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# Applications of Electronic Health Information in Public Health: Uses, Opportunities and Barriers

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## Abstract

Electronic health information systems can re-shape the practice of public health including public health surveillance, bi-directional communication, disease and injury investigation and control, decision making, quality assurance, and policy development. While these opportunities are potentially transformative, and the federal program for the meaningful use of electronic health records has included important public health components, significant barriers remain. Unlike incentives in the clinical care system, scant funding is available to public health departments to develop the necessary information infrastructure and workforce capacity to capitalize on electronic health records, personal health records, or big data. Current electronic health record systems are primarily built to serve clinical systems and practice rather than structured for public health use. In addition, there are policy issues concerning how broadly the data can be used by public health officials. As these issues are resolved and workable public health solutions emerge, they should yield a more efficient and effective public health system.

## Acknowledgements

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## Keywords

Informatics; EDM Forum; Public Health; Epidemiology; Surveillance; Quality Improvement; Quality Assurance; Policy; Electronic Medical Record; Electronic Health Record; Meaningful Use; Electronic Clinical Data; Electronic Lab Reporting

## Disciplines

Community Health and Preventive Medicine | Epidemiology | Health and Medical Administration | Health Information Technology | Health Services Administration | Health Services Research | Public Health

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# Applications of Electronic Health Information in Public Health: Uses, Opportunities & Barriers

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## Abstract

Electronic health information systems can reshape the practice of public health including public health surveillance, disease and injury investigation and control, decision making, quality assurance, and policy development. While these opportunities are potentially transformative, and the federal program for the Meaningful Use (MU) of electronic health records (EHRs) has included important public health components, significant barriers remain. Unlike incentives in the clinical care system, scant funding is available to public health departments to develop the necessary information infrastructure and workforce capacity to capitalize on EHRs, personal health records, or Big Data. Current EHR systems are primarily built to serve clinical systems and practice rather than being structured for public health use. In addition, there are policy issues concerning how broadly the data can be used by public health officials. As these issues are resolved and workable solutions emerge, they should yield a more efficient and effective public health system.

## Introduction

Public health depends on a robust information base to carry out its primary tasks of assessment, policy development and assurance.<sup>1</sup> Reliable, timely data are needed perhaps most evidently in response to infectious disease and other acute events. Historically, public health surveillance has relied on telephone and mail, and more recently online, completion of notifiable disease reports and access to electronic laboratory reporting (ELR). However, several new types of health information technology (HIT) may play an important role in support of public health in the near future, including: electronic health records (EHRs), personal health records (PHR), health information exchange (HIE), clinical decision support (CDS), and Big Data analytics. Each technology has potential benefits, as well as significant barriers to use.

This HIT is seen as central to achieving the “Triple Aim” of health-care reform: “improving the individual experience of care; improving the health of populations; and reducing the per capita costs of care for populations.”<sup>2</sup> Ready access to data at the point of care supports clinical decision making that benefits the individual patient, and that same access to data is required to support agencies making decisions that have an impact on the health of populations. For example, public health could quickly assess the completeness of immunizations, understand which populations remain underimmunized, initiate action to understand the reasons, and take action targeted at clinical care systems, physicians, or patients as the need requires.<sup>3</sup>

Similarly, the availability of electronic clinical information on cases and their management will greatly enhance the ability to improve the quality of traditional public health services. While most communicable disease services are currently provided outside of public health clinics, public health remains responsible for investigation, contact tracing and management, relying on laboratory and passive physician reporting to assure cases are referred. More efficient and more rapid transmission of medical data can lead to more rapid identification of patients, simplify identification of clusters, facilitate contact tracing and patient or professional education and other initiatives. The data can be used to identify gaps in quality of care, such as failure to follow recommended guidelines or inadequate follow up and treatment.

The advent of widely available electronic health information and Big Data, the massive amount of data produced each day, also provides new opportunities to understand social interactions, environmental and social determinants of health and the impact of those environments on individuals. The powerful analytic tools that have been applied to marketing and other fields are not commonly present in public health departments, but implementing them has the potential to fundamentally change surveillance and other systems. By the same token, technology puts information into the hands of users who can use it to drive community change. Making data readily available – with appropriate protections, of course – can empower stakeholders in ways that one can now only imagine.

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We are also at the cusp of major change as public health roles become more demanding and are being reshaped by the Affordable Care Act (ACA). As more people have insurance coverage, the need for public health to deliver clinical services will diminish substantially with a residual function for those who remain without access to the mainstream clinical care system. What will not diminish, however, is the public health responsibility to control certain clinical conditions.

This system transformation signals great opportunity for the integration of public health and health care through public health informatics. Indeed, public health informatics can support “the triple aim of achieving a public health goal faster, better, or at a lower cost by leveraging computer science, information science, or technology.”<sup>7,4</sup> The Los Angeles County Department of Public Health has begun this journey and has a well-developed ELR system for notifiable diseases. However, it foresees the need to rapidly expand its capability to use emerging HIEs to access those data. Unlike the incentives available to the clinical care system for developing MU capabilities, public health has few resources to develop its information technology infrastructure and ability to analyze and use those data efficiently and effectively. This article provides some insights into the practical impacts of the burgeoning electronic systems on public health departments.

## Current and Emerging Uses of Electronic Health Information

Electronic health information can potentially improve many of the core functions in public health (See Figure 1).

### Data Collection

Public health agencies monitor the health status of populations, collecting and analyzing data on morbidity, mortality and the predictors of health status, such as socioeconomic status and educational level. There is a particular focus on diseases of public health importance, the needs of vulnerable populations and health disparities. An EHR provides both episodic snapshots and a longitudinal view of a patient’s health related to clinical care. A PHR provides a powerful tool for gathering information about clinical visits, as providers and patients use the application to access, manage and share health information.<sup>5</sup> A survey of PHR users identified a willingness to share their data for care improvement and public health purposes.<sup>6</sup>

The use of EHR data to support public health surveillance and epidemiology has been demonstrated for a wide range of conditions, including respiratory diseases, cancer, and even social determinants for disease.<sup>7,8,9</sup> The use of data mining and analytic techniques on EHR data has the potential to identify new risk factors and target interventions at the individual level.<sup>10,11</sup> For example, a health system’s EHR was used to identify smokers for tobacco dependence interventions.<sup>12</sup>

EHRs can provide data on subpopulations, geographic areas and health conditions that are typically underrepresented in public health surveillance and large-scale surveys, most often conducted

at the federal or state level. For example EHR data from a county clinic serving children in foster care was used to describe the health status of this vulnerable population.<sup>13</sup> The NYC Macroscopic project launched “a population health surveillance system that uses electronic health records (EHRs) to track conditions managed by primary care practices that are important to public health,” where they monitor the community prevalence of “chronic conditions, such as obesity, diabetes and hypertension, as well as smoking rates and flu vaccine uptake.”<sup>14</sup>

The combination of EHR data and geographic information system (GIS) technology has the potential to provide for selective sampling of demographic groups or geographic communities and can be used to understand patterns of illness and delivery of care at the community level.<sup>15,16</sup> Cancer epidemiology has prioritized the use of Big Data, and genomics has used it to identify genetic risk factors for common diseases and mutations that confer a high risk for rare conditions.<sup>17,18</sup> Big Data facilitates more *drilling down* (viewing more detail), *drilling up* (viewing data in aggregate), and *slicing-and-dicing* (viewing specific combinations of data variables) than may be reasonable with traditional data collection and desktop-based analysis.<sup>19</sup>

Many public health departments are pursuing a health-in-all-policies approach to assure that health is a consideration in all major policy decisions. These might include developing new housing, factories, transportation systems, recreation facilities, or educational initiatives to increase graduation rates. Health impact assessments play a critical role in informing decision makers about how their decisions can be used to maximize health and mitigate harms.<sup>20</sup> Using GIS to look at both Big Data and EHR data may support the detailed knowledge of risk groups, behaviors, social and physical environments needed for both epidemiology and comprehensive policy evaluation such as health impact assessments.

### Analysis, Diagnosis, and Investigation of Public Health Concerns

Public health authorities are required to drill down for individual data and risk factors in order to diagnose, investigate and control disease and health hazards in the community, including disease that originates with social-, environmental-, occupational- and communicable-disease exposures. The community relies on public health to control exposure across jurisdictions and sectors, which may involve closing a school or business, isolating infectious individuals, or limiting exposures to health hazards. For example, a clinician or laboratory reports a case of active tuberculosis to the local health department. In response, public health staff performs chart reviews and patient interviews to identify exposed community members and immediately ensure appropriate precautions. For the next year they ensure that all affected patients receive appropriate care and case management. They may provide direct clinical services, expert consultation for drug-resistant and other challenging cases, or they may provide oversight of private sector care, to ensure an appropriate treatment regimen and patient adherence.

**Figure 1: Summary of Public Health Opportunities Utilizing HIT**

Public Health Function	Opportunities with Health IT
Collection of data on individual or community health status	EHRs provide an episodic and longitudinal view of an individual's health. <sup>5</sup>
	HIE infrastructure can reduce the technical effort required to monitor lab or physician diagnosed illnesses. <sup>33</sup>
	EHRs can monitor community prevalence of chronic conditions. <sup>14</sup>
	EHRs can describe vulnerable populations' health status. <sup>13</sup>
	EHR add-ons can supply bioterrorism monitoring through real-time, automated reporting. <sup>21</sup>
Analysis, diagnosis, and investigation of public health concerns	Social determinants for disease can be identified by linking Community Information Systems (CIS) with EHRs. <sup>9</sup>
	EHR data-mining techniques can potentially identify new risk factors for disease. <sup>10</sup>
	Bidirectional alert systems inform providers when a set of symptoms correlate with disease outbreaks. <sup>27,28</sup>
Implementation of public health strategies	EHRs and PHRs can improve efficiency of investigations and quality assurance processes and support proper treatment and case management of infectious diseases. <sup>25,26</sup>
	EHRs illuminate opportunities for targeted interventions for at-risk individuals. <sup>12</sup>
	Bidirectional support through combined registry and EHR data can alert clinicians when a patient isn't being treated for a condition. <sup>23</sup>
	GIS-analyzed Big Data and EHRs can inform Health Impact Assessments. <sup>20</sup>

This process is resource intensive and time-consuming for both the public health department and clinicians, which can lead to a suboptimal response and public health control measures. Access to EHR data can improve the efficiency of both the investigation and quality assurance process, because health department staff no longer must travel to multiple sites, manually abstract data from multiple electronic medical records (EMRs), or reenter abstracted data into an electronic public health information system. EHR data may offer a more longitudinal, complete and accurate information than a onetime interview with a patient. Data obtained from a PHR may offer data that is different in content or time frame, and it might also offer information on patients that have not had a clinical visit.

Bioterrorism events and outbreaks such as bacterial meningitis and pandemic influenza demand a rapid public health response that only timely access to clinical data can guide. EHR add-on technologies have been developed specifically to support real-time, automated reporting of notifiable diseases, influenza-like illness, and diabetes prevalence to health departments.<sup>21</sup> The efficiency of the public health response can also be improved when clinicians receive public health information in a timely way. Efforts to support bidirectional communication that integrates

public health information and interventions at the point of care have been encouraged and might include information about patients followed by the public health agency (PHA), communicable disease outbreaks and control, environmental exposures, medication and product recalls.<sup>22</sup>

### Implementation of Public Health Strategies

Several pilot studies have demonstrated the promise of bidirectional HIE to support efficient surveillance and public health interventions, including linking patients to care and assuring the quality of clinical care. The Louisiana State University Hospital System and the Louisiana Office of Public Health implemented a bidirectional data exchange to link HIV-positive patients not currently receiving HIV treatment to appropriate medical care.<sup>23</sup> By matching hospital registration data with the local health department's HIV/AIDS registry, the authors were able to alert physicians that a presenting patient was not currently receiving HIV treatment. The median time between the patient's last medical visit and the alert was 20 months. More than 70% of alerts issued were followed by a documented action by the provider, helping to assure appropriate patient care.



**Figure 2: Public Health Functionality within MU**

Meaningful Use Stage	Public Health EHR Opportunity
<p><b>1. Data Capture and Sharing</b>            Components include the following:</p> <ul style="list-style-type: none"> <li>• Electronically capturing health information in a standardized format</li> <li>• Using that information to track key clinical conditions</li> <li>• Communicating that information for care coordination processes</li> <li>• Initiating the reporting of clinical quality measures (CQMs) and public health information</li> </ul>	<p>The reporting of clinical quality measures (CQMs) (e.g., HgbA1C control, Chlamydia screening, and influenza or pneumococcal vaccinations).</p> <p>Data submission to support traditional public health functions (i.e., reportable laboratory results, syndromic surveillance, immunization information systems, cancer registries, and other specialized registries).</p>
<p><b>2. Advance Clinical Processes</b>            Components include the following:</p> <ul style="list-style-type: none"> <li>• More rigorous HIE</li> <li>• Electronic transmission of patient care summaries across multiple settings</li> <li>• More patient-controlled data</li> </ul>	<p>The collection of clinical data of possible public health interest (e.g., demographics, vital signs, smoking status, and family history).</p> <p>HIE infrastructure standardizes data exchanged through varied PHA IT systems and clinical EHR models.</p>
<p><b>3. Improved Outcomes</b>            Components include the following:</p> <ul style="list-style-type: none"> <li>• Improving quality, safety, and efficiency, leading to improved health outcomes</li> <li>• Decision support for national high-priority conditions</li> <li>• Patient access to self-management tools</li> <li>• Access to comprehensive patient data through patient-centered HIE</li> <li>• Improving population health</li> </ul>	<p>Submission of HAI reports.</p> <p>An immunization information system that provides person-specific recommendations.</p> <p>Submission of adverse event reports.</p>

This example of bidirectional communication provided person-specific, context-sensitive knowledge that supported both health-related decision making and action by healthcare providers, assuring high-quality clinical care and an effective and efficient public health intervention using CDS. More than merely providing information, CDS tools and processes can include automated reminders and alerts, condition-specific order sets, data reports and visualizations, clinical guidelines and evidence-based references.<sup>24</sup> CDS is generally available as an embedded function of an EHR at the point of care; less commonly, CDS is provided through an EHR as an HIE service or to an individual via a PHR. CDS supports quality assurance efforts in that it facilitates high-quality clinical care that helps ensure a timely and effective public health response benefitting both the individual patient and the community.<sup>25,26</sup>

The Institute for Family Health in New York City used advisory statements from the local health department to create alerts within their EHR system, prompting appropriate laboratory testing during foodborne disease outbreaks and appropriate testing and treatment during a local *Legionella* outbreak.<sup>27,28</sup> The alert was triggered by symptoms such as cough, chest pain, fever, chest

congestion or cold symptoms, and the management guidance included information on diagnosis, testing and treatment. A prepared order set “included orders for sputum culture, *Legionella* urine antigen, chest x-ray, and complete blood count, as well as outpatient antibiotic prescriptions appropriate for community acquired pneumonia.”

Bidirectional communication via a PHR or a SMART (“Substitutable Medical Applications, Reusable Technologies”) application for a mobile device may also offer CDS to guide individual patient action or provide data for population surveillance and investigation via HIE services.<sup>29,30</sup> PHR communications outside of clinical visits can link patients to appropriate care and exposure precautions. For example, perinatal Hepatitis B cases require lengthy oversight for to ensure that both patients receive appropriate care. Communications and oversight can be cumbersome, as mothers and their babies are often cared for in different health systems by different clinicians and covered by different health insurance plans. The combination of EHR and PHR technology could make this quality assurance activity much more efficient and timely for health departments.

## Opportunities: Improvements in Infrastructure

The application of electronic health information in public health is supporting the increased adoption of EHRs by the medical community, the inclusion of required public health reporting within the Centers for Medicare and Medicaid Services (CMS) incentives for EHR adoption, and the national infrastructure for HIE.

CMS incentives for demonstrating the MU of certified EHR technology have increased the adoption of EHRs by healthcare providers and hospitals.<sup>31</sup> The first two stages of MU have both required and optional EHR functionality relevant to public health. The proposed third stage of MU recommends submission of Healthcare Associated Infection (HAI) reports, adverse event reports, and the ability to receive person-specific recommendations from an immunization information system. (See Figure 2.)

HIE refers to the electronic movement of health-related information, including MU data, among organizations according to nationally recognized standards.<sup>32</sup> HIE may positively support public health data exchange with clinical health partners in a number of ways, including the following: reducing the number of system interfaces required to exchange data; providing automated routing of relevant electronic health information to public health; providing data standardization; providing record-linking services and supporting simultaneous queries across many care settings; supporting public health reminders and alerts; and, where agreed to, providing centralized data storage for efficient analysis.

HIE infrastructure serves as a hub, through which hospitals, ambulatory practices, laboratories, pharmacies, and other clinical entities exchange electronic data among their information systems. Connecting to an HIE may reduce the technical effort for a PHA versus attempting to connect and maintain direct interfaces with each clinical entity. HIE infrastructure can potentially monitor data transactions for specific laboratory or physician-based

diagnoses, whether mandated or not mandated by statute, and can route appropriate health information to the PHA; this may preclude having the PHA work directly with each clinical entity or their technology vendor to achieve the same end.<sup>33</sup> HIE infrastructure may provide services to standardize data exchanged across disparate IT systems, potentially reducing the data mapping effort of the PHA to create comparable population sets. A common feature of HIE service is the provision of a portal, which allows authorized users to search for health information about an individual across multiple healthcare settings, which could be used to support public health investigations. HIE infrastructure may serve as a mechanism for PHA communications back to clinical health; for example, in connecting to a provider's EHR to identify individuals with notifiable diseases that have been lost to follow up, or to provide general information on epidemiologic trends in the community.<sup>33</sup> Finally, HIE services may include the aggregation of data of public health interest into a centralized data warehouse to facilitate analysis.

## Barriers and Limitations

Barriers and limitations are detailed below, and illustrated in Figure 3.

### Limitations of EHR and PHR Data

While EHRs have demonstrated potential to support public health practice, there are current limitations to more widespread public health use of EHR data. With respect to data availability, EHRs are generally designed around the provider-patient clinical encounter, and often do not include psychosocial, behavioral, and environmental variables of interest to public health. Some projects have attempted to capture such information within the clinical workflow, but outside of the EHR context.<sup>34</sup> Attempting to incorporate these variables into EHRs can require significant time and resource investment by PHAs to engage with EHR vendors and may also add additional burden to clinician workflow.<sup>35</sup>

**Figure 3: HIT Implementation Barriers and Limitations**

Barriers and Limitations to HIT in Public Health	
Limitations of EHR and PHR Data	Questionable reliability and validity of EHR data for public health; variables of interest to public health may be missing (e.g., psychosocial, behavioral, and environmental factors).
Health Information Organizations (HIOs)	Questionable viability and sustainability of HIOs; PHA participation in HIOs entails risk to the HIO.
Infrastructure Funding	Significant variation in PHA IT infrastructure; insufficient funding to build a centralized system within a PHA in accordance with MU.
Workforce Capacity	PHA staff lack project management and technical skills to implement and maintain new HIT programs.
Policies/Legislation	Clinical partners may misinterpret the Health Insurance Portability and Accountability Act (HIPAA), and be wary of data exchange with PHAs.

With respect to data quality, the reliability and validity of EHR data for public health use may not be adequate, due to the use of different data models across EHRs, or to variation in data collection across practice settings, or to the use of free-text rather than structured data collection; however, there are demonstration projects currently underway to assess some of these issues.<sup>36</sup> With respect to data exchange with EHRs, significant barriers include the following: the inconsistent use of available data and messaging standards, which may require ongoing encouragement of public health's clinical partners; the establishment and ongoing monitoring of interfaces between clinical and public health; and policy or performance barriers to a PHA conducting direct queries or analyses.

Similarly, PHRs may also be difficult to use as a public health data source. Current evidence is limited with regard to the effectiveness of PHRs as a surveillance tool.<sup>37</sup> In addition, there has been limited adoption of PHRs, their respective functionalities vary, uncertainty exists regarding market demand and who will support the cost of PHRs, in addition to lack of standards for data collection and biophysical measurements that may make PHRs prone to data quality issues.<sup>38,39</sup>

### Health Information Organizations

While HIE shows promise as a service, there are significant concerns with regard to the financial viability and sustainability of the health information organizations (HIOs) that provide the oversight and governance for this service.<sup>40</sup> In a survey to assess the state of HIE activity in the United States, only 75 of 197 potential HIOs were operational, 50 of those 75 HIOs did not meet criteria for financial viability, and only 13 of the HIOs surveyed met criteria for the first stage of MU.<sup>41</sup> While information exchange with clinical care partners is conceptually attractive, PHA participation in an HIO entails significant risk where HIE is not already firmly entrenched as a sustainable, private community enterprise. Alternatively, where not supported by the market, HIE activity would have to be treated as a “public good,” with support provided by government and/or payers.<sup>42</sup> If a PHA undertakes implementation of HIE activity, there are a number of prohibitive factors to consider: local PHA expertise in implementing these technologies should not be assumed; budgets must remain flexible to account for undiscovered work that is inevitably revealed during implementation; leadership should remain constant to ensure consistent vision; and contingencies must be in place to avoid delays that may undermine confidence, but delays should nevertheless be expected.<sup>43</sup>

### Infrastructure Funding

The status of public-health information-technology infrastructure at health departments across the country is mixed. Baker and Koplan cited critical gaps in basic information technology services (such as fax, e-mail, and internet connectivity), although these gaps have been closing over the past decade.<sup>44</sup> However, the software applications that are used to support core public health functions present a more variegated picture, as some PHAs have modern systems, while others maintain outdated legacy systems,

and there are still others for whom these applications are “virtually nonexistent.”<sup>45</sup> Seven percent of local health departments have implemented HIE and half have “no activity” in the area.<sup>46</sup>

Even within health departments, there is significant variation. Categorically funded public health programs have historically been prohibited from developing information systems that might also support the needs of other programs, leading to the development of information technology silos and information process silos (i.e., different programs in a PHA having parallel interactions with external data partners, such as hospitals and laboratories, leading to redundant coordination and resource investment).<sup>47,48</sup> To support broad use of electronic health information across all programs in a public health department, shared infrastructure should be established for the receipt, processing, and analysis of data; development of such infrastructure will require separate dedicated funding and/or increased flexibility in the use of categorical funds.<sup>48</sup>

Although eligible hospitals and providers are receiving incentive funding for MU of certified EHR technology – including the submission of relevant data to PHAs, dedicated funding for public health to support ongoing receipt and management of MU data has been sparse. Recently, traditional grant funding sources, including the CDC Cooperative Agreements for Epidemiology and Laboratory Capacity and Public Health Emergency Preparedness, have allowed PHAs more latitude to establish infrastructure that specifically supports MU engagement with hospitals and providers, although without providing specific guidance on specific, sustainable approaches.<sup>49,50,51</sup> The National Association of County and City Health Officials have called for additional funds and The Joint Public Health Informatics Taskforce has called for alterations to cooperative agreements to fund necessary changes.<sup>52,53</sup>

Public health will need to advocate not only for building capacity to connect to clinical health, but to connect more efficiently through centralized HIE. While more than \$547 million was initially awarded to states to support HIE activity through the State Health Information Exchange Cooperative Agreement Program, PHAs were generally not funded through these awards to connect into HIE infrastructure, nor was public health engagement of primary interest to some HIE efforts: in a survey of 27 of these cooperative programs, less than half supported public health use cases for HIE, such as the reporting of notifiable conditions or immunization data.<sup>54</sup> It is critical for HIOs to be aware of PHAs as data exchange partners, and for both to pursue mutually beneficial funding opportunities that will sustain these relationships.

### Workforce Capacity

Public health departments have variable information technology, and informatics and data analysis expertise, to receive, store, manage, and utilize new electronic health information sources. In an informatics needs assessment by the National Association of County and City Health Officials (NACCHO), barriers to implementing information systems (after insufficient funding and



lack of time and resources) included lack of project management staff and lack of persons with technical skill to support systems.<sup>46</sup> Even with information systems in place, local health departments may not have the appropriate staff to manipulate and understand the data: the percentage of local health departments that had epidemiologists, public health information specialists, and public health informatics specialists were 28%, 21%, and 13%, respectively.<sup>55</sup> This is further compounded by a more general loss of approximately 15% of the local public health workforce from 2008 to 2011.<sup>56</sup>

For the moment, public health departments have not been mandated to receive MU data from hospitals and providers; however, if public health departments are compelled, or choose, to receive MU and other EHR data, they will likely need to add staff to conduct business analysis and project management to support the development of new systems and interfaces between public health and clinic health, as well as data analysts and epidemiology staff to prepare and analyze this new or augmented influx of data.

### Policies and Legislation

In engagements between clinical and public health, the Health Insurance Portability and Accountability Act (HIPAA) is an oft-cited barrier to data exchange; in fact, according to the HIPAA Privacy Rule, covered entities may disclose protected health information for public health use, including reporting, surveillance, investigations, and interventions.<sup>57</sup> Public health will need to continue to educate its clinical partners on permissibility of disclosures to public health, in order to support necessary and novel secondary uses of electronic health information.

State and local statutes have mandated the reporting of selected infectious and noncommunicable diseases. However, many other conditions of interest to public health, including indicators of chronic disease – or even negative results from tests for reportable diseases – do not enjoy the same sanctions. As new sources of electronic health data become available, corresponding legislation will be required to support their use for public health purposes. For example, in 2005, the New York City Board of Health mandated the laboratory reporting of hemoglobin A1C test results to track blood glucose levels in diabetes patients; while preliminary feedback has been positive, it has not been without controversy, and may provide important lessons for other health agencies.<sup>58</sup>

### Conclusion

Ultimately, the broad vision is that electronic health information from EHRs and PHRs will be made available to PHAs through direct connections or via consolidated HIE. The latter will leverage Big Data science to conduct surveillance and make inferences about health determinants, implementing traditional population-level interventions and individual clinical interventions via CDS technologies. The potential of electronic HIE implies timely availability and improved access to data, compared to traditional paper-based manual processes. The availability of enhanced technology implies more timely analysis and opportunities for innovation.

In order to realize this vision, local health departments require additional funding and technical support from national bodies for infrastructure development. Additional personnel are needed for policy development and advocacy for the needs of public health departments in local HIE. Technical personnel must engage with both internal and external partners regarding MU reporting and must navigate the complex field of changing requirements and standards for health information technology. Appropriate business analysis and project management staff will be required to ensure that all systems are designed to help users work more efficiently, rather than simply automating and reinforcing redundant processes. Data analysis staff must then appropriately interpret these data and present the data in a way that makes decision making clear and actionable.

Public health leaders at the state and local levels need an increased commitment to public health informatics and the development of sustainable centralized HIE. They must develop their own strategic plan for sustainability that includes the public health workforce and technical expertise. Furthermore, leaders will need to offer ongoing education to all parties involved in HIE on the role of HIPAA for health departments. Surveillance laws must be addressed to include chronic diseases and other diseases of public health importance to protect access to electronic clinical data for the benefit of the public's health.

Just as electronic health information will transform the day-to-day practice of medicine, it will transform the practice of public health. Together with the changes brought about by health reform, it will facilitate the development of PHAs into knowledge organizations. The transition will require investment in new technology, analytic and application techniques, hiring and retraining of staff, but – most importantly – creative leadership to capitalize on these new opportunities.

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