Electronic Health Records and US Public Health: Current Realities and Future Promise

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Electronic health records (EHRs) could contribute to improving population health in the United States. Realizing this potential will require understanding what EHRs can realistically offer to efforts to improve population health, the requirements for obtaining useful information from EHRs, and a plan for addressing these requirements. Potential contributions of EHRs to improving population health include better understanding of the level and distribution of disease, function, and well-being within populations. Requirements are improved population coverage of EHRs, standardized EHR content and reporting methods, and adequate legal authority for using EHRs, particularly for population health. A collaborative national effort to address the most pressing prerequisites for and barriers to the use of EHRs for improving population health is needed to realize the EHR's potential. (*Am J Public Health.* 2013;103:1560–1567. doi:10.2105/AJPH.2013.301220)

The potential contributions of electronic health records (EHRs) to clinical care, on the one hand, and to population health and public health on the other, were delineated in the United States in the 1990s and early 2000s.[1–4] (Population health is defined as "The health outcomes of a group of individuals, including the distribution of such outcomes within the group"[5(p381)]; public health is "The practices, procedures, institutions, and disciplines required to achieve the desired state of population health."[6(p138)] For other definitions used in this article, see appendix, available as a supplement to the online version of this article at http://www.ajph.org.) Data flows would be simplified and streamlined, and burdens on data providers and data collectors reduced; EHRs would enable collection of data just once, which then could be repurposed for multiple uses.

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Standards for Privacy of Individually Identifiable Health Information (Privacy Rule) established national legal authority permitting, though not requiring, "covered entities" to transmit individually identifiable health information from EHRs and health care transactions to public health authorities. The Privacy Rule authorizes public health authorities to receive such information for the purpose of preventing or controlling disease, injury, or disability and for specified uses including "reporting of disease, injury, and vital events" and "conducting public health surveillance, investigations, and interventions."[7(p2)] Covered entities can also disclose deidentified data and limited data sets, as defined in the Privacy Rule.[7]

Whereas the Privacy Rule established national legal authority for sharing EHR data for specific public health purposes, the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 established funding for sharing specified EHR data with public health authorities. The EHR Incentive Program mandated under HITECH provides Medicare and Medicaid incentive payments and penalties for specified "meaningful uses" of EHRs.[8] For the first stage of meaningful use implementation, EHR systems certified under HITECH must be able to perform 3 functions for public health population-based programs: interfacing with immunization registries to transmit electronic data as directed by public health agencies; electronically recording, modifying, retrieving, and submitting syndromic surveillance data; and electronically recording, modifying, retrieving, and submitting reportable clinical laboratory results using Health Level Seven standards.[9] The second stage of meaningful use adds 2 more functions: identifying and reporting cancer cases to a state cancer registry, and identifying and reporting specific cases to a specialized registry (other than a cancer registry).[10] For those public health purposes currently included within HITECH's meaningful use provisions, initial data and transmission standards are specified.[9] Through January 2011, the Office of the National Coordinator issued $548 million in grants to help states develop health information exchanges for transmitting electronic health data among health care providers, and with Medicare, Medicaid, and public health agencies.[11]

In addition to the HIPAA Privacy Rule and the HITECH meaningful use provisions, longstanding state statutes and regulations require transmission of health care provider data for specified surveillance and civil registration purposes, such as reportable diseases and conditions, vital records, and cancer registries. State legal authority typically also enables collection of data in response to threats to public health.

Our purpose in this article is fourfold: (1) to describe briefly current US efforts to use EHRs for population and public health; (2) to identify potential contributions of EHRs to population and public health; (3) to delineate barriers and prerequisites to achieving those potential contributions; and (4) to suggest next steps for realizing this potential.

CURRENT US EFFORTS TO USE EHRS FOR POPULATION AND PUBLIC HEALTH

Despite investments and progress within the last decade toward the use of EHRs and health information exchanges for clinical care and health care administration, current and planned near-term uses of EHRs for public health under HITECH meaningful use are limited to syndromic surveillance, laboratory reporting, and registries. These uses are essential to public health practice, but the data collected for them constitute only a small portion of ongoing data collections by state and local health departments and the US Centers for Disease Control and Prevention.[12] Even the positive effects of the now mandated "meaningful uses" of EHRs for public health are limited by uneven health information exchange coverage across the United States, uneven penetration of EHRs into ambulatory practices and acute care hospitals, and uneven coverage of EHRs within individual communities.[13,14] Apart from meaningful use, EHR uses for public health have typically been limited to identifying diseases of public health importance, such as acute hepatitis B infection, influenza-like illness, and acute infectious gastrointestinal disease, within specific locations.[15,16] Current EHR content in the United States remains inadequate for meeting essential population health and public health information needs, including functional status, well-being, and societal factors that influence population health.

POTENTIAL CONTRIBUTIONS OF ELECTRONIC HEALTH RECORDS

The potential contributions of EHRs differ for population health and public health, on the one hand, and individual health and health care, on the other (Tables 1 and 2).[36] The most basic differences lie in the types of information that EHRs could contribute to improve population and public health versus the types that are required from EHRs to facilitate individual patient care. Consequently, the prerequisites for EHRs providing these types of information also differ for populations and for individuals. To provide information about populations rather than individual patients, EHRs must cover entire populations, definable subpopulations, or representative samples of populations; have standardized measures for disease, functional status, well-being, and influences on population health; and provide timely, accessible, and standardized reporting of specific EHR data.

Potential Contributions to Population Health

EHRs can contribute to population health through providing clinically based measurements of the levels and distributions of diseases, functional status, and well-being, and through providing data for developing and maintaining population health records.[18] For example, a useful EHR contribution to population and public health would be comprehensive and accurate patient problem lists, revised at every clinical visit, which when linked over time for individual patients, aggregated for population and subpopulations, and appropriately analyzed could provide both cross-sectional and trend information about the health of populations, including incidence and prevalence estimates of both acute and chronic conditions. Such a contribution would place little or no additional burden on providers, as a current problem list is already required as part of a patient's summary of care document under stage 2 meaningful use.[10] Other useful—but potentially more burdensome—EHR contributions might include expanded information on social and behavioral risks and other influences on population health, such as patient diet, lack of exercise, occupational history, exposure to domestic violence, and guns in homes.

Four prerequisites are needed for EHRs to contribute needed information about populations and subpopulations. First, EHRs must cover an entire population, one or more defined subpopulations, or a representative sample of an entire population or a defined subpopulation.[18,37] Total population coverage or coverage of a representative sample is necessary to provide valid and reliable generalizations about the population. Second, standardized EHR measures of functional status, well-being, disease, and major factors influencing population health must exist. Standardization of measures enables aggregation of data from multiple health care provider sites in multiple geographies. Third, reporting of EHR measures must be standardized to enable population-level and subpopulation-level aggregation. Standardized reporting enables periodic or ongoing aggregation from multiple health care provider sites in multiple geographies. Fourth, robust methods must exist to enable the linkage of EHR data on individuals over time, to track health over lifetimes, and to facilitate population health analysis over the life course. Although having unique health care identifiers for individuals would be the best method for record linkage,[38] current law and political realities require the use of other methods, such as probabilistic matching[39–41] (Table 1).

Potential Contributions to Public Health Population-Based Programs

EHRs can contribute to public health population-based programs through improving the reporting and investigation of diseases and conditions that are mandated for reporting to state and local public health agencies; identifying sentinel diseases, injuries, and events that "can be used to assess the stability or change in the health levels of a population"[2](p167); and providing data for population and disease registries, such as registries of newly diagnosed cancers. The first 3 prerequisites needed for EHRs to contribute needed information for public health population-based programs are the same as those for population health. The fourth and final prerequisite is timely reporting of, or access to, specific EHR information needed for implementing and evaluating time-sensitive public health actions[42] (Table 1).

Potential Contributions to Public Health Policies and Financing

EHRs can contribute to government public health policies and financing through providing estimates of disease burden and its distribution in the population and population subgroups. Such estimates could facilitate program planning, targeting, implementation, and monitoring. Prerequisites for EHRs providing needed information for government public health policies and financing are the same as those for public health population-based programs (Table 1).

FULFILLING THE POTENTIAL OF ELECTRONIC HEALTH RECORDS

Conditions within the US health care system will affect whether the potential of EHRs for public health and population health are achieved. These conditions include health care economics, clinical workflow, and trends in health care provider acquisition of certified electronic health record technology (CEHRT). The transition from fee for service to forms of payment that reflect providers' management of risk across patient populations will take time, require local innovation, and complicate the

TABLE 1—Potential Contributions of Electronic Health Records (EHRs) to Information Needs for Population Health and Public Health and Prerequisites for These Contributions

Topic and Target	Activities to Influence Target	Information Needed About the Target	Potential Contribution of EHRs to Needed Information About Target	Prerequisites for EHRs Providing Needed Information
		Health		
Population health (level and distribution of population's well-being and functional status). Primary target: population or population subgroup.	• Public health (providing a healthful environment; promoting healthy lifestyles) • Health care (treatment of disease; amelioration of disability and relief of suffering)	• Level of population's functional status • Level of population's well-being • Knowledge of societal factors that influence population health and likelihood that they will affect health	• Measuring level and distribution of disease, functional status, and well-being • Tracking health disparities (Office of the National Coordinator) • Building population health record(s)[18]	• Coverage by EHRs of population or definable subpopulations, or representative population subsamples • Standardized EHR measures for disease, functional status, well-being, and influences on population health[17] • Standardized reporting to enable population and subpopulation aggregations and analysis • Unique health care identifier for individuals[19] or effective record linkage
		Health programs		
Public health population-based programs (such as fluoridation of water, fortification of cereals with folic acid, antitobacco media campaigns). Primary target: population or population subgroup.	• Public health policies and programs • Policies and programs affecting influences on population health	• Level of population's functional status • Level of population's well-being • Presence of societal factors that influence population health and likelihood that they will affect health • Knowledge of safe, effective population strategies to improve health	• Improving reporting and investigation of notifiable diseases[17,20] • Identifying sentinel diseases, injuries, and events[21–23] • Improving surveillance, program targeting, and program interventions for chronic conditions[24,25] • Populating population and disease registries[26]	• Coverage by EHRs of population or definable subpopulations, or representative population subsamples • Standardized EHR measures for disease, functional status, and well-being, as needed for and specific to individual programs • Standardized reporting to enable population and subpopulation aggregations and analysis • Timely reporting of, or access to, specific EHR information
		Financing and policy		
Government public health policies and financing (such as banning sale of cigarettes to minors). Primary target: population or population subgroups.	• Health policies and regulations (such as clean water regulations) • Financing of public health population level programs (such as restaurant inspections and antismoking media campaigns)	• Knowledge of safe, effective strategies to improve population health • Level and distribution of population health problems • Level and distribution of population health disparities	• Estimates of disease burden and its distribution in population and population subgroups	• See entries for "Public Health Population-Based Programs" in this column above

TABLE 2—Potential Contributions of Electronic Health Records (EHRs) to Information Needs for Individual Health and Health Care and Prerequisites for These Contributions

Topic and Target	Activities to Influence Target	Information Needed About the Target	Potential Contribution of EHRs to Needed Information About Target	Prerequisites for EHRs Providing Needed Information
Health				
Individual health (well-being, functional status). Primary target: individual.	• Public health (providing a healthful environment; promoting healthy lifestyles) • Health care (treatment of disease; amelioration of disability; relief of suffering) • Policies (secondhand smoke) • Financing (employer-based or nongroup health care insurance)	• Level of functional status • Level of well-being • Factors that influence health and likelihood that they will affect health	• Assessing patient's well-being and function • Past medical history • History of clinical encounters • Physiologic and pathologic findings • Diagnosis and treatment of disease and injury • Clinical research[27,29]	• Linkage of all clinical records to provide a comprehensive, longitudinal individual record • Privacy assurances • Timely access to individual records • Presence of individual identifier[19] • Universal standards[27,28]
Health services				
Individual health care services (delivery of clinical preventive services; clinical encounters and clinical management; clinical services for designated populations [neighborhood health centers, Veterans Administration]). Primary target: individual patient.	• Supply and distribution of health care providers and facilities • Availability and quality of health care services, including clinical preventive services • Financing (health insurance) • Policies (e.g., required clinical preventive services)	• See entries for "Individual Health" in this column above • Assessment of comparative effectiveness of strategies to improve health, treat disease, and relieve suffering for individual patients • Assessment of quality of health care	• See entries for "individual health" in this column above • Record of clinical encounters and providers for coordinating care[30] • Monitoring delivery of clinical preventive services, such as screening, counseling, immunization, preventive medication • Providing information on the safety and effectiveness of clinical services • Dissemination of public health practice guidelines[31] • Implementation of surveillance-based clinical decision rules[32] • Monitoring health care quality and safety[33,34]	• See entries for "Individual Health" in this column above
Financing and policy				
Government health care policies and financing. Primary target: individuals and individual patients in designated population subgroups.	• Health care regulation and incentives • Health insurance for designated population subgroups (Medicare, uniformed services, veterans) • Financing clinical services for underserved or uninsured populations (Medicaid, Indian Health Service, neighborhood health centers)	• Knowledge of safe, effective strategies to improve health, treat disease, and relieve suffering for designated population subgroups • Number and distribution of underserved or uninsured individuals • Costs of providing health care for designated population subgroups and underserved or uninsured populations	• Identification of adverse health care outcomes and enhancing health care quality[35] • Identification of need for coordinating care • Providing information on the safety and effectiveness of clinical services	• Coverage by EHRs of population or definable subpopulations, or representative population subsamples • Standardized reporting to enable population and population subgroup aggregations and analysis

adoption of CEHRT.[43,44] Although CEHRT is an essential component of meaningful use and will be critical for measuring health status and outcomes, the pace of adoption of CEHRT cannot be accurately predicted. As HITECH meaningful use stage 3 approaches, providers may make a calculated decision to forego incentive payments, anticipating that waiting for more progress and stability in EHR capability—and greater simplicity in installation and maintenance—will minimize their total costs. Adding to this complexity, the Centers for Medicare and Medicaid Services, through Medicare, may drive further change in EHR capability by requiring specific data and performance measures.[45]

In addition to potential barriers posed by uncertainties in the health care system, existing barriers to the potential contributions of EHRs to the US population and public health will require new legal authority, funding authority, standards (data and transmission), information content and analytical methods, and public and political acceptance of these new uses of EHRs. Specific barriers and steps for overcoming them may differ for population health, public health population-based programs, and government public health policies and financing (Table 3).

Next Steps for EHR Use for Population Health

Explicit state or federal legal and funding authority that would enable EHR data to be used for population health information does not exist, apart from specific state legal authority for collecting data on births, deaths, and cancer incidence. Legal and funding authority does not mandate universal population coverage of EHRs or assignment of unique health care identifiers for use in EHRs. Current penetration of EHRs into US hospitals and ambulatory care practices is uneven and far from universal; even with HITECH incentives, achieving universal coverage remains a distant goal.[46] EHR data and transmission standards are lacking key aspects of population health and the influences on population health, including well-being and functional status. In the absence of data standards, highly structured data would be needed. Lacking structured data, free-text data mining would need to be developed that is appropriate for culling needed data from EHRs. Use of EHR data for population health information purposes may generate privacy and confidentiality concerns, especially any proposals for implementation of a unique national health care identifier for individuals and for sharing of identified or perhaps even deidentified EHR data without the patient's consent.

Overcoming barriers to using EHRs for population health information will require a broad effort. New legal authority may be needed for using EHR data for general population health information purposes under the HIPAA Privacy Rule or through other legislation. Similarly, the applicability of general provisions in existing state laws and regulations enabling collection of identifiable data for unspecified public health purposes will need to be expanded to cover EHR data. A national framework for secondary use of EHR data for population health will need to be established.[47] As proposed by Detmer, one approach to facilitating the use of identified EHR data for population health information purposes would be national legislation that mandates a unique identifier and the use of anonymized EHR data without consent, but allows opt-outs for individuals who do not wish to participate.[19] To make population health data that are derived from EHRs more useful, standards development will need to focus on key aspects of population health and influences on population health, including functional status, well-being, and various health behaviors. Adoption of the International Classification of Functioning, Disability and Health[48] and the Public Health Reporting Initiative within the Standards and Interoperability Framework[49] are potential starting points for needed standards. A common standards agenda for population health and public health must be developed, similar to the processes currently under way for developing data standards for reportable conditions convened by the Office of the National Coordinator and the Public Health Data Standards Consortium.[49–51] Developing an approach to integrating currently fragmented population health data from multiple sources, including EHRs, to provide a truly useful "population health record" would further the usefulness of EHR data for population and public health.[18]

Next Steps for EHR Use for Public Health Population-Based Programs

There are fewer barriers to using EHR data for public health population-based programs than for population health information. Whether the sources of these data are EHRs, hospital records, or direct collection from patients, public opinion apparently accepts transmission and use of data for specified public health surveillance and response activities, and for civil registration. To expand use of EHRs for public health population-based programs, HITECH provisions could be augmented for the third stage of meaningful use implementation to include a broad range of measures needed for public health population-based programs. The patient problem list and important social and behavioral influences on health could also serve public health programs. Similarly, existing state laws and regulations could be expanded to encompass additional data collection and use for specific purposes. As meaningful use provisions for public health and existing state laws and regulations are expanded, relevant gaps in data content and transmission standards will need to be filled; the Office of the National Coordinator and Public Health Data Standards Consortium processes, discussed in "Next Steps for EHR Use for Population Health," might serve as a useful model here as well.

CONCLUSIONS

The potential contributions of EHRs to US population and public health are substantial. HIPAA and the HITECH Act's meaningful use provisions provide a solid grounding and structure for expanding the contributions of EHRs to public health. However, the statutory grounding for expanding the contributions of EHRs to population health remains unclear. Challenges to the use of EHRs for population health information extend beyond legal and funding issues to include the need to improve EHR data quality, expand EHR data content, and develop and implement EHR data standards for a broad range of population health measures. These challenges also include developing or improving techniques for generating valid estimates for populations and subpopulations from EHRs with incomplete population coverage; linking EHRs to public

TABLE 3—Barriers to Fulfilling Potential of Electronic Health Records (EHRs) for Contributing to Population and Public Health

	Barriers to Fulfilling Potential				
Topic	Legal Authority	Funding Authority	Standards (Data and Transmission)	Information Content and Analytical Methods	Public Acceptability of Purpose and Use
Population health	• Lack of explicit state or federal legal authority for collection and use of EHR data for assessing population health • Lack of state or federal legal authority for universal population coverage by EHRs • Lack of state or federal legal authority for unique health care identifier for individuals	• State funding for collection and use of EHR data for population health may depend on state general fund revenues and federal cooperative agreements and grants • Lack of state or federal funding for universal population coverage by EHRs • Lack of state or federal funding for development and implementation of unique health care identifier for individuals	• Lack of EHR data and transmission standards for measurement of well-being, functional status, and societal influences on population health	• Lack of structured EHR data on well-being, functional status, and societal influences on population health • In absence of structured data, need for data mining of free-text data to measure well-being, functional status, and societal influences on population health • Lack of unique health care identifier for individuals that would facilitate accurate linkage of health records for an individual over time and from various providers	• Use of EHR data for population health information likely to generate privacy and confidentiality concerns • Any proposal for unique national health care identifier for individuals likely to encounter substantial political opposition • Need for resolution of issues relating to individual patient's opt-out, opt-in, or ability to delineate part of the EHR not to be shared for population health information
Public health population-based programs[a]	• HIPAA enables use of EHR and other health care transaction data for designated public health purposes • Explicit state and federal legal authority for collection and use of EHR data for population-based programs varies and is specific to individual programs • HITECH Act "meaningful use" provisions promote use of selected EHR data for specific designated purposes	• State and federal funding for collection and use of EHR data are specific to individual uses, as in Medicare and Medicaid incentives for "meaningful use"	• Availability of EHR data and transmission standards varies with content of public health population-based programs	• Availability of EHR data content relevant to selected public health population-based programs (such as smoking cessation)	• US history of requiring transmission of data for public health purposes may minimize political opposition to use of segmented EHR data for public health population-based programs

Note. HIPAA = Health Insurance Portability and Accountability Act; HITECH = Health Information Technology for Economic and Clinical Health.

[a] Barriers to fulfilling potential of EHRs for government public health policies and financing are the same as those for public health population-based programs.

health data to enable longitudinal population- and person-based portraits of a full range of individual health, population health, and the influences on both; and ensuring the security and confidentiality of individual-level EHR when used for public and population health purposes.

Expectations about using EHRs for population health need to be tempered by practical considerations, recognizing that even those countries with relatively high rates of EHR penetration have achieved only limited successes in using EHR data for population health.[52–54] A highly visible national effort, perhaps initiated by an Institute of Medicine roundtable and expert panel, to recommend necessary developments to enable use of EHRs for population health information could stimulate public and political support for the individual steps discussed in this article. ■

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Contributors

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