

Accelerating Time-to-Value for Health Information Exchange (HIE)

Health-e-cITi-NJ simplifies HIE deployment with a hybrid model and technologies from Intel and IGI Health

Using Intel® Expressway Service Gateway for Healthcare and IGI Health ORBIT Healthcare Portal,* Health-e-cITi-NJ is implementing a regional HIE that facilitates safer, more efficient care while reducing deployment complexity and increasing performance and security.

Introduction: Meeting the Challenges of HIE Implementation

Health information exchanges are increasingly in the spotlight as governments, health-care systems, and providers strive to deliver higher quality, more affordable, and more collaborative care. By creating a backbone for healthcare organizations to securely exchange clinical data, HIEs can improve information sharing among all HIE stakeholders, including patients and their families or caregivers and all offices or institutions involved in their care. HIEs can give providers a more comprehensive and longitudinal view of their patients' health; help healthcare organizations increase efficiency, improve safety, and control costs; and offer ways for patients/citizens to become more engaged in their care.

HIEs support healthcare reform goals and are essential infrastructure for improving care within a state, region, or nation. They are critical for entities that want to deliver coordinated care through an Accountable Care Organization (ACO) or similar structure. Establishing or joining an HIE can facilitate meaningful use of electronic healthcare information and increase the return on investment (ROI) in electronic health records (EHRs) and other healthcare IT (HIT) solutions. Local, regional, and state HIEs can also serve as building blocks to prepare for larger-scale networks, such as the forthcoming Nationwide Health Information Network (NwHIN) Exchange in the U.S.

But HIEs can be challenging to implement. HIE planners must establish a practical, secure, interoperable, and affordable framework for information exchange among a large set of legacy and modern applications and evolving standards. They must address issues such as governance and sustainability, as well as technical challenges that include choosing an architectural model, coping with evolving

data standards, implementing a scalable design, and maintaining the confidentiality of patient records. They must ensure interoperability while enabling member organizations to preserve their investments in disparate legacy systems.

This paper describes the Greater Newark Community HIE, known as Health-e-cITi-NJ. A regional HIE centered in the Newark metropolitan area, Health-e-cITi-NJ was established in 2010 with a grant of USD 3.2 million from the Office of the National Coordinator for Health Information Technology (ONC). Health-e-cITi-NJ is based on a hybrid architectural model that provides a best-of-both-worlds combination of centralized and federated models. Health-e-cITi-NJ is using two forward-looking technologies to implement its HIE:

- Intel® Expressway Service Gateway (Intel® ESG for Healthcare) (formerly SOA Expressway for Healthcare), a software appliance that provides an integrated, high-performance message gateway, service mediation engine, and security gateway.

“The more information you have about patients, the better the treatment plan and outcomes.

This is even more critical for patients who are new, show up in your ED, the patient who’s on vacation and lands in your office, the patient who’s being transferred between hospitals for different levels of care. As a clinician, you make judgment calls when you don’t have enough information. You go on your experience and the limited information obtained directly from the patient or family member. The HIE is going to be a big help by having prior encounter and result information at your fingertips.”

*Nina DiQuollo
Senior Director of IT and Services
Newark Beth Israel Medical Center*

- IGI ORBIT Healthcare Portal,* a comprehensive solutions framework for physician and patient e-services, offered by IGI Health LLC (IGI).

Health-e-clTi-NJ’s leaders say these technologies are enabling them to develop a robust HIE that is quicker to implement, provides timelier information, and simplifies privacy and security compared to alternative approaches.

New Jersey Context for Health-e-clTi-NJ

The State of New Jersey has been an active innovator in HIEs, based on a stated long-term goal of ensuring that all providers in the state have access to healthcare IT regardless of size, financial capacity, or location. The State applied for a federal HIE grant under the provisions of the American Recovery and Reinvestment Act (ARRA) of 2009, and received funding that it used for establishing Health-e-clTi-NJ and three community HIEs. These HIEs will serve as building blocks and be united with other HIEs into a state-wide New Jersey Health Information Network (NJHIN).

Among other steps, New Jersey has established an HIE Technical Workgroup to evaluate and prioritize use cases and establish operating procedures for sharing health information within and across HIEs in the state. Reflecting the broad range of stakeholders in an effective HIE, the workgroup includes representatives from the State-wide HIT Coordinator, HIT Commission, Office for eHIT Development, NJ-HITEC, Medicaid, Health-e-clTi-NJ and other HIEs within the state, and other organizations. Prioritized use cases include the secure exchange of:

- Medicaid medication database
- Lab results
- Care summaries (both discharge summaries and continuity-of-care records)
- Other medication history
- Medication allergies
- Radiology reports

New Jersey HIEs are also working to interface with state databases and registries, to provide access to information such as immunization records, as well as to payer services for claims information. Other potential use cases include access to data on lead-screening tests and early hearing-loss detection.

Mission-Focused HIE: Improving Care in the Inner City and Beyond

With its center in Newark, Health-e-clTi is a Northeast New Jersey regional exchange representing the state’s largest city and some of its most distressed citizens. Newark is located just eight miles west of Manhattan, and is home to corporate headquarters, highly ranked universities, and major league sports teams. Yet, census data show that roughly one third of city residents live below the poverty line.

In the aftermath of two hospital closures in the spring of 2008, Newark’s healthcare leaders looked at ways to make the most of increasingly-scarce resources and counteract some of the impact of the closures on Newark’s poor. Health-e-clTi-NJ was one result.

“One of the things that’s unique about Health-e-clTi-NJ is that we’re focused around inner-city, mission-centric hospitals,” says Jim Cavanagh, vice president and CIO of St. Joseph’s Healthcare System and a member of the Health-e-clTi-NJ executive board. “As institutions, we have a focus on high volumes of patients with challenging demographics. We have a mission to make sure we don’t create a healthcare system that provides disparity in care. We want all providers, regardless of where the patient is coming from, to have access to the same tools and capabilities.”

In 2009, Newark Beth Israel Medical Center (NBI) rolled out a demonstration project that became the foundation of Health-e-clTi-NJ. NBI is a 673-bed, nonprofit, community teaching hospital and the flagship of New Jersey's largest integrated delivery network (IDN), Barnabas Health System. A major referral and treatment center, NBI handles more than 300,000 outpatient visits and 25,000 admissions annually. As a tertiary and quaternary care center, it is one of two hospitals in New Jersey that performs heart transplants and the only hospital in the state certified for lung transplants.

The initial project, which is still in operation, uses Intel ESG for Healthcare and IGI Health Portal to provide NBI clinicians and neighboring federally qualified health centers (FQHC) with web-based portal access to integrated patient information and a common look and feel across facilities. Initial services included access to New Jersey Medicaid's medication histories, an interface to the New Jersey state immunization system, and lab and radiology results from the NBI emergency departments.

Today, operating as a nonprofit corporation, Health-e-clTi-NJ has broadened its membership but retained its focus on enabling member organizations to deliver more coordinated care, particularly for patients with complex chronic conditions who are frequent users of Emergency Departments (EDs) in the area. Health-e-clTi-NJ comprises seven hospital members in addition to NBI:

- **Christ Hospital**, Jersey City, a 381-bed acute care facility and community health provider with over 500 physicians.
- **East Orange General Hospital**, a 211-bed, not-for-profit New Jersey community hospital and an emerging premiere urban medical center.

- **Jersey City Medical Center**, a private, not-for-profit regional referral and teaching hospital providing the highest level of care for women and infants, trauma, and cardiac patients. JCMC is a member of Liberty Health Systems and a major teaching affiliate of the Mount Sinai School of Medicine.
- **Meadowlands Hospital Medical Center**, a 230-bed acute-care community hospital fully accredited by the Joint Commission and located in Secaucus.
- **St. Joseph's Healthcare System**, a two-hospital system including St. Joseph's Regional Medical Center, a 651-bed academic tertiary medical center and state-designated trauma center located in Paterson, and St. Joseph's Wayne Hospital, a 229-bed acute-care community hospital that provides comprehensive medical and surgical care, emergency and diagnostic services to the residents of Wayne and communities in northern New Jersey.
- **St. Michael's Medical Center**, a 357-bed regional tertiary care, teaching, and research center in the heart of Newark's business and educational district.
- **University of Medicine and Dentistry of New Jersey (UMDNJ) Hospital** is a 518-bed facility and the principal teaching hospital of New Jersey Medical School. The University Hospital is the busiest trauma center in New Jersey and a center of referral for many of the state's most advanced medical services and specialty care programs.

Reflecting the breadth of organizations involved in delivering collaborative care, Health-e-clTi-NJ also includes:

- Newark Community Health Center, an FQHC with six locations in Newark and surrounding communities.
- Monmouth Ocean Hospital Service Company (MONOC), a not-for-profit consortium providing emergency medical services (EMS) and other services to 15 acute-care hospitals in New Jersey.

CIO PERSPECTIVE: ST. JOSEPH'S HEALTHCARE SYSTEM

Sharing health records across a community has long been a vision of improved healthcare. HIEs are helping us move closer to that goal.

One of the big challenges in healthcare is making the most effective use of resources. For all the things that are expensive in healthcare, we want to make sure that we only do them once, and we get the full benefit of doing them by making the results and the diagnosis available to practitioners and healthcare teams. We don't want the information from your doctor visit or hospital admission to remain within that office or that hospital.

It serves the patient if we can make sure their health record is preserved across the community. It can mean that tests done at one organization won't get repeated at the next hospital—to the inconvenience and the possible detriment of the patient. That's one of the key benefits. It helps us provide the best outcomes for the patient, which always drives us as a starting point. Anything that serves the patient and brings more efficiency to us is of benefit.

—JIM CAVANAGH

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- Visiting Nurse Association of Central Jersey, a member of VNA Health Group and a premiere Medicare/Medicaid-certified provider of home health, hospice, and community-based services.
- The Newark Department of Child and Family Well Being.
- Approximately 1,000 physicians in primary and specialty practices.

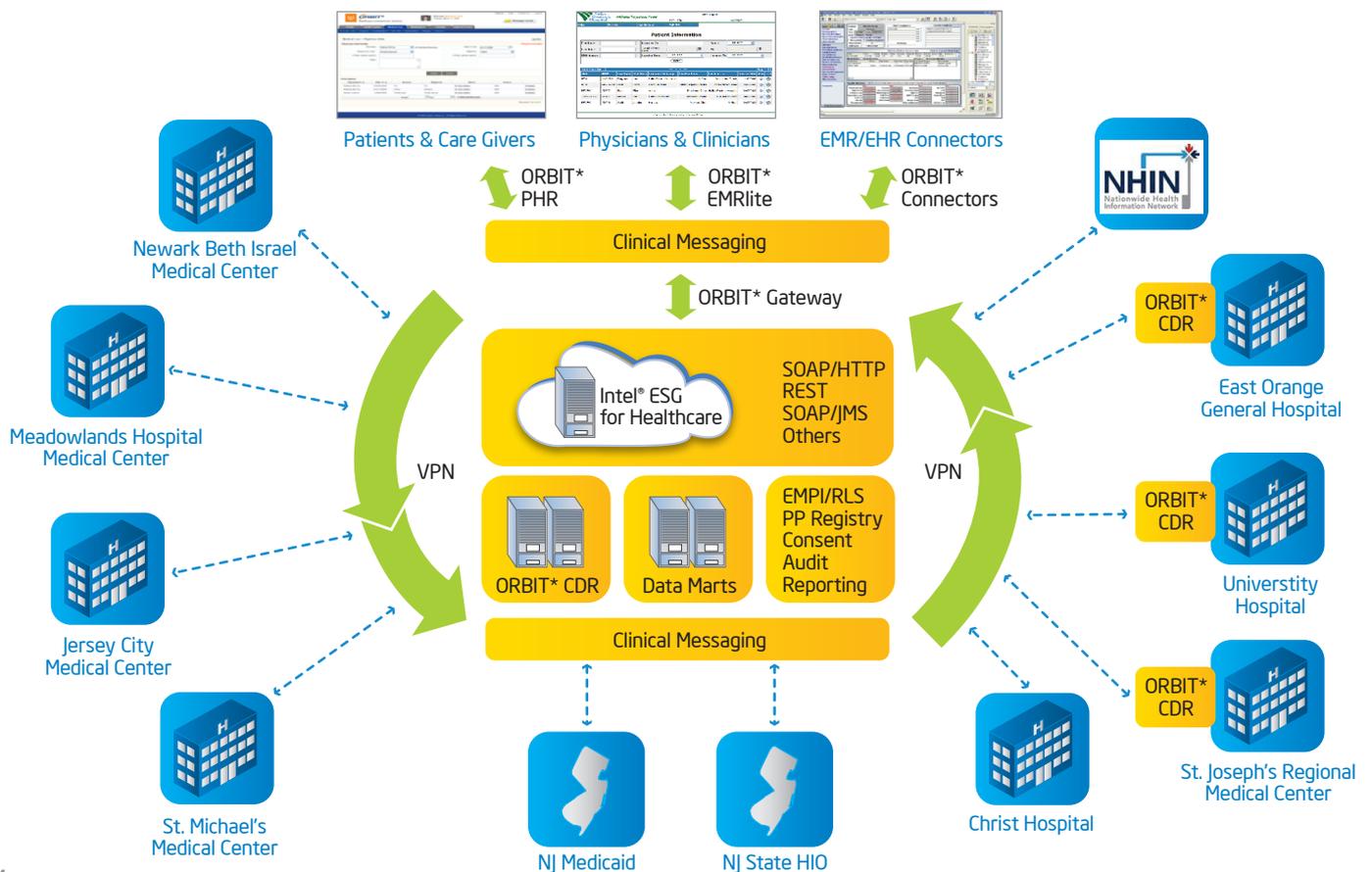
Health-e-cITi-NJ received its ONC funding in May 2011, and has focused on establishing links among all members and meeting the state's requirements for 2012 information exchange. Accomplishments as of April 2012 include:

- Establishing a board of trustees, corporate bylaws, and a financial sustainability plan.

- Creating physician and patient portals.
- Completing interface testing for data exchange by most member hospitals.
- Providing access to lab results, radiology results, encounters and ED visits, including notes, for all eight hospitals.
- Adopting a Universal Transfer Form between licensed entities.
- Providing access to New Jersey immunization registry and New Jersey Medicaid medication histories.
- Establishing master patient index and consent management capabilities.

An interoperability demonstration presented at the New Jersey/Delaware Valley 2011 HIMSS conference depicts the high degree of collaboration envisioned by Health-e-cITi-NJ leaders, and suggests some of the ways HIE-enabled collaboration can improve patient care and resource utilization.¹ Using a secure PC, laptop, or tablet, authorized personnel at every point of the care continuum can securely access timely data about the patient's medical background and treatment plan. In addition, the information they chart can be made quickly available to other members of the HIE. EMS technicians, ED staff, hospitalists, clinic physicians and staff, and home health providers all have a more complete view of the patient's condition and care plan, with the potential to collaborate more effectively, make more informed clinical decisions, and improve resource utilization.

Figure 1. Health-e-cITi-NJ: Multiple stakeholders and information sources



Best-of-Both-Worlds Architecture

HIEs are best viewed as a complex network of participants rather than a simple point-to-point exchange of information. Information must be reconciled from multiple sources of data, incompatible systems, and multiple points along the care continuum. Each time information changes hands, steps must be taken to match clinician and patient registries, make sure the requester is authorized to receive the information and the patient has authorized disclosure, normalize terminology, and in many cases, aggregate patient information from disparate sources.

The traditional approach to managing such a challenge is to establish a centralized repository that consolidates and manages all necessary data and performs the work needed to enable secure data transfer to authorized users. The centralized or warehouse model is frequently used in IDNs or national health services where all participants rely on the same EHR. This model is expensive to create, scale, and maintain. It requires strong centralized management, and makes it complex to ensure timely updates of data. It also introduces a single point of failure and provides a single target for security attacks.

Federated or decentralized models store clinical data on the “edge” of the network, at the site where it originated. To obtain clinical data, HIE users access the central site and are routed to the appropriate sites. Among the benefits of this model are that data is always current, and the organization that originated the patient information retains control of it. However, HIE users may need to visit multiple sites to gather information about a single patient.

Health-e-clTi-NJ is implementing a hybrid model. Most data resides with the originating organizations, and core servers provide shared services such as terminology, master patient indexes, and certain demographics.

“Because we use a distributed model, we’re not sending data to a central location,” explains Nina DiQuollo, senior director of IT and services for Barnabas Health at NBI. “HIE information is maintained by whoever owns the data. It’s only shared when there’s a query and the sender and receiver have a match. We’re pulling information when it’s needed rather than pushing it to a central core.”

The hybrid model means that after an initial request to a patient’s record, subsequent requests use edge resources only to gather new results. Cavanagh likens the process to an airline search engine. “When you go online to search for a flight, it’s not a system where every airline dumps all its schedules into a common place and you go look at that,” he says. “Instead, when you do an inquiry, the system goes out to each airline scheduling system in real time and pulls in the latest information. That’s the approach we’re hoping to emulate in healthcare: real-time data based on an Internet portal versus a huge repository.”

The hybrid approach also provides benefits for privacy, security, and flexibility. “Each organization has servers within its own firewall, and all data is local, so you can use all your normal privacy and security precautions,” says DiQuollo. “It’s also easier for providers to take their data with them if they move.”

Next-Generation Technologies: Codeless Implementation, High Performance

To implement its hybrid model, Health-e-clTi-NJ uses IGI Health Portal, a comprehensive, user-friendly portal from IGI Health; and Intel Expressway Service Gateway for Healthcare, a high-performance software appliance and service gateway from Intel. The implementation is based on service-oriented architecture (SOA) principles applied to the applicable Integrating the Healthcare Enterprise (IHE) profiles. It conforms to the Healthcare Information Technology Standards Panel (HITSP) Integration profiles, and complies with HIPAA, New Jersey Health-

care Information Networks and Technologies (NJ HINT), and applicable federal and state healthcare laws and regulations.

Physical infrastructure uses a two-tiered approach with Intel ESG edge servers connecting providers to normalize their Health Level 7 Version 2 (HL7v2) data to the Health Level 7 Version 3 (HL7v3) standard, and Intel ESG core servers where shared services such as terminology and master patient indexes reside. These servers overlay existing legacy systems, preserving investments in those systems. For connectivity to organizations using the Federal Health Architecture, Health-e-clTi-NJ will exchange data using the federally developed Connect adapter and gateway software.

Cavanagh says Health-e-clTi-NJ’s choice of technologies benefits both implementers and users. “The fact that we’re using a more modern portal model, and a very distributed and federated model, makes Health-e-clTi-NJ a little lighter, less costly, and more sustainable,” he comments. “We think it’s the right model because it’s so important to get real-time data. Healthcare data gets old very quickly, and you don’t want to miss a key lab result or a recent ER visit. The Intel and IGI tools really do a good job of mining data from the source directly and responding to an inquiry in real time.”

Intel ESG for Healthcare is the healthcare version of the Intel Expressway Service Gateway, a cross-domain solution that provides gateway security for cloud and other infrastructure at large financial, retail, governmental, and healthcare organizations. Intel ESG for Healthcare helps simplify operations and contain costs through a design and a feature set that are built from the bottom up to support SOA and edge services in today’s virtualized and cloud computing environments.

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Intel ESG for Healthcare integrates the common functions of a service bus, security gateway, and XML acceleration engine into a single product that scales on Intel processor-based servers and can be deployed as a virtual appliance. Key capabilities include:

- An integrated core that provides exceptional performance for message-processing, data transformation, and validation for XML, HL7, and EDI transactions.
- Powerful service mediation, protocol translation, and routing for the most demanding, real-time data exchange environments.
- Threat prevention via XML firewalls and support for hardware-aided encryption.
- A modern, visual integrated development environment for codeless workflow and data map design.
- Simplified web-based management and installation within minutes.

- Cost reductions and excellent scalability as a software appliance that runs on affordable, widely available servers.

IGI Health Portal provides a simple, consistent gateway for physicians, nurses, and other authorized users to access information regardless of which organization within the HIE originated the information and what EHR or platform they used to create the original data. Modular in design, it has open capabilities to facilitate collaboration via the secure exchange of clinical and administrative information.

In addition to supporting HIEs, Intel Expressway and IGI Portal can be used to integrate disparate systems within an organization, simplifying workflow and data sharing beyond HIE requirements. For example, at NBI's ED, nurses used to manually transfer data from the ED's clinical system to the hospital EHR. NBI used Intel ESG for Healthcare to provide a transparent interface between the two systems, eliminating the duplicate effort,

saving time for busy professionals, and reducing the chance of transcription errors. Physicians and staff can view the data using IGI Health Portal or the EHR.

Delivering Strategic Value

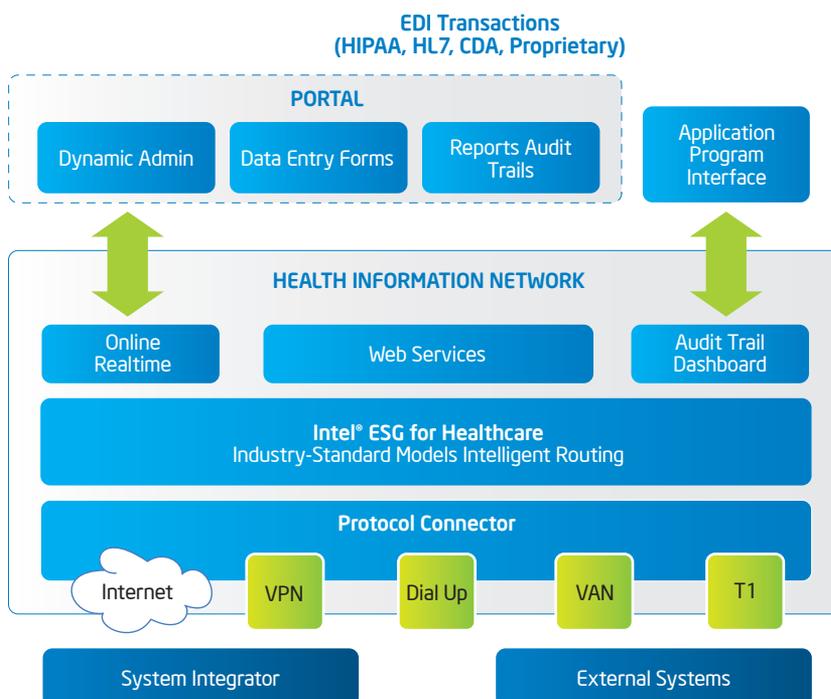
Early experiences at Health-e-cITi-NJ and with other healthcare IT deployments suggest that the Health-e-cITi-NJ HIE will deliver a broad range of strategic benefits.²

Patient safety and quality of care

More collaborative, comprehensive care is essential to improving outcomes for patients with complex chronic conditions. HIEs facilitate frictionless information-transfer in real time among EMS technicians, ED physicians/staff, hospitalists, physician practices, and home health organizations. This can enable healthcare professionals to make more informed decisions, collaborate more effectively, and ensure a smoother transition for patients as they pass through the continuum of care. Health-e-cITi-NJ is creating the capability to generate a list of patients each day who have been hospitalized or seen in the ED, which will facilitate follow up by clinics, case managers, and primary care practices. With more comprehensive information in real time, physicians may be able to reduce duplicate tests and procedures, also lowering the patient's exposure to complications from those extra procedures.

New Jersey also anticipates its HIE investments will generate savings and ROI through sharing of electronic clinical summaries created for patients' ED visits, faster and more thorough reporting of vital statistics and tracking of communicable diseases, and other types of information exchange.³

Figure 2. Information architecture for the Health-e-cITi-NJ HIE



Access to care

Efficient information-sharing is critical to new models of team-oriented care that make the most of physician resources. Real-time collaboration and information exchange may be able to help healthcare teams better engage and manage patients with chronic conditions, thereby reducing ED visits and length of stay. Comprehensive information can help professionals provide care in more cost-efficient settings and reduce duplicate tests. All these factors may combine to relieve stress on busy EDs, wards, clinics, and physician practices.

Physician and staff productivity

With easy access to patient summaries and other information, health professionals and staff can reduce tedious communications via phone, paper, and fax. Comprehensive information also supports broader workflow redesign, which can produce further other efficiencies and time savings.

Patient/citizen satisfaction

In an environment with robust and timely information flow, patients are less likely to be inconvenienced by unnecessary tests and procedures. The potential exists to reduce ED overcrowding by providing more comprehensive, team-oriented care in more cost-effective settings, to reduce unnecessary ED visits.

The HIE will provide a patient portal, encouraging patients to engage more fully in their own care and improving their ability to interact with the healthcare system.

Physician and staff satisfaction

Inasmuch as it contributes to an efficient working environment, an effective HIE with a comprehensive, easy-to-use interface can help hospitals and IDNs attract and retain physicians, nurses, and other clinicians.

Revenue enhancement

Comprehensive, real-time information flow can enable organizations to schedule expensive resources, from specialist appointments to sophisticated diagnostics procedures, more efficiently and ensure that equipment is utilized optimally.

HIE leadership can enhance an organization's reputation as a healthcare innovator and a great place to work, potentially improving recruitment and retention of physicians, staff, and patients. Improvements in physician recruitment and retention can help generate revenue to enhance and maintain hospital operations. In the U.S., physicians generate an average of USD 1,543,788 apiece for their affiliated hospitals, ranging from a low of USD 696,888 for nephrologists and a high of USD 2,815,650 for neurosurgeons.⁴

Cost optimization

HIE-enabled increases in efficiency, productivity, and retention, along with reductions in duplicate procedures, can contribute to cost savings. HIE-based communications can also reduce costs associated with referrals and coordination by reducing or eliminating the need to scan and fax documents, mail patient charts, and conduct manual phone calls to verify delivery of referrals and test results.

By making healthcare IT information easier to share, HIEs increase the return on investments that states and healthcare organizations made to create that information. For example, New Jersey's broadband penetration is at 98 percent, among the highest in the nation.⁵ HIEs are a great way to derive further value from the investments in broadband technology. Shared information also provides a basis for value-added services such as recruiting patients for clinical trials, comparing the effectiveness of treatment protocols, and more accurately comparing institutional quality.

As in the NBI ED example above, the technologies used to establish the HIE can be extended to support workflow optimization within the hospital, further contributing to ROI.

Lessons Learned

Healthcare and technology leaders involved with Health-e-cITI-NJ say the HIE's experiences suggest several recommendations and insights:

- With the right solutions, technology implementation is the easy part. Choose a hybrid distributed model, a standards-based service gateway, and an easily customizable portal with comprehensive functionality.
- Participation agreements are complex to develop and take time to gain agreement on. Start on them early.
- It's time—or past time—to move forward. If you wait for states and federal governments to finalize budgets and nail down network definitions and for standards to be fully baked, you're missing out on the benefits of an HIE and an opportunity to achieve competitive differentiation. Make the best assumptions as to how things will work, and prepare accordingly.
- To hedge against change, follow industry standards and best practices. Build flexibility into your architecture and choose open, flexible technologies so you'll be able to adjust quickly.
- The work isn't done when the HIE begins operation. Keep committees and subcommittees engaged and ready to implement further improvements and take advantage of new opportunities.

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What's Your Next Step?

Intel and IGI can help healthcare planners, hospital and IDN leaders, and system integrators to envision, design, and implement strategic digital health initiatives. To move forward:

- Talk to your Intel representative or visit Intel's Healthcare site:
www.intel.com/healthcare
- Visit as a guest, or join the Intel community of health IT professionals at:
<http://premierit.intel.com/community/ipip/healthcare>
- Read about Intel Expressway Service Gateway for Healthcare:
<http://cloudsecurity.intel.com/products/api-web-service-rest-security>
- Learn more about IGI Health connectivity solutions:
<http://www.igihealth.com/>

¹ See Interoperability Demonstrations: <http://www.youtube.com/watch?v=PWOJ8Na8qM8&feature=related> and <http://www.youtube.com/watch?v=orKglz9IY-U&feature=relmfu>

² This discussion uses the HIT benefit categories identified in Intel's healthcare IT value model. See Ben Wilson and Jim Athanasiou, The Value of Healthcare IT: A Practical Approach to Discussing and Measuring the Benefits of HIT Investments, Intel Corporation, 2007. <http://www.intel.com/Assets/PDF/whitepaper/health-317997001.pdf>

³ State of New Jersey Application: Office of the National Coordinator for Health Information Technology State Health Information Exchange Cooperative Agreements Program Project Narrative. http://www.state.nj.us/dobi/division_insurance/hint/njhieproject.pdf

⁴ Merritt Hawkins, 2010 Physician Inpatient/Outpatient Revenue Survey. http://www.merrithawkins.com/pdf/2010_revenuesurvey.pdf

⁵ State of New Jersey. State HIT Operational Plan. Submitted to ONC. August 30, 2010.

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