Cincinnati's HealthBridge: Bringing Results From Multiple Service Locations to One Record

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Medical practice in the twenty-first century could easily be consumed by records management. Patients have opportunities (and reasons) to receive both inpatient and ambulatory care, literally, all over town. Quality care requires that a treating physician have knowledge of what happened in all of these venues, both to incorporate the observations into their assessment and care and to avoid duplication and repetition. As a patient's history becomes more complicated, the process of record retrieval becomes concurrently more difficult yet more important.

Because of an unusually successful regional health information clearing-house known as HealthBridge, the 2.2 million people living in greater Cincinnati, Ohio, and their 4,800 physicians have the records management problem better solved than many other populations. Funded primarily by local hospital systems, this data distribution network provides local physicians with one interface for accessing results from virtually every local provider. In its doing so, providers save money and remain compliant with Health Insurance Portability and Accountability Act (HIPAA) standards, while providing greater efficiency in physicians' offices.

Just 10 years ago, if physicians in Cincinnati wanted clinical test results from a hospital system in which they worked, all they had to do was ask, and the hospital was happy to equip that physician's office with a dedicated terminal connected to their information network. However, if they wanted results from another hospital, they needed another terminal. Similarly, national clinical laboratories, which wanted to compete with the hospital systems to provide outpatient laboratory testing, would put their system into place. At Oncology Hematology Care (OHC), a medical, radiation, gynecologic, and neuro-oncology practice currently with 41 physicians in 15 offices in three states, it was not uncommon for between three and five such connections to be installed in a particular office. Even worse, at sites without dedicated terminals, results would drift in by courier, mail, fax, or be hand carried by doctors from their hospital mailboxes. Some results would arrive with multiple copies. Others arrived only when someone remembered that they were needed (usually because the patient was waiting to be seen in the office), prompting harried and impolite phone calls and impatient toe tapping at the fax machine.

We are most familiar with the benefits HealthBridge provides to our oncology practice, OHC, and will use our test and patient visit volumes for illustration. In 2005, OHC's 29

medical oncologists saw approximately 95,000 office visits and 40,000 hospital visits, caring for 23,000 unique patients. In the same year, OHC received 600,000 results electronically through HealthBridge, indicating an average of 2,300 separate messages each weekday, and either 25 results per patient or four results per patient encounter. Across the community, HealthBridge delivered 1.4 million results in January 2006, including laboratory results, radiology reports, and transcriptions. Inpatient, outpatient, emergency department, and hospital preadmission results are all sent through this system.

To accomplish these kinds of volume deliveries, HealthBridge pushes results to all physicians of record (e.g., admitting, attending, referring, primary care physicians) who are associated with a particular patient. Whenever a result for that patient is posted, results are sent by mail, by fax, or electronically. Within the system, each patient has a unique identifier by which authorized physicians are able to query and locate patient records. All results sent electronically (currently 89%) are stored in physician group databases, with the group controlling all secondary access to their data, such as forwarding for referral or analyzing patterns of care. There is no attempt to create a community-wide repository organized around the patient. Results are available and organized around physicians or physician practices. The function of HealthBridge is to bridge the flow of data between laboratory and hospital systems, and to maintain the barrier that allows only those physicians (and their designated nursing and clerical agents) caring for a particular patient, access to their records.

How HealthBridge Works

There are two main features to HealthBridge. First, a clinical messaging system allows laboratory and other provider systems to push results out to physicians and other health care providers. Second, a simple interface gives physicians and their agents one point of access to hospital information systems.

The latter is more straightforward. HealthBridge provides one Internet site that provides access to all participating hospital systems' clinical applications. Using a variety of commercial software products, a physician can log onto any hospital information system to which he has the appropriate passwords and access rights, just as if they were sitting at a nursing station inside the hospital. Figure 1 is a view of the HealthBridge portal.

Reporting laboratory analyses and other tests is somewhat more complicated and is accomplished through what is called

Figure 1. View of HealthBridge Portal.

the clinical messaging system. For this system to work, there must be a single patient index, a physician index, and a result routing engine. (Fig 2)

Perhaps the most difficult element in the system is the master patient index (MPI), which uniquely identifies patients and allows each to be associated with the individual physicians who care for them. This index is automatically created and updated “in the background,” with data elements from the hospital data feeds. The MPI creation process uses data elements such as social security number, birth date, name, gender, and a variant of the Markle Foundation (www.connectingforhealth.org) MPI algorithm to determine whether records from multiple sources belong to the same unique patient. Once this determination is made, the process assigns each patient a unique identifier.

The physician information associated with each patient is stored in a separate database. There, each physician is assigned their unique identifier and can specify their preferred method for result delivery—either secure Web interface, result pick up, dedicated printer, fax, or postal mail. Associated street addresses, telephone and fax numbers, and IP addresses are also stored in this database.

Identification numbers for all physicians of record associated with a test result and with the patient are incorporated into the data feeds sent out by each hospital’s feeder system, such as the Health Alliance’s LastWord system. The clinical messaging system uses this information to send a copy of each test result to all physicians of record associated with that result, by matching the physician identification numbers with the routing information in the master physician directory.

Any message not delivered goes to an error queue for same-day resolution by the hospital sending the result. (The most

frequent causes of these nondeliveries are changed fax numbers or street addresses, or entry of a physician name in free text rather than use of the physician identification number.) Address updates identified by the sending hospital are then entered into HealthBridge’s master address book so the correct information is available to all users simultaneously. Another common source of nondelivery is misidentification of the ordering physician. For example, if the wrong Dr Jones is selected at patient registration, the laboratory result will be sent to the wrong physician. If the physician has elected to receive the results electronically, they can then select a “not my patient” button on their interface, which returns the result to the sending hospital for correction. The immediacy of feedback to hospital registrars appears to decrease error rates.

When physician practices agree to receive their results electronically through HealthBridge, they submit to the responsibilities associated with any electronic result delivery. For example, they agree to comply with HIPAA security requirements. They also agree to monitor their electronic inbox on a regular basis to retrieve messages. HealthBridge also maintains a close relationship with each office using clinical messaging, monitoring certain aspects of daily utilization such as a build-up of clinical results in the awaiting action inbox. Should a build-up occur (usually because someone is out sick or on vacation) HealthBridge staff calls the practice to make sure they have access to the results needed. HealthBridge monitors the system and flags practices that have not accessed the system recently, and schedules training where staff turnover has occurred or additional training is needed.

HIPAA: Privacy Concerns and Solutions

On their first login, each user must acknowledge that they have read and agree with a privacy and confidentiality statement to meet requirements of HIPAA and other regulations that pertain to electronically delivered clinical results. Clinical results are only sent to physicians of record for a given patient encounter; therefore, they are classified as results necessary for patient care under HIPAA, and a separate patient notification is not required. It is also important to note that results are saved in physician practice databases and *not* in any kind of patient-centric or community-aggregated database. Though this design restricts the ability to access all data for a given patient, it does help to maintain HIPAA compliance.

Currently, physicians cannot “pull” or query data based on patient identifiers, for two reasons. First, a community clinical data repository is not currently part of the system, and

Figure 2. HealthBridge clinical messaging system overview.

second, a search across existing databases is not allowed. The intentional omission of these features illustrates the tension between compliance with privacy regulations, and the clinical utility and safety of having patient information available to appropriate users. For instance, physicians who are seeing a patient for the first time do not have electronic access to the patient's previous laboratory results unless those results are individually forwarded as part of the referral process.

Naturally perhaps, HealthBridge is attempting to resolve the tension between privacy concerns and a system that permits queries of historical information by moving toward a special kind of clinical data repository that features separate databases for each content-providing health system. With the record locator service already in place, this should enable providers within a system to find testing results by different practitioners, perhaps eliminating duplicative testing and better informing providers (such as radiologists interpreting images) who either lack direct patient access, or clinicians who are evaluating patients with a poor understanding or memory of the specifics of a patient's medical history.

One of the most difficult aspects of health information exchange is data ownership and control issues. Even the concept of "ownership" is unclear when multiple copies of the same data are maintained in different databases (for example, each physician practice could maintain their own results database), with different nominal owners. HealthBridge does not control or own the patient or clinical laboratory data. In fact, the defined access points to HealthBridge data occur in four ways:

1. The content provider (hospital or laboratory) can access their own database of results even after they have released copies.
2. Physician practices that have been sent data electronically also have ongoing access to all data that has been sent to them by all the content providers. (For instance, OHC has nearly 3 million results in its clinical messaging database.)

3. HealthBridge is working with 20 different electronic medical record vendors and a number of physician practices to allow automatic interfaces that will push data sent through the clinical messaging system directly into a practice's electronic medical record system.
4. Physicians can use the clinical messaging system to forward results to any other physician defined in the master physician directory. This is done as part of a patient referral process.

How Was HealthBridge Built?

Though the many functions now available through HealthBridge are obviously helpful, when the network was just an idea, it took some real trust and leadership, and an even more concrete capital investment, to get HealthBridge off the ground. Just 8 years ago, in 1997, five hospital systems and two insurance plans each loaned HealthBridge \$250,000 as a 5-year interest-free loan. All five hospital-system loans have been extended to 2015, though interest is now paid. In exchange for their loans, each of the hospital systems was given a seat on the HealthBridge board of directors. (Two of the local systems had merged into one, but since 1997, still have provided two loans and still have two seats on the Board.) HealthBridge is a subsidiary of the not-for-profit Health Improvement Collaborative, which is itself a subsidiary of the Greater Cincinnati Health Council.

Additional funding has come in the form of two grants totaling approximately \$105,000.

The Health Foundation, a not-for-profit organization created when Humana purchased a local health plan, gave \$29,000 in 2002 as part of a physician health alert system. This allowed OHC to use the foundation of HealthBridge and the clinical messaging system to create an electronic process for public health commissioners to notify physicians (by fax and electronically) of any "health alert" situation.

In December 2005, HealthBridge received a \$75,000 Robert Wood Johnson grant, with the Hamilton County Health District, which will use the existing clinical messaging data flow and "data triggers" to identify those results that represent a public health reportable event (such as an infectious disease outbreak). In general, applicable results (such as sputum cultures for *Mycobacterium tuberculosis* or positive *Cryptosporidium* or *Salmonella* cultures) will be forwarded to a clinical inbox (just like the one OHC uses), accessible by the 17 different health departments that operate in HealthBridge's service area. Spontaneous paper reporting will be compared with the automated reporting of HealthBridge.

Currently, the yearly budget of HealthBridge is \$2.6 million and includes flow through costs for transcription and printing; the budget provides for 13 and 1/5 full time equivalent employees. Three quarters of its current revenue comes from the five Health System customers and clinical

laboratories, and the remaining fourth comes from premium services fees (such as transcription and physician office network monitoring) and from other customers such as billing companies. Beyond their interest in participating in a community-wide collaborative effort to improve the quality and safety of patient care, the health systems participating have actually saved money by using a shared technical infrastructure and by streamlining result delivery processes. Billing companies use the service to electronically access the data necessary for billing. To further expedite billing functions, some have even added evening and overnight staff.

What Do the Users Say?

A survey of the nurses and doctors at OHC demonstrated some very old truths. The nurses adopted HealthBridge before the physicians, mainly because it helps them to more efficiently gather results for the doctors' review. Although they were initially somewhat reluctant to adapt to the system, their biggest complaint now is that it is intermittently and temporarily "down," at which time results must be obtained through a more traditional channel.

Physician users have almost uniformly failed to obtain formal training on HealthBridge. Their appreciation and use of its features varies tremendously. Some depend on it for access to the hospital information system from home, to allow for signing off on medical records where this function is available, or to review clinical laboratory results and other documents. Other physicians are creative in their use of the image archival system to review x-ray images with their patients. This is an unbelievably powerful tool for an oncologist accustomed to having a staff member physically retrieve the x-ray jacket or a CD-ROM containing a viewer and the image files.

Both the nurse and physician groups complain about the duplicate test results that the system often provides. Because a patient may be assigned to multiple providers within one office, the results are routed to those providers individually.

But everyone can't imagine how they got by before HealthBridge was in place.

Other Uses of This Technology

There are other obvious uses of the HealthBridge system. For example, it is apparent that moving records past a centralized

point allows for some quantification of the number of times certain tests are ordered or specific results reported, and with this, the possibility of epidemiologic surveillance. In this true community model, the system can look for spikes in, for example, emergency department visits of patients complaining of a cough. It can search for numbers of tests ordered (like chest x-rays or cultures), looking for epidemics or even evidence of bioterrorism. A pilot project with the University of Pittsburgh using their Real-time Outbreak Disease Surveillance (RODS) is underway. This data set examines emergency department visits and looks at 12 variables including zip code, patient age, and "patient's chief complaint," and creates a visual display that putatively indicates when something "unexpected" is happening. When an anomaly is identified by the system, the data are reviewed by epidemiologists at several local health departments to determine whether it requires further investigation.

Summary and Conclusion

Regional health information exchanges such as HealthBridge provide an important function as we move toward electronic medical records. These systems do so by providing one-stop shopping for doctors, their practices, and their electronic result retrieval interfaces, allowing results from any participating source to come into their practice through a single gateway. Cincinnati's HealthBridge has successfully built a program that allows results from multiple sources to be distributed with greater efficiency in time and cost as compared with traditional methods. Though there is no centralized database of results, the centralized routing of results allows epidemiologic and public health needs to be met more effectively than random observation and intermittent voluntary (though often mandated) reporting. True gains in efficiency are achievable with the cooperation of test and information providers, and the system appears to benefit both the providers of testing and the physician coordinators of care.

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