective medical records requires the full complement of usability expertise, from the contextual inquiry and ethnography required for understanding user needs to the development of comprehensible information and interaction designs, and finally to the evaluations necessary for understanding successes and failures in complex medical environments.

The diversity of medical care contexts complicates this already-challenging scenario even further.

Vastly differing scales, disciplinary requirements, user perspectives, and social/cultural contexts complicate design and limit generalizability. Small, independent medical primary-care physicians may have needs that are radically different from those of physicians in large academic medical centers. Systems used in emergency departments may need to provide triage and bed-request functionality not needed several floors upstairs in the same hospital. Doctors and nurses may want to see different views of data for the same patients. Administrators and researchers interested in mining data to improve care will have further requirements. Highly trained physicians in well-equipped hospitals might be willing to use complex interfaces, while rural health clinics in low-resource countries may need interfaces that can easily be used with much less computer experience.

Although systems developed in these environments may differ drastically, lessons learned may transfer. Just as clinical decision-support systems developed in research hospital environments might be adapted to provide guidance to clinical health workers in low-resource settings (both in developing countries and in under-served regions of industrial nations), simplified interfaces created for use in those low-resource settings might help developers fight the staggering complexity of some EMR interfaces.

Overlaying these complexities on an evolving infrastructure that

includes numerous developers of EMRs presents an interesting challenge: In the face of this diversity, what does it mean to say that an electronic medical record is usable? Purchasing and evaluation decisions and the development of improved designs would benefit greatly from detailed reports allowing comparisons between alternatives. Informative reports would describe how well systems prevent user error, provide effective decision support, and help clinicians interpret complex clinical data. Standardized reporting formats such as the National Institute for Standards and Technology's Common Industry Format might be used to describe results, but meaningful comparisons will require adoption of common testing protocols. Vendors, regulators, and purchasers working together to develop such shared metrics would provide valuable momentum toward the stated goal of meaningful use of EMRs.

The widespread adoption of EMRs into the mainstream of medical care is a complex endeavor, involving numerous perspectives and raising many policy and technical questions. The three articles in this section touch on a few current issues, illustrating some of the challenges faced by developers and designers working in different contexts across the globe. One thing is certain: Usability will play a key role in the safety, efficacy, and success of medical informatics.