# The Promise of Information and Communication Technology in Healthcare: Extracting Value From the Chaos

Burke W. Mamlin, MD and William M. Tierney, MD

## ABSTRACT

Healthcare is an information business with expanding use of information and communication technologies (ICTs). Current ICT tools are immature, but a brighter future looms. We examine 7 areas of ICT in healthcare: electronic health records (EHRs), health information exchange (HIE), patient portals, telemedicine, social media, mobile devices and wearable sensors and monitors, and privacy and security. In each of these areas, we examine the current status and future promise, highlighting how each might reach its promise.

Steps to better EHRs include a universal programming interface, universal patient identifiers, improved documentation and improved data analysis. HIEs require federal subsidies for sustainability and support from EHR vendors, targeting seamless sharing of EHR data. Patient portals must bring patients into the EHR with better design and training, greater provider engagement and leveraging HIEs. Telemedicine needs sustainable payment models, clear rules of engagement, quality measures and monitoring. Social media needs consensus on rules of engagement for providers, better data mining tools and approaches to counter disinformation. Mobile and wearable devices benefit from a universal programming interface, improved infrastructure, more rigorous research and integration with EHRs and HIEs. Laws for privacy and security need updating to match current technologies, and data stewards should share information on breaches and standardize best practices.

ICT tools are evolving quickly in healthcare and require a rational and well-funded national agenda for development, use and assessment.

**Key Indexing Terms:** Health information technologies; Electronic medical records; Telemedicine; Information management.
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## INTRODUCTION

Healthcare is mainly an information business. The quality, efficiency and outcomes of care depend on effectively capturing and managing patient information. There is no healthcare without management, and there is no management without information. The use of information and communication technologies (ICTs) is expanding dramatically in healthcare: more than three-quarters of U.S. hospitals and half of outpatient practices have installed electronic health records (EHRs).[1] Almost all practice venues have high-speed Internet connections, and most clinicians use electronic media for professional and personal communications.[2,3] Yet, chaos reigns:

- The many different EHR systems serving U.S. healthcare have limited ability to share information.
- There are no secure connections between EHRs, no national identifiers to link patients' data and few existing standards for formatting, summarizing or displaying patient information.
- Mandates for billing, quality improvement and other initiatives have expanded documentation requirements whereas funding constraints have reduced clinician time. Consequently, clinicians use shortcuts (eg, templates and copy-and-paste) that often increase the amount of information recorded but decrease its readability.[4]
- The amount of available information is constantly increasing; the tools to safely digest, summarize and empower the provider have not kept up.

Despite the chaos, a brighter future looms as new, exciting ICT solutions are being applied to healthcare in:

- evolving EHRs,
- health information exchange (HIE),
- patient portals and personal health records (PHR),
- telemedicine,
- social media,
- mobile devices and wearable sensors or monitors,
- privacy and security.

We discuss each area's current status, promises for tomorrow and how to realize those promises (Table).

## ELECTRONIC HEALTH RECORDS

### Current Status

EHR systems are longitudinal repositories of patients' health information. Nearly every U.S. physician has

**TABLE.** Future uses of information and communication technologies and how to achieve them

| Technology | Promise | Getting there |
|---|---|---|
| Electronic health records (EHRs) | (1) User interactions will improve with less variability between EHRs, improving provider experience<br>(2) Standards will enhance data sharing<br>(3) Documentation will be easy and less time-consuming<br>(4) Instead of being an electronic version of the paper patient record, the EHR will become an active participant in care<br>(5) EHR data will be routinely used for practice management, public health and research | (1) Create a universal application programming interface (API)<br>(2) Demand and commit to creating and using a universal patient identifier<br>(3) Improve role-specific clinical documentation<br>(4) Grow and evolve the field of clinical database epidemiology |
| Health information exchange (HIE) | (1) The number of sustainable HIEs will grow<br>(2) Regardless of source, all patients' data will be available in all of their care encounters | (1) Establish federal subsidies for HIEs to help them become sustainable<br>(2) Require EHR vendors to support export of patient data both into HIEs and import of data from HIEs<br>(3) Focus HIEs on enhancing existing EHRs rather than becoming yet another EHR |
| Patient portals and personal health records (PHRs) | (1) Patients will be able to easily access their data across health systems and apps<br>(2) Access to their data will help patients be active participants in their care<br>(3) Patients will contribute data to their PHRs and EHRs | (1) Design better patient portals and PHR platforms<br>(2) Consider and incorporate patients as integral users into PHR and EHR designs<br>(3) Develop training programs to enhance patient health and EHR literacy<br>(4) Establish provider payment models that support their using patient portals in delivering care and managing patients' health<br>(5) Leverage HIEs to facilitate PHRs without becoming yet another PHR |
| Telemedicine | (1) Telemedicine systems will be widely used to connect patients to providers<br>(2) Most routine care will be conducted via telemedicine | (1) Establish realistic and sustainable payment models for telemedicine<br>(2) Develop more user-friendly interfaces between providers and patients<br>(3) Agree upon clear rules of engagement for telemedicine and educate providers about them<br>(4) Establish telemedicine quality measures and monitoring |
| Social media | (1) Social media will be widely used to disseminate health information and enhance communication between healthcare providers and consumers<br>(2) Social media will increase peer-to-peer support among patients<br>(3) Social media will provide data for public health surveillance | (1) Expand our understanding of social media beyond Facebook and Twitter<br>(2) Establish reliable and valid approaches to mining health information from social media<br>(3) Learn how to effectively leverage social media to disseminate appropriate health information and counter existing disinformation |
| Mobile devices and wearable sensors and monitors | (1) The number and variety of mobile apps and sensing devices for capturing health data will rapidly increase<br>(2) Data from mobile apps and sensors will be incorporated into PHRs, EHRs and HIEs and become increasingly used in patient care | (1) Develop a universal platform or API that would encourage rapid development of apps for capturing data into mobile devices<br>(2) Enhance our communication infrastructure to allow widely available, fast connectivity<br>(3) Fund research that assesses the value of mobile apps to enhance health and healthcare<br>(4) Continually improve human-computer interfaces and interactions for consumer-facing solutions<br>(5) Contribute data from mobile apps to the medical record<br>(6) Discover how wearable sensor and monitoring data should be presented to providers |
| Privacy and security | (1) Standards and tools will ensure that data are safe and breaches are rare.<br>(2) Security and privacy standards will adapt over time.<br>(3) Patients will have granular control over privacy. | (1) Update law to match current methods for recording and transmitting data.<br>(2) Standardize and share best practices for security and privacy.<br>(3) Increase public awareness and transparency of uses of deidentified data.<br>(4) Routinely budget and plan for regular security enhancements. |