

# Approaches to Patient Health Information Exchange and Their Impact on Emergency Medicine

**Jason S. Shapiro, MD**

**Joseph Kannry, MD**

**Mark Lipton, MD**

**Eric Goldberg, MD**

**Paul Conocenti, MBA**

**Susan Stuard, MBA**

**Brian M. Wyatt, JD**

**Gilad Kuperman, MD, PhD**

From the Department of Emergency Medicine, Mount Sinai School of Medicine (Shapiro); the Department of Biomedical Informatics, Columbia University (Shapiro, Kuperman); the Division of Informatics, Department of Medicine, Mount Sinai School of Medicine (Kannry); the Department of Medicine, New York University School of Medicine (Lipton, Goldberg); the Department of Information Technology, New York University Medical Center (Lipton, Goldberg, Conocenti); the Department of Legal, Regulatory and Professional Affairs, Greater New York Hospital Association (Stuard); the Office of Legal Affairs, Hospital for Special Surgery (Wyatt); and the Department of Quality Assurance, New York-Presbyterian Hospital (Kuperman), New York, NY.

Regional health information organizations and electronic health information exchange may have an important impact on the practice of emergency medicine in the United States. Regional health information organizations are local or regional information-sharing networks that enable electronic data interchange among stakeholders in a given geographic area. These stakeholders may include hospitals, skilled nursing facilities, clinics, private physicians' offices, pharmacies, laboratories, radiology facilities, health departments, payers, and possibly the patients themselves. Regional health information organizations are being formed across the country to improve the safety and efficiency of clinical care; improve public health efforts, biosurveillance, and disaster management response; and potentially create large databases of deidentified aggregate data for research. Because of the unique need for rapid access to information and the acuity of the clinical environment, few areas of the health care delivery system stand to change and benefit more from health information exchange than our nation's emergency departments. This article will explain the motivation for the development of regional health information organizations, identify some of the important issues in their formation, and discuss how their development might affect the practice of emergency medicine. [Ann Emerg Med. 2006;48:426-432.]

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## INTRODUCTION

A patient is brought into your emergency department (ED) by ambulance after having a seizure on the street. He is initially postictal and hemodynamically stable and after a short while is able to speak. He tells you that he is homeless and receiving phenytoin and that, although he had not had a seizure in 6 months, this is the third seizure he has had today. He was discharged from another nearby hospital less than 2 hours ago, where he recalls that they drew some blood and performed a computed tomography scan. He does not know the results of any of the tests and only has a discharge note telling him to return to their neurology clinic in 2 weeks. How long will it take to have the results of a computed tomography scan and phenytoin level sent from the other hospital? Is it easier to just repeat the entire evaluation?

At midnight, a 74-year-old woman with 8/10 midsternal chest pain that began 1 hour before her arrival is brought in by a friend. She has a history of diabetes and "heart trouble"

but is normally treated by a cardiologist in a nearby suburban hospital. She was in the city visiting the friend and came to the nearest hospital when the pain started. The ECG shows a left bundle branch block. Is this a new finding? Will you be able to get a copy of an old ECG quickly? Do you call in your hospital's cardiac catheterization laboratory for emergency coronary angiography?

These are all-too-common scenarios that emergency physicians face regularly. With ED crowding affecting much of the United States, the pressure to make rapid, often critical decisions with incomplete information has a significant impact on care. Between 1992 and 2003, the number of ED visits in the United States increased from 90.3 million to 113.9 million visits annually, whereas during the same period, the number of hospital EDs decreased by about 12.3%.<sup>1</sup> This combination of increased ED visits yet fewer EDs to accommodate these patients makes it increasingly difficult to provide high-quality, maximally safe, and efficient care in the ED.

Regional health information organizations are local or regional information-sharing consortiums of stakeholders that have come together for the purpose of creating computerized health information exchange networks. Potential stakeholders include hospitals, skilled nursing facilities, clinics, private physicians' offices, pharmacies, laboratories, radiology facilities, health departments, payers, and possibly the patients themselves. The specific stakeholders may vary regionally, as may the role played by each category of stakeholder as a data user, data provider, or both. As regional health information organizations develop, they will become the building blocks for a nationwide health information network, which would provide health information exchange over a secure national network. Health information exchange has the potential to decrease rates of medical errors, decrease costs, and improve efficiency in crowded, fast-paced EDs. In the clinical scenarios above, if a health information exchange network were in place, with laboratory, radiology, and cardiology data from other nearby hospitals readily available to providers, one might well imagine a smoother clinical course for the patient and a more efficient workflow for the provider. This article will describe the background and motivation for current regional health information organization efforts, discuss some of the issues that may need to be addressed by emerging regional health information organizations, and discuss some of the specific issues that are likely to affect emergency physicians.

## Background

In 1999, the Institute of Medicine published its report *To Err is Human: Building a Safer Health System*, which claimed that preventable medical errors result in as many as 98,000 deaths per year in the United States and upwards of \$29 billion annually in lost income, lost household production, disability, and additional health care costs.<sup>2</sup> The report stated that a major cause of these errors is the inability of providers to have access to complete patient data at the point of care because of decentralization and fragmentation of the health care system. To address the problem of data fragmentation, the Institute of Medicine recommended that the country increase the implementation of electronic health record systems and adopt data standards, which are the critical underpinnings of health information exchange, the development of regional health information organizations, and eventually a nationwide health information network.<sup>3-5</sup>

The goal of a nationwide health information network would be "to deliver information to individuals—consumers, patients, and professionals—when and where they need it, so they can use this information to make informed decisions about health and health care."<sup>6</sup> Proponents of the nationwide health information network noted that it should not contain a centralized government database of personal health information but rather should help to connect existing sources of distributed electronic health data in the framework of a secure network.<sup>7</sup>

In 2004, the Office of the National Coordinator for Health Information Technology was created within the Department of

Health and Human Services. In response to the Office of the National Coordinator for Health Information Technology's *Framework for Strategic Action*<sup>8</sup> and various state and federal funding opportunities, there are currently 109 regional health information organizations at various stages of development in 45 states.<sup>9</sup> A wide variety of regional health information organization models are now being field tested, and successful projects will eventually be integrated into a nationwide health information network. Toward this goal, \$18.6 million in contracts was recently awarded to 4 companies involved in health information technology to begin working with 16 existing regional health information organizations to develop prototypes for a nationwide health information network.<sup>10</sup>

One motivation for health information exchange is that it helps to overcome gaps in information that occur when patients move among providers and provider organizations. Crossover analyses suggest that there is significant migration of patients among EDs. A study of 9 EDs representing 5 health care systems in Indianapolis showed that 25% of patients with multiple ED visits in a 1-year period had visited more than 1 health care system in that year.<sup>11</sup> These crossover visits composed 19% of all ED visits during the study period. In 2 managed care plans in New York City, 21% and 30% of ED visits were from patients who either received their primary care at another hospital or had been treated in the ED of another hospital within the last year.<sup>12</sup>

It is not difficult to imagine how this level of patient movement can lead to fragmentation of a patient's health data. One study in 2003 showed that information about the patient was unavailable to the clinician in 32.2% of ED visits. The prevalence of an information gap was more common in sicker patients, and the missing information was thought by the provider to be essential 47.8% of the time.<sup>13</sup> In another study, clinical information was missing in 13.6% of ambulatory primary care visits, and the missing information was present in a clinical system outside of the provider's organization 52.3% of the time.<sup>14</sup> In 44% of these cases, the provider thought that the absence of the data was at least somewhat likely to adversely affect care.

Current regional health information organization efforts differ from the mostly failed community health information networks of the 1990s mainly in their ability to decentralize data, allowing each stakeholder to maintain control over its own information, and through the availability of more advanced and less expensive networking technology, which uses the Internet instead of expensive standalone networks that many of the community health information networks tried to use.<sup>15-18</sup>

## ISSUES TO BE ADDRESSED BY EMERGING REGIONAL HEALTH INFORMATION ORGANIZATIONS

We are all familiar with the use of electronic networks in other industries to make our business transactions more efficient and secure. We experience this every time we sign a wireless keypad for a package delivery or withdraw money from bank

accounts through automated teller machines anywhere in the world. If up-to-date information can be brought to the point of business in the shipping and banking industries, then why not to the point of care in health care? Although a recent survey showed that only 21% of academic EDs have computerized clinical documentation, a majority of those organizations maintain laboratory results, as well as radiology, cardiology, and other reports, in electronic form.<sup>19</sup> Why not start making electronic data available to other institutions? This is exactly what regional health information organizations and the nationwide health information network aim to do through computerized health information exchange. In its ideal form, the nationwide health information network would allow a patient's existing automated clinical data to be securely accessed by any authorized health care provider.

Emerging regional health information organizations must address the following issues to successfully implement health information exchange: (1) availability of electronic data, (2) data standards, (3) regional health information organization technical architecture, (4) financial, (5) privacy, and (6) public health and research.

#### Availability of Electronic Data

Regional health information organizations enable the interchange of electronic data. Although a large portion of clinical data currently is in electronic form as stated above, many data important to emergency physicians are stored only in paper form (eg, ambulatory information from most physicians' offices, progress notes from many hospitals' medical records). The prevalence of electronic health records in this country is still low.<sup>20</sup> If health information exchange is to be successful on a large scale, the amount of clinical data captured in electronic form will need to increase through greater implementation of electronic health records. Health information exchange, conversely, increases the value of electronic health records by allowing them to become a window onto the patient's data no matter where it resides.

#### Data Standards

Health care institutions often have proprietary or homegrown methods for representing in their databases the medical concepts that are of interest to emergency physicians. For example, each institution may have its own scheme for representing medications, laboratory tests, radiology tests, and cardiology studies. Standards are necessary for messaging and data representation, and their relevance to ED information systems and health information exchange has been discussed previously in the emergency medicine literature.<sup>21-24</sup> The absence of standards means that regional health information organizations need to do extensive custom work to match the data elements from each of the participating institutions. Such painstaking work of matching data elements from different information systems is a major barrier to the rapid and widespread deployment of health information exchange.<sup>25</sup> Proposed congressional legislation would provide support for

the development of standards for the structure and representation of automated health data.<sup>26</sup> In addition, the Office of the National Coordinator for Health Information Technology in the U.S. Department of Health and Human Services is working to promote the development of standards for health information exchange.<sup>27</sup> The advancement of such standards would greatly facilitate the development of health information exchange; however, it is important that regional health information organizations do not wait for standards to be completed but continue to develop in such a way to allow easy integration of future standards as they evolve.

#### Technical Architecture of a Regional Health Information Organization

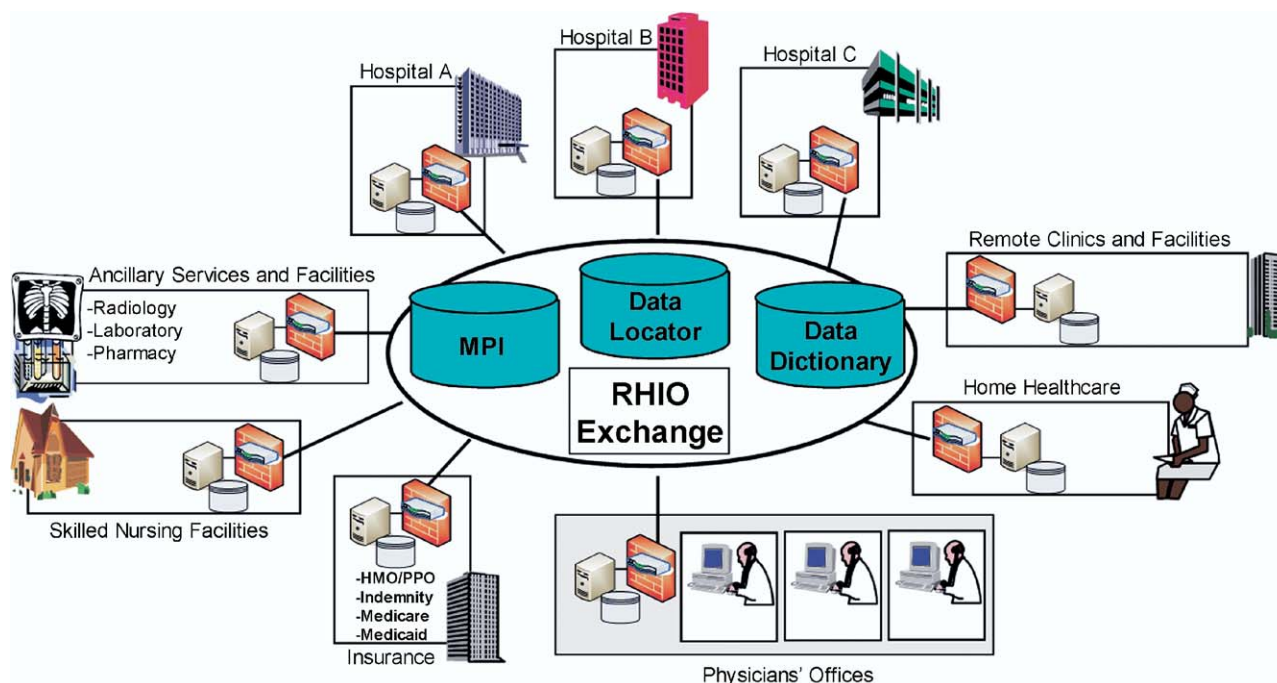
Many regional health information organizations are using a variation of the peer-to-peer file sharing model common in other industries such as music file sharing, which was popularized by applications such as Napster. In this model, no clinical data are stored centrally. The regional health information organization centralizes the tasks of security management, patient identity resolution, and data standardization (Figure).

Because no single identifier for patients exists in the United States, health information exchange initiatives often must use a statistical approach to matching a patient's records across participating institutions. In such an approach, the regional health information organization exchange contains copies of each of the participants' registration files. When a physician requests data from the regional health information organization about a patient, the patient's demographic information first is sent to the regional health information organization, and probabilistic matching algorithms are used to determine whether the patient has been treated at another participating institution. If a match is found, the clinical data from the remote institution are then retrieved and presented to the requesting physician.

#### Financial Issues

The cost to implement a nationwide health information network with health information exchange capabilities was estimated in one study to be \$276 billion during 10 years. Potential savings during the 10 years, largely because of reduced duplicate resource use and administrative costs, were \$613 billion, for a net savings of \$337 billion dollars.<sup>28</sup> On an ongoing basis, the study estimated the system would yield a net savings of \$77.8 billion per year. Another study estimated the 5-year implementation costs for a nationwide health information network to be \$156 billion.<sup>29</sup> In both studies, the implementation of electronic health records in physicians' offices accounted for a majority of the costs.

Some regional health information organizations have shown financial benefits. Access to patient data from other institutions has been shown to reduce redundant testing,<sup>30</sup> one large cause of increased cost and potential morbidity. A study of the Indiana Health Information Exchange (formerly called the



**Figure.** Regional health information organization system architecture. *MPI*, Master patient index; *RHIO*, regional health information organization.

Indiana Network for Patient Care)<sup>31</sup> estimated a \$26-per-visit reduction in charges at one ED when they had access to data from another hospital.<sup>32</sup> Another study estimated a decrease of \$5 per visit when emergency physicians had access to computer-based records for patients at a Veterans Administration hospital.<sup>33</sup> These results, taken together with the estimated 113.9 million ED visits per year in this country, could extrapolate to savings countrywide of between \$570 million and \$2.9 billion in EDs alone.

There are no robust business or funding models that can be used to cover the costs of regional health information organization development and maintenance. If care is improved and health care costs are decreased as a result of health information exchange, it may ultimately make the most sense for health care payers to support the wide-scale development of health information exchange. However, until such benefits are well documented, payers might understandably be hesitant to provide such support. In the meantime, the pilot development of regional health information organizations<sup>9</sup> is being supported by grant programs and forward-thinking health care institutions. Proposed congressional legislation would further fund the development of pilot regional health information organization programs.<sup>22</sup> Although significant savings have been presumed and modeled,<sup>17,18</sup> actual realization of these benefits in a wide variety of settings remains to be demonstrated and should be the focus of future research.

### Privacy Issues

The foundation for considering health data privacy issues in this country is the Health Insurance Portability and

Accountability Act (HIPAA) of 1996. HIPAA states that patient data may be communicated for treatment purposes without explicit patient consent.<sup>34</sup> Thus, strictly speaking, communication of patient data by a regional health information organization to emergency physicians providing care would be permitted under HIPAA. However, because regional health information organizations could increase circumstances under which patient data may be inappropriately accessed, some parties have argued that regional health information organizations should adopt additional procedures to help ensure that data are used only for the intended purposes. For example, some regional health information organizations are allowing the patient to decide whether to include data from any individual organization in the regional health information organization. Established privacy policies as they relate to regional health information organizations will take some time to emerge, particularly because regional health information organizations must also take into consideration applicable state laws governing the privacy and confidentiality of individually identifiable health information.

### Public Health and Research

Many regional health information organizations are also creating public health databases of reportable diseases that presently require the clinician to call their local department of health. Other features being streamlined through regional health information organizations on public health databases include vaccination registries and deidentified databases with elements such as chief complaints, vital signs, and laboratory data for biosurveillance. Regional health information organizations may



allow real-time biosurveillance systems to be built with messages fed back to emergency physicians, alerting them to outbreaks of anything from influenza to small pox. These deidentified databases of health information exchange data may also create new opportunities for large database, aggregate, clinical research.

### HEALTH INFORMATION EXCHANGE ISSUES RELEVANT TO EMERGENCY DEPARTMENTS AND EMERGENCY PHYSICIANS

The ED has already been the target of early health information exchange activities and stands to continue to be significantly affected as regional health information organizations develop and health information exchange data are widely deployed. Issues surrounding health information exchange that will be important to clinicians and ED administrators are as follows:

- Ability to access health information exchange data will likely affect the current workflow in many departments. Clinical, information systems, and administrative leaders would need to be involved in decisions about how best to present the emergency physician with data from other institutions and how to integrate review of external data into current workflow. Options for data review processes include the following:
  1. Attaching a printed summary of external data to the patient's medical record. If clinically warranted, the clinician then could log on to the health information exchange system to see more detail.
  2. Making a hyperlink to external data available in the existing ED tracking and information systems, which would allow the emergency physician seamless access to health information exchange data with 1 click if their departmental information technology infrastructure can support this functionality.
- Access to clinical data sent from external institutions could change what is considered the standard of care in emergency medicine. If external data are available, it is conceivable that emergency physicians will be held responsible for accessing the data in a timely manner and acting on it appropriately, which may have liability and medical malpractice implications.
- Hospitals and hospital administrators will need to decide whether to enter into agreements to share their clinical data with other organizations. Competitive concerns may exist among area providers, and some stakeholders may feel that involvement in a regional health information organization exposes them to financial and legal risks. Concerns may also exist about patient privacy, regional health information organization governance, and sustainability. Health care organizations appropriately may be concerned with how the regional health information organization will pay for itself. These forces may affect ED administrators because hospitals may look to the ED for input on some of these issues. Conversely, a regional health information organization project may prove a positive force in bringing competing

stakeholders together with the common goals of reducing costs and improving quality. If a regional health information organization in any one area becomes large enough, stakeholders may feel they need to participate to remain competitive.

- EDs often are the loci of early stages of regional health information organization development and implementation, and so ED administrators and emergency physicians may be asked to participate before the projects are well understood in the rest of the organization.
- Health information exchange may decrease redundant testing, ED throughput times, and unnecessary admissions, thereby decreasing the number of admitted patients waiting for beds, the number of patients outside in the waiting room waiting to be treated, and the number of patients who walk out because they waited too long. This could improve ED and hospital finances, safety and convenience for patients, and the health of the community as a whole.
- How can an ED or emergency physicians get involved? Many of these projects would benefit from emergency physician representatives on their subcommittees and boards and would likely welcome emergency physicians for their clinical perspective. Involvement of emergency physicians early in the process of planning and development is crucial to ensure that the systems are designed around end-user needs. Resources about various regional health information organizations can be found on the Web through the eHealth Initiative website, available at <http://www.ehealthinitiative.org>.<sup>35</sup> Emergency physicians may also become involved through standards organizations,<sup>36</sup> formal research fellowships in informatics,<sup>37</sup> and applied, executive, and intensive informatics training programs.<sup>38</sup>

### CONCLUSION

According to the studies presented above, health information exchange could make emergency care less expensive, more efficient, and safer for patients. Much work, however, remains to be done to evaluate the impact of health information exchange on (1) quality (compliance with guidelines), (2) safety (reduced errors), (3) workflow efficiency (decreased redundancy and time savings on the part of the provider), (4) patient satisfaction, (5) provider perceptions and decisionmaking, (6) specific diseases (eg, impact of ECG availability on management of coronary disease), (7) efficiency of public health reporting, and (8) cost of caring for ED patients. Several existing models predict that many of these benefits will be realized; however, only minimal data have been generated thus far, and much more remains to be done. There are ample opportunities for health information exchange studies to be conducted in the ED setting and for ED professionals to be integrally involved.

Although barriers exist to the implementation of health information exchange, access to data from external organizations likely benefits patients and the overall health care system. Because health information exchange would also increase the

availability of data for conducting biosurveillance, there are also distinct benefits for public health and homeland security. Large database research on aggregate, deidentified data will also likely increase once health information exchange data are available, potentially leading to significant new opportunities for clinical research.

The development of widespread health information exchange is likely to become a reality in the near future. The ED will be significantly affected by the availability of health information exchange data, and the standard of care in emergency medicine may change as these systems become available. The world, even in health care, is rapidly becoming a smaller place through information technology.

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*Address for correspondence:* Jason Shapiro, MD, Department of Emergency Medicine, Mount Sinai School of Medicine, One Gustave L. Levy Place, Box 1149, New York, NY 10029; 917-334-6233, fax 212-663-1489; E-mail [jason.shapiro@mssm.edu](mailto:jason.shapiro@mssm.edu).

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