



Health Informatics



Systemic changes enabled by electronic record keeping, networked databases, and the Internet have radically changed the way healthcare providers, researchers, and the public analyze, distribute, and consume health information. But the healthcare industry is still far behind other sectors in IT implementation, and serious questions remain about the connections between information technology, healthcare, and public health initiatives.

How do consumers find and process health information on the Internet? How do age and income influence health-related searches? How will portable digital health records change patient-provider relationships and support research? Health

informatics researchers from across the University of Maryland are answering these and other questions. Their work will lead to more effective delivery of health information and more efficient management of health care.

Nancy Atkinson studies how information technology can be used to improve public health—especially for underserved groups. She also develops e-health education systems.

Bo Xie examines how aging affects the ways people access and use online health information.

Ritu Agarwal studies IT issues in the healthcare industry, including technology issues related to the distributed management of health records.

Ben Shneiderman and Catherine Plaisant develop computer visualization technology to reveal hidden patterns in electronic health records, offering powerful new tools for disease research and patient diagnosis.

Using Technology to Improve Public Health

Nancy Atkinson directs Maryland's Public Health Informatics Laboratory, and she specializes in health education instruction and multimedia product development. Her research interests range from the usability of e-health Web portals to the demographic factors that influence the effectiveness of online health information. Atkinson is especially interested in using technology to improve public health for underserved, at-risk groups.

In one recent study Atkinson examined variables that could affect how Internet technology is used to distribute health information to low-income, rural mothers. Women in isolated locations with busy schedules and limited resources can encounter significant barriers to traditional sources of health information. Atkinson conducted telephone interviews and convened focus groups to determine how rural moms searched for information about obesity on the Internet. She also assessed if these searches changed obesity-related behaviors.

Atkinson found that, contrary to expectations, most of the women were already using or planned to use the Internet for health information searches. She also found that online information had increased their awareness of obesity factors, like diet and exercise-level; however, awareness did not necessarily result in healthy behaviors. These results indicate that the Internet is a viable conduit for delivering health information to poor rural families, but more research needs to be done to improve the content of e-health initiatives.

Currently Atkinson is developing e-health systems for the Department of Defense, including tools to improve self-care and preventive behaviors among women in the military.

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Older Adults and e-Health Literacy

Bo Xie, a researcher with the university's College of Information Studies, examines how information and communication technologies can improve the e-health literacy of older adults, especially those who are underprivileged and underserved.

Xie is currently collaborating with the Prince George's County Memorial Library System to help older adults learn to access, assess, and use online health and medical information. This project will lead to improved training techniques that can better

accommodate the special needs of lifelong learners. It is expected that some older adult participants of this project will be trained as peer instructors who can then provide similar training at other public libraries.

Xie hopes to develop a practical model that public libraries nationwide can use to promote the health literacy, computer literacy, and civic engagement of the aging population. This project contributes to Xie's broader research program, which examines how age-related changes influence older adults' learning and how technology can support educational interventions for this population.

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Using Technology to Transform the Healthcare Industry

When it comes to implementing information systems, the healthcare sector lags behind other industries by a decade or more. The results of this lag are expensive and life-threatening. Each year billions of dollars are wasted when lost or outdated records lead to needlessly repeated tests and redundant inoculations. Thousands of people die when medical mistakes result from inaccurate information in mismanaged records or from a lack of information at the point of care.

Ritu Agarwal, Director of the Center for Health Information and Decision Systems, examines how emerging information technologies can transform the healthcare system into a safer and more efficient industry. Two promising and related technologies are the electronic personal health record (PHR) and the electronic medical record (EMR). PHRs are standardized electronic records that can be accessed by both doctors and patients, but they are largely used by patients. EMRs are standardized records for wider use by other stakeholders. Widespread implementation of PHRs and EMRs could transform the management side of healthcare, if healthcare providers move to systems that integrate these universal standards. Personal access to PHRs can also give consumers greater control over their medical information, which can lead to more proactive personal health management. This aspect of the PHR could be especially important for people who do not regularly interact with healthcare providers because of economic barriers or other obstacles.

Agarwal's research on the early implementation of PHRs suggests that consumers' motivations for using PHRs are complicated by interacting demographic and medical factors. For example, consumers with less education value the PHR as an organizational tool. Those who suffer from chronic conditions believe PHRs will increase connected-ness to medical providers. Understanding the human side of medical record-keeping is important if access to PHRs is to transform how consumers manage health.

But access also leads to new IT challenges. Security and privacy become especially important if the sensitive information of PHRs and EMRs is stored on unsecured personal computers. More research is needed to determine if security issues will hinder the implementation of these potentially transformational technologies.

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Visualizing Health Records

Ben Shneiderman and Catherine Plaisant have been changing the way doctors see medical information for more than a decade, and their latest work continues to innovate.

Their LifeLines program, a product available through the university's Human-Computer Interaction Lab, turns the text of a personal medical history into an instantly accessible color-coded visualization. At a glance, doctors can see timelines of office visits and hospitalizations, track the development of a condition, or observe changes in medications or dosages. LifeLines reduces doctors' chances of overlooking important information, and it can help them instantly identify trends and anomalies in the health of individual patients.

Most recently, Shneiderman and Plaisant have been developing PatternFinder, the next generation of medical-record visualization technology. A vast improvement over LifeLines, PatternFinder allows physicians and researchers to create visualizations from custom queries, both within and between patient records. This cross-record functionality is the real innovation of PatternFinder. Visual queries of large medical databases can reveal visual patterns that are difficult or impossible to express in other media. PatternFinder visualizations will guide new research projects, aid the analysis of clinical trial data, and help identify invisible risks to public health.

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