Future Needs of Health Departments

A Ride in the Time Machine: Information Management Capabilities Health Departments Will Need

Seth Foldy, MD, MPH, Shaun Grannis, MD, MS, David Ross, PhD, and Torney Smith, MSHE

We have proposed needed information management capabilities for future US health departments predicated on trends in health care reform and health information technology.

Regardless of whether health departments provide direct clinical services (and many will), they will manage unprecedented quantities of sensitive information for the public health core functions of assurance and assessment, including population-level health surveillance and metrics. Absent improved capabilities, health departments risk vestigial status, with consequences for vulnerable populations. Developments in electronic health records, interoperability and information exchange, public information sharing, decision support, and cloud technologies can support information management if health departments have appropriate capabilities.

The need for national engagement in and consensus on these capabilities and their importance to health department sustainability make them appropriate for consideration in the context of accreditation. (*Am J Public Health.* 2014;104:1592–1600. doi:10.2105/AJPH.2014.301956)

WHAT INFORMATION MANAGE- ment capabilities will be needed by tomorrow's US health departments? The Public Health Accreditation Board establishes standards and provides accreditation to US local, tribal, and state health departments. Because we are experienced in local, state, and federal public health informatics (the systematic application of information and computer science and technology to improve public health practice, research, or education),[1] a Public Health Accreditation Board think tank asked us to predict the effects of emerging trends on requirements for future accreditation standards.

The Patient Protection and Affordable Care Act (ACA) may radically change the functions of US health departments. New developments in health information technology (technology standards, applications, and hardware for health data) will profoundly change how information is managed and exchanged. Different predictions about these changes may produce markedly different predictions of required health department capabilities.

Some have asserted that ACA reforms (more people insured, preventive services covered, and provider incentives) may lead health departments to stop delivering individual services, such as immunizations.[2] Meanwhile, some predict that digitization and the exchange of health care data will produce "distributed access to information without exposing the details of the underlying data . . . collect[ing] only summarized data . . . or key results."[3] Taken together, these trends suggest that health departments may eliminate direct services and consume rather than create health information products, thus minimizing their management of sensitive health information.

We predict, rather, that health departments will struggle with managing more information to improve service cost efficiency, collaborate on prevention with a leaner health care system, and meet demands for unbiased population health statistics. Competitive pressures will emerge rapidly over the next 5 years. Health departments that cannot manage information appropriately may become vestigial—to the detriment of their communities (and especially to vulnerable underserved populations). The pace of change will challenge many health departments. Emerging advances in health information technology can help meet these challenges, but only if health departments develop needed capabilities.

HEALTH DEPARTMENT ROLES AND INFORMATION MANAGEMENT

Aspects of the ACA encourage private health care providers to perform preventive care. Reductions in the number of uninsured individuals, improved financial incentives for preventive services, and business models such as accountable care organizations and primary care medical homes, could reduce the need for health departments to provide personal services, such as immunizations and tuberculosis management.

However, this reduction may be offset by a continuing obligation to ensure prevention for those remaining unprotected and an increased demand for community-based services. Assumptions that ACA reforms will optimize population delivery of preventive services rest on continuous care access and accountability. Millions will still lack health insurance (especially in states declining Medicaid expansion),[4] move frequently,[5] and experience provider turnover because patients and

insurers will shop for value. The ACA reduces hospital reimbursement, which may disrupt uncompensated care, although new nonprofit requirements may offset this. Thus, discontinuities in insurance, care, and information (pending improved health information exchange) will perpetuate preventive service gaps. The ACA follows earlier reforms (e.g., health maintenance organizations, managed competition) that, despite great promises, yielded mixed and modest changes in preventive care.[6]

Despite recommendations to shift from service delivery to assurance, from 1997 to 2008 22% of local health departments maintained or increased the types of clinical services they offered.[7] In 2013 more than 90% offered immunizations, more than 80% offered some infectious disease screening or treatment, and more than 60% offered some chronic disease screening.[8] Under Massachusetts's ACA-like reform, public health programs experienced varying changes in demand, and an incapacity to analyze client data impeded planning.[9] Many departments will continue serving uninsured and hard-to-reach individuals,[10] and expectations that they bill insurers, when possible, will compound information management needs.[11]

Beyond clinical services, departments may be invited to partner in case management and community-based services (foreshadowed in ACA initiatives, e.g., community health teams and home visit programs).[12] Success in such partnerships cannot be assumed because there is cost competition in the resource-constrained accountable care organization environment. Health departments will need to accept electronic referrals as other providers do. Whether serving insured or uninsured patients, in partnerships or separately, health departments will be expected to deliver and document services more efficiently than before.

Thus, departments will need to assess and satisfy patients' needs in a timely, coordinated way, not at the convenience of fragmented programs. Patients' longitudinal and cross-program information will be needed at the point of service and for performance improvement. This requires changing the program-based culture of many health departments with silos of disconnected information.[13] Cross-program business intelligence is becoming business as usual in the private sector and is becoming critical to creating "learning health systems" that continuously improve services.[14]

Health departments that do not deliver direct services will continue to receive and manage sensitive health information for disease and injury surveillance, outbreak and emergency management (e.g., vaccine or drug countermeasure administration), and maternal, child, and environmental health. The capability to match identifiable records over time and across all health care providers is needed to track important community-level questions, such as,

- What proportion of persons with HIV lacks antiviral treatment or screening for tuberculosis and syphilis?
- Who received a first but not second immunization for a new pandemic influenza strain?
- Which prenatal care factors contribute to local infant mortality disparities?
- Which infants lack follow-up for abnormal newborn screens?
- Where do concentrations of people live with chronic disease risk factors who are not receiving preventive services?

Such information is required for effective public health assessment and assurance and is supported by unique reporting mandates and Health Insurance Portability and Accountability Act considerations.[15] Although accountable care organizations may perform within-network measurement and may report similar metrics, this will not assess people and problems falling between networks. Private providers are also reluctant to share information that might affect competition for patients or payers. This conflict between competition and transparency may create demand for health departments to create impartial metrics of quality and safety, as they do for vital events, diseases, and injuries.[16] Legally authorized, neutral public health registries (e.g., immunization registries and disease registries) often have established community-wide information sharing even as other health information exchange arrangements fall prey to competitive pressures.[17]

Therefore, provider-controlled aggregate reports may augment, but cannot replace, the mandated universal reporting of identifiable individual reports to health departments. We believe health departments will continue to be held accountable for the completeness, accuracy, and transparency of whole-community health information, ensuring public access to unbiased information about the health of the community and sometimes providing impartial assessment of the performance of health care providers and networks. This accountability will require health departments to use and steward individuals' health information.

The demand for person-linked information across diverse sources and systems will also grow because of the recognition of "syndemics," for example, interactions between HIV, tuberculosis, and syphilis and other sexually transmitted infections; relationships between obesity, diabetes, and hypertension and other cardiovascular diseases; relationships between social factors, infant mortality, adverse childhood experiences, and chronic disease morbidity; and the relationships of these syndemics to health disparities, whose elimination are a national priority.[18] Segregated information silos are inadequate for studying and managing such syndemics, which require a synergistic (personcentric and needs based, not program based) paradigm for public health services and the information systems that serve them.

Thus, future health departments must maintain and improve their capability to receive, secure, manage, link, analyze, and use individuals' personal health information for many purposes. Privacy and security will remain critical concerns, requiring ongoing capability building to stay

ahead of emerging security threats.[19] In many jurisdictions, privacy concerns have led to prohibitions against sharing information across public health programs. Unfortunately, such barriers limit departments' ability to meet clients' needs, improve programs, and protect the public health, when, ironically, private companies now routinely link identified data for marketing and other goals of lesser public importance.

Fortunately, technical advances can facilitate the management, security, and use of tomorrow's growing information challenges and may obviate the need for every health department, state and local, large and small, to maintain all needed systems locally.

ELECTRONIC HEALTH RECORDS

The federal Electronic Health Record (EHR) Incentive Program (often called "Meaningful Use"), which began in 2010, is accelerating health professionals' and hospitals' adoption of EHR systems.[20] The requirement for EHR systems to be certified to new interoperability standards (which enable machines to exchange and use information with minimal human intervention), combined with incentives to achieve meaningful use objectives of public health reporting, is creating more standardized information exchange between health care providers and health departments.

The rules of meaningful use stages 1 and 2 specify message formats and vocabularies for reporting immunizations, syndromic surveillance, electronic laboratory results, and cancer diagnoses and care. In stage 3 (beginning 2015), EHRs may be required to display patient vaccination histories and incomplete immunization alerts from public health immunization information systems.[21] Previously, information exchange relationships between health care providers and health departments were established idiosyncratically using a variety of standards and methods, and they often failed to scale up to include large proportions of the population or to achieve operational efficiency. For example, many immunization information and electronic laboratory results systems receive reports from only a modest proportion of providers despite supporting multiple information exchange formats.[22] The new combination of national standards and provider incentives creates a compelling opportunity (if not requirement) for health departments to migrate toward more universal, rapid, and automated electronic communication with providers' EHR systems.[23] This could increase the ascertainment, speed, and efficiency of reporting but requires health department capability to do the following:

- Update public health systems to new interoperability standards for secure transmission (e.g., the Direct project protocol), formatting (e.g., HL7 version 2.5.1), and vocabulary (e.g., SNOMED-CT).
- Interpret and improve the quality of information derived from EHRs. Public health systems increasingly rely on information recorded for clinical—not public health—use, risking misreporting or misinterpretation. Data elements and vocabularies used in EHRs for public health reporting must be thoughtfully defined (nationally) and consistently used.
- Manage larger information volumes. For example, electronic laboratory results have increased report volumes over manual methods.[24] Process automation can help staff manage the increase.
- Respond in real time to urgent information. Health departments should leverage electronic reporting for faster data-driven suppression of emergencies, such as hepatitis A and meningococcal outbreaks.[25]
- Protect privacy and security. Electronic information must be protected during transmission, storage, and use to avoid loss, corruption, and diversion.

New organizations and technologies may facilitate public health access to EHR information. Health information exchange organizations can facilitate report delivery and record access.[26] Distributed data-mining protocols increasingly allow health departments to actively query EHRs to augment or replace passive surveillance of provider-initiated reports (while concealing sensitive personal identifiers, if desired).[27] Because health departments remain accountable for surveillance data quality and completeness, they must decide whether such arrangements are to be used and, if so, how.[28]

DECISION SUPPORT

Health care professionals rely on timely public health information, but delivering actionable information in the context of care to improve medical decisions is a challenge. EHR clinical decision support systems can monitor care and trigger alerts to improve diagnosis, treatment, and disease prevention at the point of service.

The EHR incentive program is accelerating the adoption of standardized clinical decision support systems. In addition to helping clinicians adhere to static evidence-based practice rules, clinical decision support systems have been used by health departments to signal when a patient is at particular risk from a local outbreak or a recent drug recall (situational clinical decision support).[29] For example, a provider caring for a preschool patient with diarrhea can be alerted to a current local daycare-associated dysentery outbreak, potentially improving diagnostic and therapeutic decisions.[30]

EHR systems can solicit information from public health immunization registries to alert providers to immunization deficiencies and from prescription drug–monitoring databases for evidence of substance abuse.[31] Clinicians can also be alerted to opportunities to address health disparities on the basis of elevated risks in a patient's geographic and demographic cohort.[32]

Health departments are uniquely able to provide local, timely, and population-based information; thus, they have a unique obligation to support such situational clinical decision support in clinical EHRs as the

technical capability grows. As familiarity increases, health departments should also deploy decision support in their own systems to manage caseloads more efficiently and effectively.

ENGAGING THE PUBLIC AND THE DIGITAL DIVIDE

Members of the public are increasingly using personal health records (PHRs), EHR patient portals, social media, and mobile health tools. These support patient engagement in health care but can also facilitate information exchange for public health surveillance, health promotion, research, and other purposes. Patient acceptance of sharing PHR information for public health purposes (with appropriate privacy protections) is high and increasing.[33]

Social media (e.g., http://www.patientslikeme.com) offer sharing and networking about health issues beyond one's medical team. The capability and inclination of individuals to send or broadcast information over the Internet (sometimes called Web 2.0, contributed data, or crowdsourcing) is growing rapidly and becomes more potent with ubiquitous smart phones and mobile tablets, which can add photos, video, and geographic position.[34] Standards facilitating patient downloading and sharing of their EHR information,[35] combined with the ubiquity of smart mobile devices, may enable powerful platforms for public health surveillance, tailored alerting (e.g., notifying asthmatics of air quality problems), and personal health decision support (e.g., when to seek care).[36]

Crowdsourcing has already assisted disaster and outbreak management,[37] and many people value opportunities to communicate about potential hazards and events.[38] Online information from outbreak "cases" may replace much future public health interviewing (as it has replaced voice interactions for many purchases, travel reservations, and appointments). Information collected electronically from affected individuals is sometimes more useful than is that obtained face-to-face and filtered by health care providers.[39]

Internet polls and surveys are becoming more important as landline and cell phone surveys lose representativeness.[40] Constituents and policymakers will also likely expect health departments, like other successful businesses, to use Internet feedback to improve services and products.[41] Methodological issues abound to ensure that the noise of high volumes of lay information can be appropriately filtered and structured to reveal meaningful signals for health departments, but as in other businesses, rising quantities of contributed and social media information are coming whether departments are prepared or not.

The public also expects unprecedented information access in return. "Data liberation" is a federal policy to make information that public agencies hold accessible to both individuals and application developers.[42] Health department data stewards should expect to wrestle with increased public data sharing while managing privacy hazards (e.g., mosaic effect reidentification hazards from the increasing availability of multiple overlapping granular data sets).

Technical inequalities, for example in computer skills or high-speed Internet access, are sometimes called "the digital divide." As the use of electronic tools for health become more widespread, such inequalities must be identified and managed to avoid reinforcing health disparities. Trends sometimes confound expectations. For example, among cell phone users today, African Americans and Hispanics are more likely to look up health information using mobile devices than are White non-Hispanics.[43] Uneven diffusion of technology in the community also affects health department costs. For example, persistence of parallel paper systems may frustrate anticipated savings from electronic reporting.

INFORMATION AND KNOWLEDGE OVERLOAD

These developments, together with increased use of genomic and phenomic data and the networking of sensors (Internet of things) in home, work, and the environment, will rapidly increase the volume of information that health departments manage.[44] Health departments will need to sort the data flood into actionable information for various users' needs through 3 critical capabilities.

The first is to leverage interoperability for automation: to use the increasingly standardized formats and vocabularies of high-volume data streams to automate tasks of receipt, validation, sorting, distribution, storage, filtering, and display with minimal human intervention. Natural language processing and sophisticated algorithms might reduce the need to standardize data tomorrow, but meaningful use standards can substantially advance automation today.[45]

The second is to enable information, currently separated into program-oriented silos, to be linked on the basis of person, specimen, location (e.g., address), licensee, and event (e.g., outbreak), thus allowing users to more easily explore and understand information in context. An early example is the "child health record" linking information from multiple sources, such as birth records, newborn screening, lead screening, and immunization records.[46]

Similar efforts are needed for systems such as those to manage foodborne outbreaks in which complex information on patients, laboratory specimens, food products, and food-handling licensees must be interpreted in concert with speed and efficiency. Information can continue to be stored separately (for security or other considerations) but must be accessible to integration applications that can assemble it meaningfully for use in different ways (e.g., caring for an individual, understanding an outbreak, protecting vulnerable populations in a disaster).

Finally, this automation and integration must be designed to support the specific workflows of different types of public health workers: to help them perform tasks efficiently, effectively, and safely (i.e., a user-centered design). For example, EHR systems

designed to support episodic health care delivery may frustrate longitudinal case management or outbreak investigation, and systems focused on collecting data for state or national use may neglect the workflow needs of local case investigation. Analyzing and improving business processes and their subsidiary workflows is a critical first step in user-based design. Because many of the most urgent and complex information tasks related to case and outbreak management occur at the local level, redesign should build from local workflows upward to ensure and improve the information supply chain (even when statewide or national information systems support these functions).[47]

All 3 capabilities (automation, information linkage, and user-centered design) are required to manage overload and convert information into better outcomes. They require an enterprise-wide information architecture (the capability to access and use information across silo systems to meet business needs). This is increasingly considered a core capability of modern organizations both for routine business processes (e.g., services) and for performance improvement. National standards are necessary but not sufficient. Prioritization, planning, and execution of information architecture (inside and between health departments and programs, supported by national standards and aligned program funding) are still required to ensure that timely actionable information reaches those who need it.

The challenge of managing public health knowledge (truth or principles gained from accumulated information and inference, e.g., evidence-based practices, experience) is growing alongside the explosion in data and information. This is driven by 3 factors: an aging public health workforce whose turnover requires transfer of experiential knowledge; growing volumes of public health and prevention research; and the evermore interdisciplinary nature of public health work.[48] These require access to and sharing of knowledge and expertise, including policies, procedures, and practices; bibliographic and training resources; and subject matter experts who often as not work outside a particular health department. Technologies to share knowledge synchronously (live, including webcasts and teleconsulting) or asynchronously (storing useful knowledge for searching and retrieving on demand) are developing rapidly. Using such technologies effectively is an emerging core capability for future health departments.[49]

CLOUD COMPUTING

Improvements in Internet access, speed, and distributed computing now enable practical access to massive computing power, applications, and data sets "in the cloud" (i.e., on the Internet) instead of on local servers. This allows the purchase of infrastructure as a service (i.e., online computing power), software as a service, or entire platform as a service (i.e., an online environment combining access to computing, software, and data sets) from an expanding collection of public and private providers.

Assuming ongoing progress in cloud reliability, speed, security, and cost, cloud technology will likely allow health departments to lease technology online less expensively than by locally purchasing and maintaining servers and software. Such cloud-based arrangements can also facilitate secure information sharing between organizations, programs, and jurisdictions when appropriate. For example, BioSense 2.0 leverages cloud capabilities for syndromic surveillance, facilitating data submission from EHRs nationwide and permitting the voluntary sharing of data, software, and analysis products horizontally across jurisdictions and vertically from local through federal levels.[50]

The power and cost-efficacy of such shared platforms may prove sufficiently enticing to overcome health department commitments to separate jurisdictional and programmatic data and hardware silos. Programs and departments will have to accede to standards for defining and coding data elements and greater uniformity of workflows before they can enjoy convenient, scalable cloud solutions. For example, information inputs and outputs to manage a case of tuberculosis must become more uniform before cloud-based solutions become practical nationwide.

Health departments will need greater focus on information management (the competencies associated with public health informatics) than on technology management (server and network administration) during and after this transition. Fortunately, these are the same competencies that will remain in demand long after health departments have converted server closets to other functions.

TOMORROW'S CAPABLE HEALTH DEPARTMENT

Health department roles will change with health care finance reform, but their need to use and protect personal health information will still increase. Higher volumes of more timely information will need to be integrated and used more rapidly to improve outcomes. Capabilities such as those in Table 1 will be needed to manage information to the greatest advantage.

Stand-alone local solutions will become obstacles to necessary interoperability and information sharing (with health care providers, the public, and between local, state, and federal levels). Cloud-based solutions offer economies of scale and simplified information sharing, but private solutions will not emerge spontaneously. Public health is a niche market complicated by conflicting jurisdictional and program requirements. Successful platforms will require agreement on information governance, data standardization, and, critically, health department requirements and capabilities such as those proposed in Table 1.

These capabilities (whether managed locally or supported by state or national cloud services) have important, near-universal implications for health department sustainability, planning, budgeting, workforce, and technology, making them appropriate for discussion in the context of accreditation. We hope there will be

TABLE 1—Proposed Information Management Capabilities for Health Departments

Needed Capabilities	Technology Considerations	Informatics Considerations	Workforce Considerations
Provide vigilant stewardship of confidential health information; secure information from loss, theft, and inappropriate use	Have data encryption at rest and during transmission; enable user authentication	Have privacy and security facilitated by routine workflows; have data sets protected from reidentification	Privacy and security focus for all personnel and contractors, user authorization
For health departments providing direct clinical services, manage patient care and billing with certified HIT (e.g., an EHR system)	Acquire technology certified to national standards	Focus on information exchange and information use for quality and efficiency	Adequate informatics resources
Manage information exchange with health care provider EHR systems			
Interpret and implement "meaningful use" rules and standards and other interoperability standards	Implement certified technology	Participate (through associations) in rule and standards development to ensure public health appropriateness	Adequate informatics resources
Validate and improve electronic data quality	Implement certified technology; use data validation tools	Adhere to standardized data elements and vocabulary; implement quality analysis and continuous improvement	Universal commitment to data quality; SME participation in quality assurance
Develop cost-effective workflows to manage electronic reports	Automate report receipt, validation, routing, storage, and alerts per workflow requirements	Redesign business processes and workflow to exploit new information management capabilities; establish application requirements to match workflow demands	SMEs and affected staff participation in redesign
Regulate and manage exchange relationships with providers and health information exchange organizations	Implement to industry exchange standards	Ensure that public health functional requirements are met; negotiate data sharing consistent with public health legal authority	Informaticians and SMEs jointly define functional requirements and data-sharing arrangements
Use decision support systems to enhance the protective and preventive quality of health care	Implement public health knowledge bases accessible to EHR CDSS rules engines	Develop "situational" knowledge bases that are responsive to current jurisdictional conditions	Informaticians and SMEs collaborate on CDSS knowledge bases
Engage members of the public using PHR systems, social media, and mobile applications	Deploy apps and portals for public engagement	Integrate electronic information exchange with the public into surveillance, emergency response, and other workflows	Training in appropriate electronic interactions and new workflows
Manage increasing information and knowledge volumes			
Leverage interoperability to automate information management (e.g., receiving, sorting, sending, alerting, tracking)	Automate receipt, validation, sorting, routing, storage, alerting, and tracking per workflow requirements	Redesign business processes and workflows to exploit new information management capabilities; establish application requirements to match workflow demands	SMEs and affected staff participate in redesign
Enable information linkage (integration) by individual, laboratory specimen, license, location, and outbreak or event (to the extent permitted by law)	Implement and maintain integration technologies	Establish integrated information architecture on the basis of workflow requirements	SMEs and affected staff participate in workflow redesign
Support user tasks with user-centered design	Implement and maintain local or cloud-based systems	Establish user-centered application requirements on the basis of workflow needs	SMEs and affected staff participate in requirements development

Continued

TABLE 1—*Continued*

Evaluate, negotiate, and manage cloud-based information services	Implement and maintain secure networks (including mobile Internet access)	Participate in design or selection of cloud-based services on the basis of workflow requirements; ensure maintenance of information security and privacy	SMEs and affected workforce participate in testing and improving cloud applications

Note. CDSS = clinical decision support systems; EHR = electronic health record; HIT = health information technology; PHR = personal health record; SME = subject matter expert.

both broad consideration and timely consensus on such a set. ■

About the Authors

When this article was written, Seth Foldy was with the Public Health Surveillance and Informatics Program Office, Centers for Disease Control and Prevention, Atlanta, GA. Shaun Grannis was with the Regenstrief Institute and Indiana University School of Medicine, Indianapolis. David Ross was with the Public Health Informatics Institute, Atlanta, GA. Torney Smith was with the Regional Health Department, Spokane, WA.

Correspondence should be sent to Seth Foldy, 3061 N. Marietta Avenue, Milwaukee, WI 53211 (e-mail: sfoldy@sbcglobal.net). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

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Contributors

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Endnotes

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