

What is Wrong with EMR?

James J. Cimino, M.D.

Associate Professor, Department of Medical Informatics, Columbia University
161 Fort Washington Avenue, New York, New York 10032 USA
Phone: (212) 305-8127 Fax: (212) 305-3302
Email: ciminoj@flux.cpmc.columbia.edu
Web: <http://www.cpmc.columbia.edu/homepages/ciminoj/>

Jonathan M. Teich, M.D., Ph.D.

Director, Clinical Information Systems Research & Development, Partners Healthcare System
Assistant Professor, Harvard Medical School
850 Boylston Street, Suite 202, Chestnut Hill, MA 02467 USA
Tel. (617) 732-9072 Fax (617)731-3690
E-mail: jteich@harvard.edu
Web: <http://www.partners.org/nif/preceptors/teichbio.html>

Vimla L. Patel, Ph.D., DSc

Professor, Departments of Medicine and Psychology
Director, Center for Medical Education
McGill University
1110 Pine Avenue West, Montreal, Quebec, Canada H3A 1A3
Phone: (514) 398-4987 Fax: (514) 398-7246
Email: patel@hebb.psych.mcgill.ca
Web: <http://www.psych.mcgill.ca/perpg/fac/patel/>

Jiajie Zhang, Ph.D. (Panel Organizer)

Associate Professor, Department of Health Informatics, University of Texas at Houston
7000 Fannin Street, Suite 600, Houston, TX 77225 USA
Phone: (713)-500-3922 Fax: (713)-500-3929
Email: Jiajie.Zhang@uth.tmc.edu
Web: <http://acad88.sahs.uth.tmc.edu/>

Abstract

An ideal EMR should be able to provide complete, accurate, and timely data, alerts, reminders, clinical decision supports, medical knowledge, communications, and other aids at all points of care for all healthcare professionals at all times in a way the quality of healthcare can be dramatically improved. However, these promised functions are far from being realized in current EMR, and the resistance to current EMR from healthcare professionals is still strong. Will these promised functions ever be realized? Will EMR ever be accepted universally by healthcare professionals? What is wrong with EMR? The participants of this panel will identify and debate the fundamental problems of current EMR, and they will make

recommendations that could potentially make EMR closer to its promised functions. In their view, although from different perspectives, an ideal EMR is not impossible. To achieve its promised functions, however, the first goal that has to be satisfied is that an EMR must be usable.

General Program Description

With the rapid advancement of information technology and the explosive growth of electronic medical information over the past decade, a natural happening in health care was the implementation of comprehensive Electronic Medical Record (EMR) systems. EMR has the potential to make a highly significant contribution to the advancement of medicine and to the improvement of the quality of

healthcare. An ideal EMR should be able to provide complete, accurate, and timely data, alerts, reminders, clinical decision supports, medical knowledge, communications, and other aids at all points of care for all healthcare professionals at all times in a way the quality of healthcare can be dramatically improved. It should include the old useful functions and overcome the known problems of paper-based records, provide new useful functions that are not available from paper-based records, and at the same time it should not generate new problems associated with the electronic medium. However, despite of tremendous efforts and noticeable achievements, current EMR still has many non-trivial problems that would prevent it from being universally accepted by healthcare professionals.

This panel will focus on an issue that is fundamental to the success of EMR: usability. From different but complementary perspectives, the participants will discuss several critical usability problems of EMR.

From the perspective of system functions, *James J. Cimino* from Columbia University will discuss several usability problems (e.g., cognitive overload, disorientation, blind acceptance of information and recommendations) and their implications in real world settings. For example, cognitive overload is a major problem because of the information overload of EMR and the badly designed interfaces that demand extra cognitive resources. As another example, blind acceptance of information and recommendations can lead to serious outcomes due to factors such as lack of context or inappropriate knowledge representations in the decision support system that generates such recommendations.

From the clinical perspective, *Jonathan Teich* from Partners Healthcare System will discuss the lack of adequate task and user analyses in the design of current EMR. Task analysis is the process of identifying system functions that have to be performed, procedures and actions to be carried out to achieve task goals, information to be processed, input and output formats that are required, constraints that must be considered, communication needs that are consistent with the technology, and the organization and structure of the task. User analysis is the process of identifying the characteristics of existing and potential users, such as expertise and skills, knowledge base, education background, cognitive capacities and limitations. In the spirit of task and user analyses, Dr. Teich will focus on scenario-based clinical information needs analysis--the process of identifying the collection of information needed for a clinician's day, organized by various types of patient encounters and work tasks in various environments. The general purpose of task

and user analyses is to ensure that only the necessary and sufficient task features that match users' capacities will be included in system implementations. Extra fancy features and features that do not match users' capacities will only generate extra processing demands for the user and thus make the system harder to use.

From the cognitive perspective, *Vimla L. Patel* from McGill University will focus on the problem in using the "paper chart" metaphor for designing EMR. EMR and paper-based medical records are cognitive artifacts, and they are both parts of distributed systems in which users interact with artifacts and among themselves. On one hand, such cognitive artifacts can enhance the performance of the systems; on the other hand, they also change the users' tasks. They are inherently involved in the information processing and decision processes in clinical investigation. Because EMR and paper-based records are different artifacts that support different cognitive processes and do not have the same constraints and limitations, the "paper chart" metaphor in the implementation of EMR is doomed to usability problems.

From the perspective of user interface design, *Jiajie Zhang* from the University of Texas at Houston will discuss the problem of interface barriers in EMR. It is well known that different implementations of the same function can lead to dramatically different task difficulties, representational efficiencies, and behavioral outcomes. Many interfaces in current EMR belong to the category of indirect, hard-to-use interfaces that are barriers between users and tasks. By re-implementing these interfaces in functionally equivalent but representationally different interfaces, the barriers can be removed or minimized in a form called direct interaction. Dr. Zhang will talk about a cognitive theory of direct interaction that can determine whether an interface is direct or indirect and specify how to achieve direct interaction, and a methodology of representational analysis that provides a set of procedures for the analysis and comparison of direct and indirect interfaces. With such a theory and methodology, a good interface can be picked from several alternatives in a theory-based manner.

Position Statements of Participants

James J. Cimino: Practical Considerations for Improving the EMR. Cognitive issues of EMR will be discussed from the perspective of system function. Specifically: what cognitive processes does an EMR support and what are the potential issues for complicating the tasks of patient care? Tasks may range from the exotic (such as automated decision

support) to the mundane (such as management of patient problem lists and coordination of them across multiple providers). Issues include cognitive overload, disorientation, and blind acceptance of information and recommendations. Practical issues of studying these tasks and issues, in real world settings, will be discussed.

Jonathan Teich: Information Scenarios, Tradeoffs, and the EMR. An EMR has to provide something new and also something old and familiar. It should be structured differently than paper charts, in order to provide better access to data, display data logically, and accommodate clinical decision support. At the same time, forcing clinicians to change their way of practice to accommodate the computer is a sure road to acceptance problems. To walk this line, one needs to understand (1) scenario-based clinical information needs -- the collection of information needed for a clinician's day, organized by various types of patient encounters and work tasks; (2) the source and re-use of information -- how to appropriately use data acquired from previous visits, frequent entries, problem lists, flowsheets, registration, etc., to minimize redundant work and steer the flow of information; and (3) the "80-20" tradeoffs between complete solutions (e.g., micro-structured notes) and quicker but less structured data entry. Understanding these concepts can lead to EMR's that are easier to use, provide more useful information at the right time, and can be tailored to different types of practice to provide a friendly information milieu for each.

Vimla L. Patel: Problems in Using "Paper Chart" Metaphor for EMR. In a recent ACMI e-mail exchange, it was recognized that despite the problems, EMR is still a focal point of interest for many people in the field of medical Informatics. However, the current status of EMR is less than desired, since the problems range from poor interface design to failure in addressing fundamental cognitive aspects in how should knowledge be organized and communicated. Dr. Patel would like to argue that there is a problem in using the "paper chart" metaphor for designing EMR. The problems that exist in paper charts have also been transferred to designing EMR, when using this metaphor. More specifically, it is proposed that medical chart should be a scientific problem solving manuscript which should faithfully represent decisions made by the user in a form of clinical investigation. Arguments will be presented on why one must begin with characterization of what physicians actually do when solving patient problems in designing scientifically-based EMR rather than borrowing the paper chart

metaphor which does not currently reflect a protocol for sound clinical investigation.

Jiajie Zhang: The Interface Barriers of EMR. With the recent explosive growth of electronic medical information, the user interface design of EMR has become a crucial issue. In order for EMR to succeed, it is imperative that users be able to easily and accurately retrieve, seek, gather, encode, transform, organize, and manipulate pertinent information to accomplish desired tasks. EMR is developed to aid users' activities, not to generate secondary tasks that demand extra cognitive resources. Thus, it is crucial for the users to directly interact with the task domains, not the interfaces mediating the system. The human mind is very limited in its bandwidth of information processing, capacity of working memory and attention, speed of mental operations, and other cognitive functions. It simply cannot afford the luxury of allocating its already limited cognitive resources to processes that are not essential to the task. Thus, a good system should have an interface that is transparent to users such that the users can directly and completely engage in the primary desired task. Unfortunately, current EMR is far away from meeting such requirements of direct interaction. Worse, human factors principles have not been systematically applied in the design of current EMR. In order for EMR to perform the functions that it is promised to perform and to be universally accepted by health care professionals, human factors principles should be applied to the design of EMR at the earliest possible stage.

Panel Format

The panel organizer will spend 5 minutes to present the topic to be discussed during the panel and introduce the panelists and their different perspectives. Then the four panelists will each spend 10 minutes to present their own positions from different perspectives and connect them with other panelists' positions. This first half will take 45 minutes. For the second 45 minutes, the panelists will debate among themselves and with the audience to find common ground and resolve the differences. The debate will be around the following issues.

Issues for Interactive Participation

- Why did EMR come to existence in the first place? What is the history of EMR?
- What functions were originally promised for EMR?
- What are the major differences between EMR and paper-based medical records?
- Is the problem of EMR as serious as it is claimed to be?

- Is usability the biggest problem with EMR? If not, what is the biggest problem with EMR?
- What are the many dimensions of usability problems?
- Among the usability problems with EMR, which is the most serious one?
- How much do EMR users know about and care about the usability problems of EMR?
- Will all the problems with EMR be solved once the usability problem is solved?
- What fundamental changes can EMR make on healthcare practice and the society?
- Is an ideal EMR possible?
- What is the future of EMR?

To AMIA99 Program Committee:

This is to confirm that all four participants for this panel, James J. Cimino, Jonathan M. Teich, Vimla L. Patel, and Jiajie Zhang, have submitted their position statements and have agreed to participate in the panel.

Sincerely,

Signed, electronically

Jiajie Zhang
Associate Professor of Health Informatics
University of Texas at Houston