



POSITION STATEMENT

DESIGN FOR USE ISSUES IN A HEALTH CARE ENVIRONMENT

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IEEE-USA believes that technology for use in a health care environment should be designed with usability as a major goal to maximize the effectiveness of the interaction between the health care provider and the patient, and improve the quality and safety of the care provided.

Specifically, IEEE-USA recommends that the Office of the National Coordinator for Health Information Technology (ONCHIT):

- Promote the development of usability requirements for technology intended for use in a health care environment
- Include usability requirements in the criteria for certification of health information technology, including Electronic Health Records (EHRs)

Usability is commonly defined as the measure of a product's potential to accomplish the goals of the user. Requirements for technology to be used in a health care environment should address the following usability factors:

- Development of medical devices and information technology must reflect the working environment in which clinical procedures are performed
- Design of user interfaces must reflect the workflow, clinical protocol and business models used in patient care in a specific clinical environment
- Technology used in health care settings must be unobtrusive, and must not create barriers to the clinician/patient encounter
- Technology used in health care settings must not create additional health risks for the patient
- Usability testing should be a required part of product testing.

This statement was developed by IEEE-USA's Medical Technology Policy Committee and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of more than 210,000 engineers, scientists and allied professionals who are U.S. members of IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE or its other organizational units.

BACKGROUND

According to a study done by the American Academy of Family Physicians (AAFP), the failure rate of IT systems in small clinics/private practices is around fifty percent, due in large part to the fact that they simply do not function well in a clinical environment. Part of the problem is that systems designers have taken a “one size fits all” approach, and do not take variations in clinical practice and office workflow into account. [*Brief Report of the AAFP’s EHR Pilot Project: Key Learnings from Six Small Family Practices*. American Academy of Family Physicians Center for Health Information Technology, March 8, 2005.]

The AAFP study also points out the importance of modeling the practice workflow. Many EHR implementations are “physician-centric” and focus only on the clinical encounter documentation, ignoring the practice’s overall workflow, including such functions as appointment scheduling, billing and ordering. In his paper, “Expected Benefits of Electronic Health Records to the Pediatric Private Practice,” Dr. Mark Ginsburg emphasizes the importance of including front office functions, as well as the clinical encounter, in what he terms the “patient trajectory through the pediatric office.” [Ginsburg M. “Expected Benefits of Electronic Health Records to the Pediatric Private Practice,” *EHR Benefits to Private Pediatrics*, July 2009.]

Ginsburg provides a tabular listing of the benefits of a properly designed EHR system where usability in the clinical environment has been taken into account in the design:

Type of Benefit	Where Encountered	Effect on Practice
Minimize data input and representation errors; simplify data input	Plot errors avoided in Nurse Assessment	Less miscoding (better cash flow), more efficient processing (also improving cash flow), and better health outcome via improved longitudinal data visualization
Minimize CPT and ICD9 coding errors	Well-Visits, Sick Visits	Less miscoding (better cash flow), avoid hits to practice reputation
Graphical notation and storage of body conditions	Well Visits, Sick Visits	More accurate patient record, improved health outcomes, also enhanced practice reputation
Evidence-based medical data appears in context	Well Visits, Sick Visits	Better health outcome, since doctor better informed in procedure and diagnosis
Customization of Q&A	Well Visits	Better health outcomes, as regional idiosyncrasies can be captured, as well as doctors’ own personal knowledge
System avoids unduly capturing doctor attention	Well Visits, Sick Visits	Avoid hits to practice reputation
Public health interfaces	Sick Visits and Immunization	Could be substantial as NHIN grows. Practice can gain in reputation for proactively contributing data to epidemiological studies. Currently, one benefit is simply being compliant legally and efficiently.
System provides templates and context-sensitive data for most common situations	Well Visits, Sick Visits	Increased patient throughput; improved EHR clinical note standardization; better health outcomes due to provision of evidence-based medicine

“Eight Rights of Safe Electronic Health Record Use” [Sittig DF; Singh H: Eight Rights of Safe Electronic Health Record Use. JAMA; Vol 302, No. 10: 1111-1113] proposes eight characteristics that address systems design for patient safety:

- *Right Hardware or Software* - An EHR system must be capable of supporting required clinical activities.
- *Right Content* - Right content includes standard medical vocabularies to encode clinical findings and knowledge used to create specialty-specific features and functions.
- *Right User Interface* - The right user interface allows clinicians to quickly grasp a complex system safely and efficiently.
- *Right Personnel* - Trained and knowledgeable personnel are essential for safe use.
- *Right Workflow and Communication* - Any disruption in workflow or information transfer is fertile ground for error.
- *Right Organizational Characteristics* - As with other safety models, a culture of innovation, exploration, and continual improvement are key organizational factors for safe EHR use.
- *Right State and Federal Rules and Regulations* - State and federal regulations may act as barriers or facilitators for achieving safe use.
- *Right Monitoring* - The creation of the Certification Commission for Health Information Technology (CCHIT) is a significant step toward accelerating adoption, but an equally detailed post-implementation usability inspection process is also needed.

As Ball, et al., point out in their paper, *Failure to Provide Clinicians Useful IT Systems: Opportunities to Leapfrog Current Technologies*, “data seeks the clinician as often as the clinician seeks data. This changes ‘thoughtflow’ – how the clinician assesses, prioritizes and acts upon data – and consequently alters established workflow patterns. The system interface must permit the clinician to transition seamlessly to a mode of operation that is compatible and consistent with his or her thoughtflow.” [Ball M. J. Silva J. S. Bierstock S. Douglas J. V. Norcio A. E. Chakraborty J. Srinii J. “Failure to Provide Clinicians Useful IT Systems: Opportunities to Leapfrog Current Technologies,” *Methods of Information in Medicine* 2008; 47: 4-7.] Any device or functionality that causes delay is likely to encounter resistance. Clinicians, therefore, want systems that support and enhance their work, not complicate it.

Design of IT for the clinical environment must co-exist with existing technology. For example, while use of wireless connectivity may facilitate mobility of applications and enhance tracking of personnel and supplies in a hospital environment, care must be taken to prevent interference with telemetry systems used for patient monitoring.

Choice of materials used in designing computer hardware must also take the clinical environment into account. For example, keyboards may serve as breeding grounds for pathogens such as methicillin-resistant staphylococcus aureus (MRSA). Choosing the correct bacterium-resistant materials during the design process can mitigate this risk.

Design of applications for use in a health care environment should make use of reliability/availability/disaster recovery/capacity planning concepts borrowed from telecommunications and enterprise network engineering. As the workloads on health IT networks increase, due to the addition of bandwidth- and storage-intensive applications like imaging, EHR and telemedicine, requirements need to be developed and enforced to ensure that patient safety is not jeopardized.