

# Medical informatics in population health: Building Wisconsin's strategic framework for health information technology

Lawrence P. Hanrahan, PhD, MS; Seth Foldy, MD, MPH, FAAFP;  
Edward N. Barthell, MD, MS; Susan Wood, BS

## Abstract

Medicine is increasingly practiced through the application of information sciences. Medical informatics deals with optimal information use within bioinformatics, imaging, clinical, and population health domains. Population health informatics plays an important role in

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that it critically informs practice in each of the other domains. Proper functioning of health care systems requires an advanced health information network that supports clinical care, personal health management, population health, and research. But this infrastructure does not yet exist in the United States. A number of federal initiatives are underway to address this problem, including the development of a framework for a national health information network and funding for implementation. This network will be facilitated by federal leadership, but public and private partnerships, and state, regional, and local implementation and policy development will play a critical role. In this article, we describe several Wisconsin initiatives that are keys to developing a strategic framework and building the state's electronic health information infrastructure.

## Medical Informatics

As in many other fields, medicine is increasingly practiced through the application of information sciences. Medical informatics represents the intersection of medicine, computer hardware, networks, and software. It "concerns itself with the cognitive, information processing, and communication tasks of medical practice, education, and

research, including the information science and the technology to support these tasks."<sup>1</sup> It "deals with the storage, retrieval, sharing, and optimal use of biomedical information, data, and knowledge for problem solving and decision making. It touches on all basic and applied fields in biomedical science and is closely tied to modern information technologies, notably in the areas of computing and communication."<sup>2</sup>

*Medical informatics* is often classified into 4 domains:

- *Bioinformatics* views biology "in terms of macromolecules and then applies information science techniques (derived from disciplines such as applied math, computer science, and statistics) to understand and organize the information."<sup>2</sup>
- *Imaging Informatics* "defines the role of medical imaging and related technologies [eg robotics] within the context of medical informatics decision support and improvement of patient care and outcomes."<sup>2</sup>
- *Clinical Informatics* is "the scientific study of the effective use of information in patient care, clinical research, and medical education. Users of clinical information systems include physicians, nurses, dentists, technicians, therapists, and social workers,

as well as patients and consumers. The ultimate goals of clinical informatics are to streamline the processes of patient care, to provide clinicians with accurate data in a timely manner, improve the quality of care, and to reduce costs.”<sup>2</sup>

- Finally, *Public Health/Population Health Informatics* is the “systematic application of information and computer science and technology to public health practice, [population health], research and learning. It is the discipline that integrates public health, [our understanding of population health], and information technology.”<sup>2</sup>

These specialties represent an interconnected hierarchy of medical information, moving from the subcellular microcosm through individuals and on into monitoring the health of diverse populations. Population health sits atop this hierarchy and provides a unifying context to each of the other 3 domains. This context is achieved through its functional domain of population-based statistical aggregation, analysis, display, and data mining at each of the other hierarchical levels. For example, population health science (group level statistical analysis) is the root of randomized trials that create much of evidence-based medical practice. Similarly, population monitoring in the form of post-marketing surveillance informs clinical care when new drugs fail to meet safety expectations developed from smaller clinical trials.

One cannot imagine the highly competitive banking and finance industry functioning today without its electronic network supporting e-commerce among financial institutions and their customers. This example of competitive collaboration has resulted in an electronic global financial network

that supports automated teller transactions virtually everywhere in the world. But in the United States, our health systems lack a comparable e-commerce network to support medical practice and each of its component medical informatics domains. The health care system is “still largely a decentralized industry populated by diverse organizations with different motives, resources, and incentives—it is sometimes referred to as a ‘trillion dollar cottage industry.’... This diversity brings with it different degrees of sophistication and a diverse set of challenges, resources, and missions but makes it difficult to speak with a unified voice or to adopt a critical mass of [health information] technology.”<sup>3</sup> This has not gone unnoticed nationally and has resulted in a number of recent, far-reaching federal initiatives to address the problem.

### **National Health Information Technology Initiatives**

In April 2004, a White House Executive order established the Office of the National Coordinator for Health Information Technology (ONC) within the Department of Health and Human Services. It was charged with developing a nationwide interoperable health information technology infrastructure.<sup>4</sup> The ONC strategic framework recognizes “the critical role of health information technology (HIT) in making health care safer and more efficient by enabling complete, accurate, and timely information at the point of care for both clinicians and consumers.”<sup>5</sup> HIT is “critical to delivering safe, affordable, and consumer-oriented health care, as well as helping to mitigate public health and bioterror threats. Health Information Technology will provide a new paradigm for care that is built on 7 critical needs:”<sup>5</sup>

1. Avoid medical errors
2. Improve use of resources
3. Accelerate diffusion of knowledge
4. Reduce variability in access to care
5. Advance consumer role
6. Strengthen privacy and data protection
7. Promote public health and preparedness

The framework contains 4 overarching goals: inform clinicians about HIT benefits and provide incentives for adoption, interconnect clinicians, personalize care, and improve population health.<sup>5</sup> At the heart of the framework is the vision of an interoperable National Health Information Network (NHIN). It will be built on voluntary, non-profit, public-private regional health information organizations (RHIOs) that exchange electronic health records to support clinical care, personal health management, population health, and health research.

### **Wisconsin's Health Information Technology Initiatives**

Wisconsin is currently engaged in a substantial number of health information technology activities to support public health and population health monitoring, health information exchange, patient quality, and safety. But 2 activities in particular are closely connected to the national HIT framework. These are the Public Health Information Network (PHIN), and the Wisconsin Health Information Exchange (WHIE).

Wisconsin's PHIN supports 9 central functions, including

1. The automated exchange of data between public health partners.
2. The use of electronic clinical data for event detection.
3. Web-based manual data entry

for event detection and management.

4. Specimen and lab result information management and exchange.
5. Management of possible case, contacts, and threat data.
6. Advanced analysis and visualization and reporting within the population health domain.
7. Directories of public health and clinical personnel to support role-based access to PHIN's information assets and contact information for alerting during public health emergencies (Health Alert Network-HAN).<sup>6</sup>
8. Automated public health information dissemination and alerting.
9. Information technology (IT) security and critical infrastructure protection.<sup>7,8</sup>

Sponsored by the non-profit National Institute of Medical Informatics, WHIE is a RHIO covering the southeastern corner of the state. Its mission is to provide a system where diverse stakeholders collaborate to enable secure, confidential exchange of health information between authorized users. Its vision is of a health system where health professionals and patients access information securely, when and where needed, to improve the safety, quality, and efficiency of health care and public health. The WHIE system is closely following national standards toward an interoperable national health information infrastructure. It was 1 of 9 recipients of funding from the national Connecting Communities for Better Health program<sup>9</sup> to develop production systems and establish best practices that can then be shared across the state and country. Recent WHIE activities include establishing governance for health information exchange and developing a sustainable business plan.<sup>10</sup>

### **Building Wisconsin's Strategic Framework**

While federal leadership is important, it must be integrated with state and local efforts. Implementing an HIT agenda "requires buy-in and active collaboration among interconnected networks of providers, business interests, public officials and consumers within states and communities across the nation. These collaborations (RHIOs) play a crucial role in supporting the deployment of the appropriate infrastructure, stimulating the involvement of local leadership, and providing oversight, financing, and governance for local efforts."<sup>11</sup> A considerable number of states and local communities have recognized this need and have begun organizing RHIOs.<sup>12</sup>

The Connecting for Health Initiative of the Markle and Robert Wood Johnson Foundations provides an excellent synopsis of the issue at hand:

Ideally, RHIOs will work closely with state and local government in supporting health information exchange. State legislatures and local governments provide a potential source for crucial resources needed to finance health information technology initiatives, and state laws and regulations will play a pivotal role in either promoting or impeding initiatives' progress. Yet, in far too many communities, the dialogue about HIT has barely begun. Stymied by a lack of coordinated planning, myriad technical and legal challenges, and the need for investment in times of fiscal crises, local health providers are left understanding the importance of health information technol-

ogy, but without the tools necessary to move forward.

In the coming months as the details of federal initiatives begin to take shape, it is essential that the necessary time and effort are invested to ensure state policy develops along with it. If communities are to be prepared to take advantage of federal opportunities and if federal policies are to reflect the needs and realities of local implementation, state and local actors must be engaged in defining the national HIT technology agenda. At the same time, states must be defining their own local agendas, so that they will be prepared to launch and support the successful RHIOs upon which the national infrastructure depends.<sup>11</sup>

To address this policy problem in Wisconsin, on November 2, 2005, Governor Jim Doyle signed executive order #129, establishing the eHealth Care Quality and Patient Safety Board.<sup>13,14</sup> It is an important and necessary step toward comprehensively reviewing the issues surrounding the creation of an electronic health information infrastructure for Wisconsin. This Board is charged with identifying resources to support a statewide ehealth information infrastructure; technology options, options for serving consumer health information needs; insuring health information privacy and security, facilitating statewide adoption; and creating organization and governance structures. The Board will report to the Governor its Wisconsin Action Plan for Health Care Quality and Safety, detailing recommended actions and key milestone dates in order to achieve the goals stated in this Executive Order within the next 5 years.

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## The Population Health Context

As RHIOs are formed, the benefit of facilitating two-way information flow between health care professionals and public health agencies may be under-appreciated. Using RHIOs to simplify transmission of reportable disease surveillance information is broadly recognized, but there is also potential for public health professionals to transform population-based data into timely, useful tools for clinicians and patients as well, increasing the effectiveness of medical practice. Examples include alerting clinicians to outbreaks, helping patients find community-based services for their health problems, and supporting effective case management of infectious, chronic, or environmentally-sensitive conditions. Moreover, patient-based, population-level information can help measure inputs and outcomes of both medical and public health services. The “ability to gather data from electronic health records and provide useful, clinically relevant information in return offers the basis for rethinking how public health functions are performed. Health care professionals stand to gain from efficiencies in the interactions with public health agencies and from timely population-level information that can assist clinical decision-making.”<sup>15,16</sup>

Wisconsin will examine this population health context through a grant from the Robert Wood Johnson Foundation.<sup>15</sup> In concert with the Governor’s eHealth Care Quality and Patient Safety Board, the program will (1) create a state-wide health information strategic plan (with input from two summits and other planning meetings), (2) identify high value uses for and optimal access routes to population health information, and (3)

foster sustainable governance and funding models for regional data exchanges. In our view, population health informatics is one of the key value propositions of a regional health data exchange. It enables transformation of the health care system by providing the business intelligence to purchase population health<sup>17</sup> while providing the analytic tools for clinical and operational business decision support.<sup>18</sup> The study of these issues will be led by faculty of Wisconsin’s 2 Medical Schools, the Wisconsin Medical Society, local health departments (Wisconsin Association of Local Health Departments and Boards), the Wisconsin State Laboratory of Hygiene, the Wisconsin Health Information Exchange, the Madison Patient Safety Collaborative, and MetaStar, the quality oversight organization for Wisconsin Medicare.

## Conclusions

Medical informatics is a rapidly evolving discipline that addresses multiple domains. Improvements in health information management promise to improve both the quality and cost effectiveness of the health care system. While federal leadership is contributing to the increased application of medical informatics and health data exchange across the country, state and local efforts will be key to successful implementation. The activities described in this article are examples that show how Wisconsin is becoming positioned to be a national leader in this field. However, Wisconsin’s success will be dependent on the active participation from a broad base of stakeholders, including physicians, health care industry executives, technology leaders, content experts, major employers, community leaders, public health professionals, and

others in the public and private sector who are interested in developing Wisconsin’s health information technology plan.

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