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Envisioning Sophisticated Electronic Health Records through the Lens of Health Care Reform

One of the least publicly discussed aims of recent health care reform legislation in the United States is to vastly improve the utility of electronic health records (EHRs) for clinical practice and research. If successfully implemented, EHRs will become platforms for the bidirectional flow of information from patients and providers to researchers and policy-makers, thus creating a nationwide learning health system (1). Significant steps toward improving EHRs so that greater value can be extracted from them were made with two pieces of legislation, the Health Information Technology for Economic and Clinical Health (HITECH) Act, passed as part of the broader American Recovery and Reinvestment Act of 2009, and the Patient Protection and Affordable Care Act (PPACA) of 2010 (2, 3). These laws, and setting up a learning health system, will have a profound impact on the clinical and research communities within pulmonary, critical care, and sleep medicine. In this editorial, we will review the benefits of using enhanced EHRs to create "smart" health systems, discuss the ways in which health reform supports the development of sophisticated EHRs, and outline how these changes will impact the practice of pulmonary, critical care, and sleep medicine.

The development of EHRs in the United States has been slow and piecemeal compared with other industrialized nations (4). As recently as 2008, less than one in five hospitals or physician practices had functional EHRs (5, 6). Barriers to EHR implementation included a lack of economic incentives, the technical complexity of EHRs, problems with interoperability between systems, and privacy concerns (4). It is no surprise, therefore, that the EHR implementation process adhered to the systemic vagaries of the American health care marketplace, where competitive market forces led to a fragmented and patchwork health delivery system.

Indeed, implementation has moved at a pace far from desirable even though there is evidence for improved clinical and research capabilities at institutions where enhanced EHRs were implemented. The Department of Veterans Affairs (VA)'s Veterans Health Information Systems and Technology Architecture (VistA) system is one of the first enhanced EHR systems implemented in the United States. It contains integrated information exchange functionality (patient information can be accessed easily by any VA provider) as well as computerized physician order entry, quality data measurement, clinical decision support, and alerts and reminders. In addition, VistA incorporates a new point-of-care clinical trial design that streamlines the cumbersome clinical trial process and allows for easy transitions from research study to decision support. This functionality thus merges evidence discovery with clinical care, as is called for by a learning health system (7). By achieving near-universal EHR adoption, the VA significantly improved quality of care, resulting in a conservatively measured net value of more than $3 billion as of 2007 (8).

Other EHRs have demonstrated additional advanced capabilities. As large data repositories, EHRs have been used to identify predictors of missed opportunities for the early diagnosis of lung cancer and to enable the early detection of the 2009 novel influenza A (H1N1) pandemic, including comorbidity identification and geographic tracking (9, 10). EHRs can provide clinical decision support to improve the timing of code status documentation in patients with advanced lung cancer and to issue guideline-based reminders to clinicians to test for α_1-antitrypsin deficiency on the basis of automated recognition of airflow obstruction (11, 12). In addition, EHRs have been used for patient triage and resource

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allocation, serving as a social network platform for information exchange between patients and providers, identifying potential research subjects, stratifying patients and assessing risk, and providing large amounts of data for analysis and follow-up (13–15).

Another important capability of sophisticated EHRs is that they must serve as platforms for the integration of care across multiple settings. Consider a patient with chronic obstructive pulmonary disease (COPD). There is a recent push to require an integrated care approach to the management of this disease (16). Currently, a COPD patient may receive inpatient care from a nearby community hospital, pulmonary and primary care follow-up from providers who are affiliated with this hospital but are part of distinct private practices, and other patient care services—pulmonary rehabilitation, polysomnography, imaging, laboratory, and/or long-term oxygen therapy—from wholly independent entities. Currently, a pulmonary physician may have to interface separately with each of these providers to obtain clinically relevant information. The integrated care model, which has been shown to improve several outcomes, including lowering readmission rates after an acute COPD exacerbation, depends on linking information acquired at these disparate care settings (17). Sophisticated EHRs allow a COPD patient's pulmonary physician to more effectively provide integrated care. This capability clearly benefits pulmonary, critical care, and sleep physicians when managing not merely COPD but any number of the disease processes we treat that require multidisciplinary and coordinated care.

Nonetheless, significant areas for improvement remain even in the benchmark systems such as VistA that have adopted many advanced EHR capabilities. Priorities for future EHR development include improved cognitive support (e.g., EHR interface and integration into workflow), information synthesis (persistent reliance on unstructured, narrative information), interoperability, and filters for quickly extracting meaningful information (18). Unfortunately, health care systems and individual providers who, due to market-driven differences in institutional priorities and EHR vendor proprietary licensing agreements, have not advanced as far as the benchmark systems create a layer of obstruction to the adoption of important EHR features.

The HITECH Act addresses some of the barriers to EHR implementation, and seeks to correct the historical, decentralized, market-driven approach to EHR implementation. The HITECH Act provides about $27 billion in economic incentives to Medicare and Medicaid providers for implementing and becoming meaningful users of certified EHRs. The HITECH Act established an office to coordinate the development of health information technology, and included legislation to overcome the technical barriers to EHR integration, to improve privacy regulations, and to develop broadly accepted standards for data recording and metadata documentation (2).

Meaningful use of EHRs is the mechanism by which the HITECH Act seeks to ensure sophisticated EHR implementation. Establishing meaningful use guidelines will proceed in three stages: capturing data in an EHR (stage 1), exchanging health information between EHRs that improves coordination of care (stage 2), and improving outcomes (stage 3) (19). For example, capturing structured pulmonary function test data that show airflow obstruction in an EHR would likely fulfill stage 1 criteria; sharing this information with other providers automatically across interoperable EHRs, leading to a pulmonologist and primary care physician coordinating the prescription of guideline-based management, would seemingly meet stage 2 criteria; and finally, demonstrating that a patient had fewer COPD exacerbations after this intervention would be required for stage 3.

The PPACA aims, in part, to transform the paradigm of health care delivery from fee-for-service to a performance-based model, through implementation of value-based purchasing, accountable care organizations, health information exchange, national quality reporting, and lower administrative overhead (3). The meaningful use of EHRs is integral to this effort. Indeed, implementation of PPACA without the meaningful use of EHRs could run the perverse risk of incentivizing volume that is at the heart of the fee-for-service model. That health care reform includes organizational centralization through accountable care organizations and a redefinition of economic value from fee-for-service to pay-for-performance initiated by the PPACA, and the HITECH roadmap for EHR technology to accomplish these shifts, increases the likelihood of success for both pieces of legislation.

Whether these legislative efforts translate into a nationwide system of advanced, interoperable EHRs is an open question. Financial incentives focused on quality and coordination and a roadmap for meaningful use are important building blocks, as demonstrated by recent trends. Recent evidence from the Department of Health and Human Services points to the fact that more than 50% of providers and 80% of hospitals have become meaningful users and received incentive payments (20). However, federal regulation and incentivization can only go so far in combating the fragmented nature of our health care system. Health care institutions and networks, and the EHR vendors that supply them, are a product of our market-driven society. Thus, the development of an interoperable EHR system may be at the mercy of larger economic forces that are highly resistant to such a collaborative arrangement.

The greatest challenge to the success of a nationwide system of advanced, interoperable EHRs, however, is the fact that we may be creating an infrastructure without the human capital necessary to exploit it. EHRs are one component of a learning health system, which also relies on researchers, clinicians, and support from public health organizations. The Institute of Medicine defines a learning health system as being "designed to generate and apply the best evidence for the collaborative healthcare choices of each patient and provider; to drive the process of discovery as a natural outgrowth of patient care; and to ensure innovation, quality, safety, and value in health care" (21). Researchers must be given the resources to continually expand the evidence base and translate it into clinical practice. Clinicians and institutions must be given the resources to integrate the evidence base into their clinical practice. Unfortunately, although the federal government is regulating the implementation of EHRs, the current budget sequestration is only the latest example of a political system that limits our ability to fully realize the growth of the biomedical research and clinical enterprises necessary for establishing a successful learning health system. Dwindling resources make it more likely that we are creating an EHR shell for a learning health system without a core.

The goals of health care reform are ambitious, including transforming EHRs into a tool for a learning health system. Existing EHR systems already have some of the necessary capabilities and will be augmented in coming years, benefiting pulmonary, critical care, and sleep physicians and their patients through meaningful use, improved research and public health functions, and more sophisticated integration. However, true success will be defined by the joining of governmental regulation and market forces to create a seamless flow of medical information between clinicians, researchers, and policymakers. Only through the unified effort of these stakeholders will the promise of truly modern EHRs be achieved: the improvement of individual patient health, the advancement of scientific discovery to generate new evidence, and the rewarding of value instead of volume.

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