



From Dishwashers to Digital Medical Records

Indiana's Leadership in
Health Information Technology

For This Report

BioCrossroads has defined the health information technology (HIT) sector as companies and not-for-profit organizations that produce or use technologies that store, process, manage, and transmit health information, including patient data. Our scope of HIT is largely systems- and services-oriented - capturing, exchanging, and using patient-centric clinical data. Examples include companies that develop electronic medical records, laboratory information systems and health information exchange systems for healthcare organizations. Also included are companies developing drug database systems, health outcomes and quality measurement systems and companies providing information technology consulting to healthcare organizations. The parameters of HIT's economic measurement throughout this report do not include healthcare delivery organizations, government, academic, philanthropic and public institutions. These entities play vital roles within the overall HIT sector, but our focus for the report is on the innovative products, services and leadership activities of the entrepreneurial HIT organizations. BioCrossroads worked with the Indiana Business Research Center (IBRC) to collect and analyze financial information in the report.

About BioCrossroads

BioCrossroads (www.biocrossroads.com) is Indiana's initiative to grow, advance and invest in the life sciences, a public private collaboration that supports the region's existing research and corporate strengths while encouraging new business development. BioCrossroads provides money and support to life sciences businesses, launches new life sciences enterprises (Indiana Health Information Exchange, Fairbanks Institute for Healthy Communities, BioCrossroadsLINX, OrthoWorx, and Datalys Center), expands collaboration and partnerships among Indiana's life sciences institutions, promotes science education and markets Indiana's life sciences industry.

Additional information on Indiana's HIT sector can be obtained at the Indiana Health Information Technology, Inc. (IHIT) website: www.indianahealthit.com and the ExhibIT Indiana website: www.exibhitindiana.com.

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Executive Summary

Indiana's history of leadership in health information technology (HIT) spans nearly 50 years. Serendipitous events and unlikely players came together – and then stayed together – to build a set of capabilities that, today, puts Indiana in the forefront when it comes to the delivery of better healthcare through the use of better information.

In the 1960's, Indiana entrepreneur Sam Regenstrief invented the front-loaded dishwasher, and then became the first to install digital controls on these appliances. Regenstrief reasoned that if digital formats could work wonders in the kitchen, the use of digital information should lead to even more stunning advances when it came to providing better healthcare for more people at lower costs. Accordingly, starting in 1969, Regenstrief generously funded the Regenstrief Foundation and established the Regenstrief Institute, Inc. (Regenstrief) at Indiana University School of Medicine. From the very start, Regenstrief's mission was to research possibilities and develop applications for collecting, transmitting and analyzing patient information in an electronic, rather than a paper format. Soon, Regenstrief moved beyond its academic borders and began working with nearby Wishard Hospital, a major

downtown Indianapolis provider. In the 1970's, the hospital began to implement what would become the Regenstrief Medical Record System – one of the nation's first deployments of electronic medical records. Thus began a community-based effort to hasten the arrival of healthcare's digital age.

Regenstrief today is one of the nation's premier institutions for medical informatics research. And Central Indiana is also home to one of the most competitive hospital markets in the United States, with five premier and highly competitive primary and specialty care health systems. However, in 2003, in an unprecedented collaboration, all five came to a common table to explore the possibilities for establishing a regional health information network that would allow more effective communication for all and facilitate the delivery of better healthcare for each provider. BioCrossroads, Indiana's initiative for investment, development and advancement of the state's signature life sciences strengths, served as the convener and catalyst for this effort. In cooperation with Regenstrief and through the generous participation of leading philanthropic organizations, BioCrossroads organized a new, collaborative enterprise – the Indiana

Health Information Exchange (IHIE) – involving all five health systems, research institutions, payors and public agencies in the development of clinical messaging, health quality and other health outcomes services that would be commonly accessible on a sustainable, fee-for-service basis. IHIE today is the nation's largest electronic medical exchange, and a model that many others seek to follow.

Moreover, IHIE has collaborative company in the provision of health information exchange services in Indiana. Indiana now has five health information organizations (HIOs) that, together, connect more than 15,000 physicians, 70 medical facilities and more than 12 million patient records. And despite the typical challenges of interoperability, these HIOs actually do connect in the delivery of services. In 2009, three Indiana HIOs started securely sending clinical test results, reports and other medical information across a shared network, a first in the U.S. These HIOs – HealthBridge, based in Cincinnati, Ohio but serving many southern Indiana communities; IHIE in Indianapolis; and HealthLINC in Bloomington, Indiana – continue to collaborate in new efforts to enable medical information to flow

electronically among doctors, hospitals, laboratories, clinics and patients.

Given the complexity of healthcare, collaboration among multiple stakeholders is a pre-requisite for the effective utilization of HIT that benefits patients. Indiana's story demonstrates the value that such collaboration can bring. While other regions across the United States are still organizing plans for action, Indiana has moved to a phase of regional and statewide implementation of an increasingly interoperable system for the "meaningful use" of HIT. The results are promising – both for the prospects of better healthcare for Indiana's citizens and, as this report will begin to show, for a productive new sector for Indiana's economy.

Indiana's Leading Edge of Collaborative Assets in HIT

Academic Research Institution and Private Sector Innovation Leadership

Today, Regenstrief partners with Wishard Hospital and all its community clinics, and Indiana University Health (IU Health University Hospital, IU Health Methodist Hospital, Riley Hospital for Children at IU Health – formerly known as providers in the Clarian Health system), and these hospital systems' affiliated hospitals and clinics. The affiliates employ a unique research/operational HIT model in which the hospitals deploy HIT systems developed by Regenstrief, and Regenstrief conducts and publishes controlled research trials to evaluate the new systems. This living laboratory approach provides opportunities to study electronic medical records (EMR) and other innovations in prolonged, real world settings. Regenstrief researchers coordinate and collaborate with hospital system personnel in designing, deploying, and studying new system innovations for the benefit of all organizations that participate.

Examples of Regenstrief innovations produced through this collaborative partnership model include:

- ◆ **Electronic Medical Record System Development** In the 1970's, Regenstrief's research scientists began developing the Regenstrief Medical Records System (RMRS), one of the nation's first electronic medical record systems and the cornerstone of many Regenstrief activities. RMRS serves as the day-to-day electronic medical records system at Wishard Hospital and its affiliated community clinics, IU Health Methodist Hospital, IU Health University Hospital and Riley Hospital for Children at IU Health. Since its inception, more than 32 million physician orders have been entered into the order entry system of the RMRS that provides unique clinical decision support and guidelines. Regenstrief reports that RMRS has a database of 6 million patients, with 900 million on-line coded results, 20 million full reports including diagnostic studies, procedure results, operative notes and discharge summaries, and 65 million radiology images.

- ◆ **Medical Informatics Standards** Indiana University and Regenstrief Institute initiated the Logical Observations Identifiers Names and Codes (LOINC®) in 1994 to enable the electronic movement of laboratory test values and other clinical data from laboratories to hospitals, physician practices, payers, and others for use in clinical management of patients. The Regenstrief Institute also pioneered many aspects of the Health Level 7 (HL7) coding language. HIT developers and healthcare providers worldwide use LOINC® and HL7 as core standards and coding tools.
- ◆ **Indianapolis Network for Patient Care (INPC)** Regenstrief has partnered with the five large Indianapolis-based hospital systems, including 11 affiliated hospitals, to implement the INPC. Emergency Department (ED) physicians at any of these hospitals can see immediately upon patient presentation a comprehensive care history for all patients presenting in the ED.

Philanthropic, Educational, and Government Support

Indiana philanthropic, educational, government, and not-for-profit organizations also play a key role in the development of Indiana's HIT infrastructure.

Philanthropy

- ◆ The Richard M. Fairbanks Foundation, Inc.'s key priority is the improvement of health, and has given grants to support the formation of the Indiana University School of Public Health on the Indiana University Purdue University campus in Indianapolis and, together with the Guidant Foundation, the creation of the Fairbanks Institute for Healthy Communities. The Fairbanks Institute utilizes Regenstrief's INPC system to support its INbank™ repository and related clinical data.
- ◆ The Lilly Endowment, Inc. has made numerous grants to support the life sciences in Indiana, and recently supported the formation of the Center for Law, Ethics and Applied Research in Health Information (CLEAR Health Information), which will leverage the resources of Indiana University and the State of Indiana in health sciences, information technology, law, ethics and other disciplines. The center will also partner with industry and non-profit groups in Indiana and elsewhere to advance the quality, efficiency and affordability of healthcare.

Supporting Organizations

- ◆ BioCrossroads, which is funded by local corporations, universities and philanthropic sources, is closely involved with HIT initiatives. BioCrossroads spearheaded the development of IHIE, has a seed fund specifically for investments in HIT, and established Exhib**hit** Indiana, an initiative to advance and promote Indiana's comprehensive strengths and leadership in health information technology.

Higher Education

- ◆ Several Indiana colleges, universities, and educational organizations, including the Indiana Health Information Training Collaborative, Ivy Tech Community College, and EmployIndy (formerly the Indianapolis Private Industry Council), work closely with the healthcare delivery and HIT sectors to ensure that Indiana has the necessary skilled workforce to enable the HIT sector to grow and demonstrate leadership. Talent is also readily available to the HIT community from the many Purdue University, Indiana University and Rose-Hulman Institute of Technology software engineers who graduate each year.

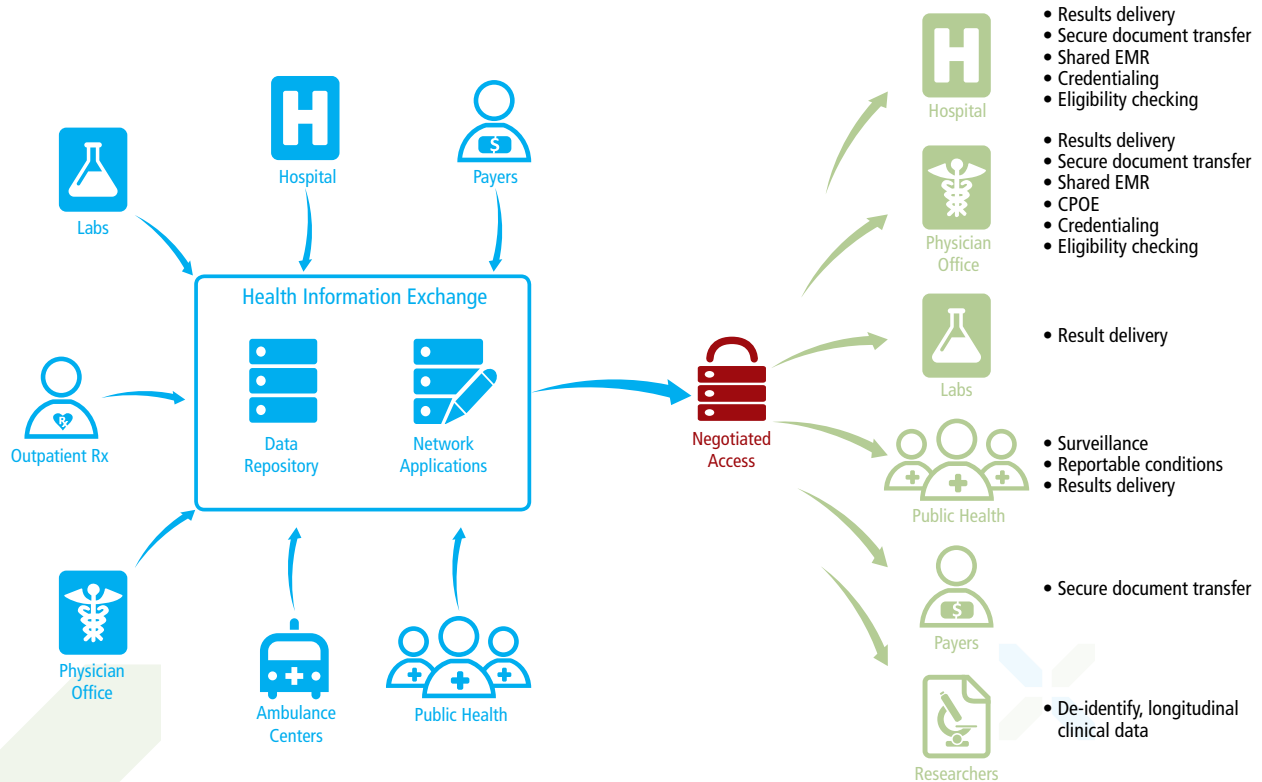
Government

- ◆ The Indiana Economic Development Corporation (IEDC) is led by Indiana Secretary of Commerce and IEDC Chief Executive Officer E. Mitchell Roob, Jr. and is charged with growing and retaining businesses in Indiana and attracting new business to the state. Mr. Roob was also appointed by Governor Mitch Daniels as the Indiana Health Information Technology, Inc. (IHIT) Board Chairman to reinforce the importance of the HIT sector to the state from an economic development perspective.
- ◆ IHIT was founded as a not-for-profit corporation in 2009 as the State Designated Entity for expanding health information exchange in the state. Leveraging the state's existing HIT infrastructure, technical expertise and relevant experience in this sector, IHIT submitted Indiana's grant application for the State Health Information Exchange Cooperative Agreement Program and received a grant of \$10.3 million from the Office of the National Coordinator for Health Information Technology (ONC) in 2010. Supported by a wide range of HIT stakeholders in Indiana, Statewide Health IT Coordinator Andrew VanZee and his staff developed a Strategic and Operational Plan for this grant and it was approved in early 2011.

Economic Impact

A recent analysis by IBM predicts a total market for HIT products and services growing annually at a rate of nearly 6%, and reaching \$42 billion by 2014, "a growth rate that is among the fastest in any industry." (Bloomberg, January 7, 2011). As a result of its early development of regional health information networks, Indiana is poised to claim a substantial share of this new market with an early but significant growth of HIT-related businesses across the state. Still in its formative years, Indiana's HIT business sector is already making a difference in the delivery of healthcare and generating productive economic opportunity for a variety of service providers along the healthcare continuum.

HIT's Economic Impact Goes Far Beyond the Patient



Establishments, Employment, Wages, and Sales

Table 1

HIT Employment in Indiana - Q1 2010

Source: IBRC using InfoGroup Data and Internal Analyses

| Quarter | Employment | Establishments | Wages |
|---------|------------|----------------|--------------|
| Q1 2010 | 2,472 | 72 | \$41,539,774 |

Total employment in the HIT sector of the Indiana life sciences industry reached nearly 2,500 in 72 establishments in the first quarter of 2010, according to IBRC estimates using InfoGroup InfoUSA data and internal analyses. Wages earned by these employees were over \$41.5 million in Q1 2010 (Table 1), resulting in an annualized wage level of over \$66,000 per employee.

Figure A

HIT Cohort Establishments, 1998 to 2008

Source: IBRC, NETS Database

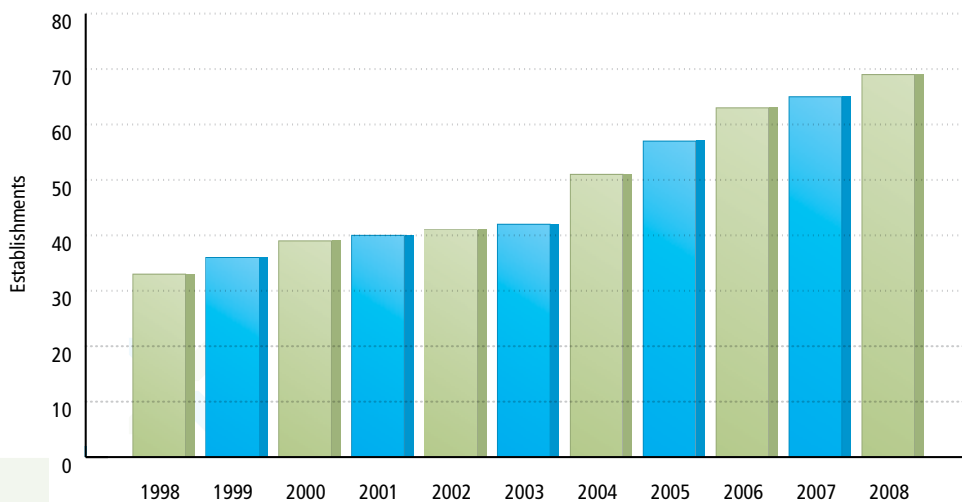
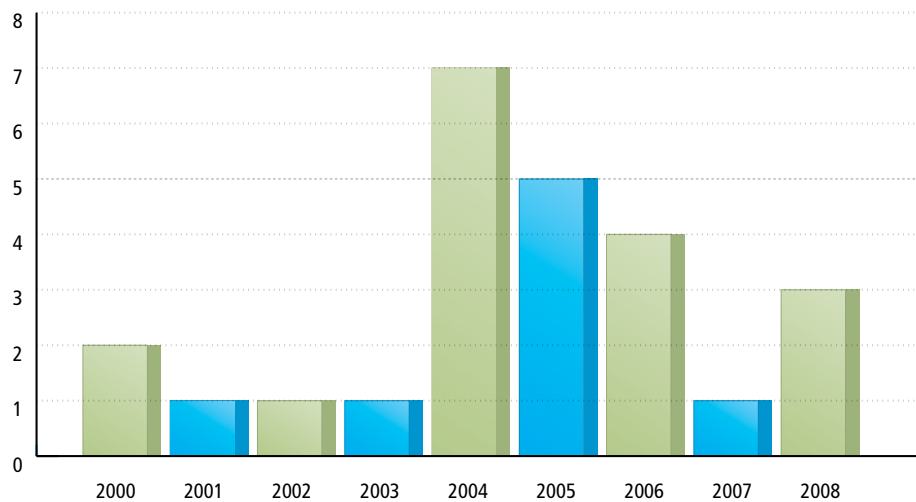


Figure B

Number of HIT Company Formations by Year, 2000 to 2008

Source: IBRC, NETS Database



In 2008, there were more than double the number of HIT firms (69) than in 1998, with the most significant amount of growth occurring since 2003 (Figure A - HIT Cohort Establishments, 1998-2008). The rate of growth of HIT establishments over the last five years (61%) is double the growth rate from 1998 to 2003 (30%). The analysis by year shows the greatest amount of new business formation occurred in 2004 to 2006 with a range of four to seven new companies forming each year, and another increase in 2008 (Figure B - Number of HIT Company Formations by Year, 2000 to 2008). Indiana entrepreneurs have formed HIT businesses and other enterprises have entered the state in response to the healthcare delivery industry needs to improve overall healthcare quality, reduce costs by improving efficiency, and convert paper-based healthcare systems to electronic systems.

Table 2

HIT Cohort Data, 1998 to 2008

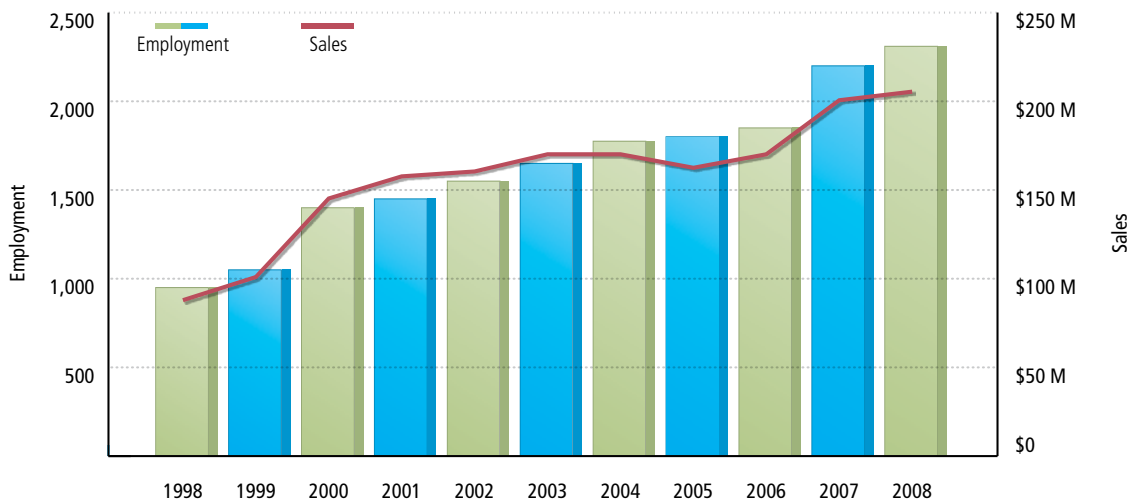
Source: IBRC using data from NETS, InfoUSA and Internal Analysis

| Year | Employment | Establishments | Sales |
|--------------------|------------|----------------|---------------|
| 1998 | 969 | 33 | \$89,948,784 |
| 1999 | 1,062 | 36 | \$102,030,363 |
| 2000 | 1,393 | 39 | \$142,589,401 |
| 2001 | 1,448 | 40 | \$157,394,690 |
| 2002 | 1,580 | 41 | \$161,041,498 |
| 2003 | 1,690 | 43 | \$172,307,545 |
| 2004 | 1,793 | 51 | \$173,139,475 |
| 2005 | 1,834 | 58 | \$166,420,668 |
| 2006 | 1,876 | 63 | \$173,815,802 |
| 2007 | 2,180 | 65 | \$197,935,193 |
| 2008 | 2,316 | 69 | \$201,974,696 |
| Avg. Annual Growth | 8.7% | 7.3% | 8.1% |

Figure C

HIT Cohort Employment and Sales, 1998 to 2008

Source: IBRC, NETS Database

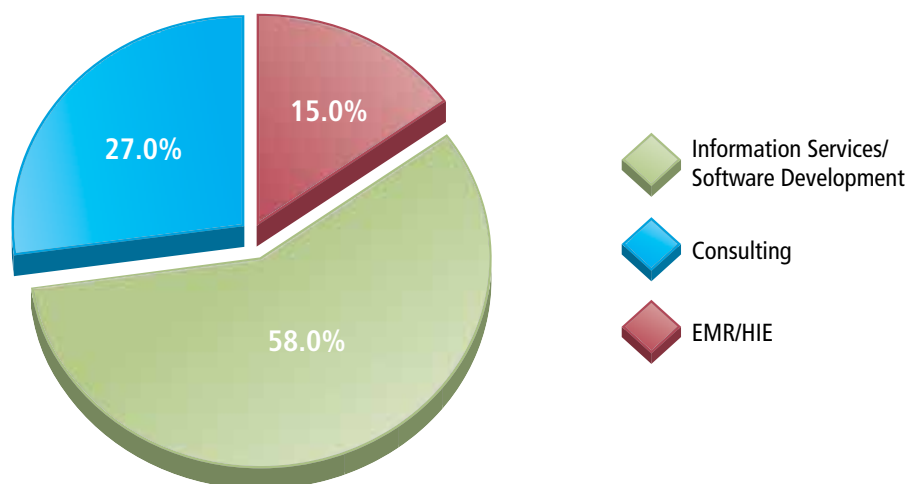


These driving forces also moved the new companies and existing HIT firms to expand their workforce as HIT employment increased in Indiana by an average annual rate of 8.7% over the 10 years to 2,316 positions in 2008. (Table 2 – HIT Cohort Data, 1998 to 2008). Employment grew at a faster rate in 2007 and 2008 than in the previous years, suggesting that the economic downturn did not have as large an effect on the HIT sector as it did on overall economic activity in Indiana or nationally. A comparison of HIT employment and sales in Indiana for this time period also shows that the increase in employment was accompanied with a corresponding increase in sales. Revenues from the HIT cohort of companies totaled \$202 million in 2008 (a year that had significant economic challenges for most industries), an increase of 125% over sales of \$90 million in 1998 (Figure C - HIT Cohort Employment and Sales, 1998 to 2008). This more than doubling of sales came at a time when a significant number of new electronic medical record, health information exchange, software development, HIT information services, and consulting businesses were established.

Figure D

Indiana HIT Cohort Employment 2008

Source: IBRC, NETS Database

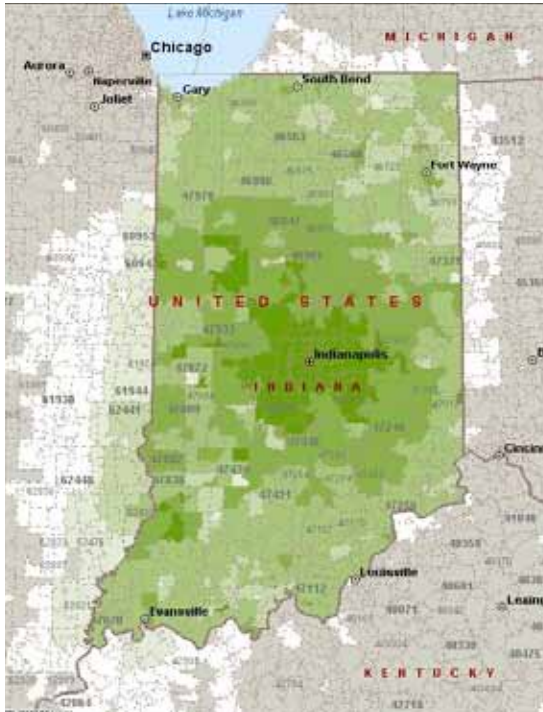


In 2008, the largest segment of HIT employment was Information Services/Software Development with 1,342 positions (58%), followed by Consulting with 633 (27%), and EMR/HIE with 341 positions (15%) (Figure D - Indiana HIT Cohort Employment 2008). Examples of firms in these segments include:

Electronic Medical Record/Health Information Exchange Segment

Firms in this segment develop sophisticated electronic medical record and health information exchange systems and install and/or operate these systems for the full range of healthcare delivery organizations in Indiana and throughout the nation. The systems employ both client server and software as a service (SaaS) cloud computing technologies. These companies concentrate on providing the capability for healthcare providers to manage patient-centric data. Indiana companies include GEMMS, Inc., Indiana Health Information Exchange/Regenstrief Institute, iSALUS Healthcare, Medical Informatics Engineering and NoMoreClipboard.com.

Penetration of Patient Population in IHIE's Network



The Indiana Health Information Exchange network's territory spans the state, covering a large number of hospitals and native software and consulting firms.

Information Services/Software Development Segment

Companies in this segment provide a wide range of technologies and services to healthcare delivery organizations across the United States and internationally. These technologies include developing and commercializing laboratory information systems and providing information services to help healthcare providers improve quality, institutional performance, and economic efficiency. Indiana companies include Clinical Architecture, Orchard Software and Press Ganey.

HIT Consulting Segment

Firms in the consulting segment provide installation and operational advice and support to healthcare delivery organizations on the expanding range of patient-centric and operational HIT systems now being offered. Indiana companies include maxIT Healthcare and Strategies for Tomorrow.

Tax Base and External Investment

Table 3

Indiana HIT Payroll and Sales Tax
Source: Indiana Department of Revenue and IBRC

| Year | Payroll Tax | Sales Tax |
|------|-------------|-----------|
| 2006 | \$4,430,369 | \$506,514 |
| 2007 | \$5,441,329 | \$472,521 |
| 2008 | \$7,958,417 | \$737,039 |
| 2009 | \$6,587,344 | \$782,824 |
| 2010 | \$6,776,487 | \$635,113 |

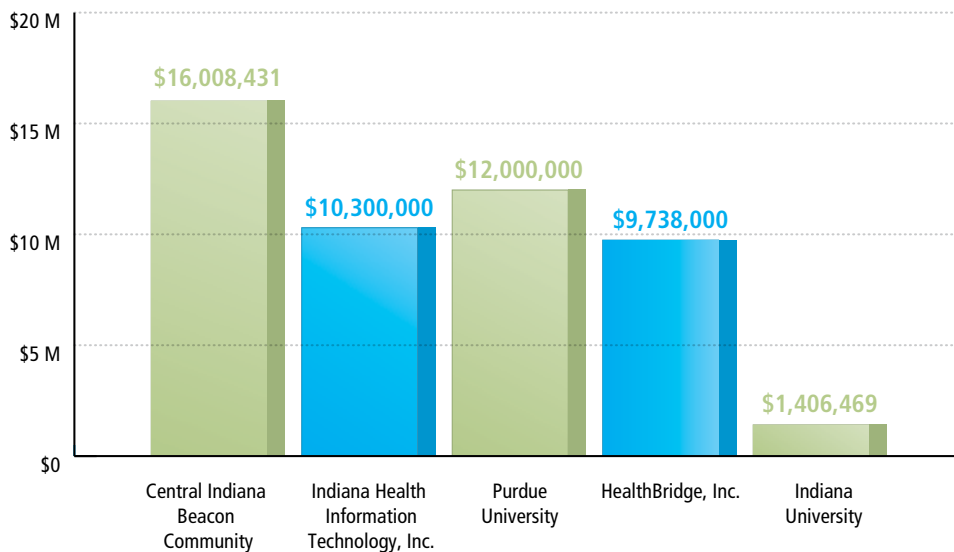
An evaluation of tax base measures and external investment in Indiana HIT companies gives a measure of the sector's strength. Payroll taxes withheld by HIT companies in the state for employees show overall growth over the last four years (Table 3 - Indiana HIT Payroll and Sales Tax). Taxes withheld in 2010 were 53% higher than withholding in 2006. Although taxes withheld in 2010 were down 15% from the peak in 2008, the withholding started to grow again between 2009 and 2010. While this suggests some decrease in employment caused by the recession, the withholding amounts suggest that job growth started to bounce back in the latest year.

Sales taxes paid by Indiana HIT companies also show growth over the last five years, increasing 25% in the four years between 2006 and 2010. This pattern suggests that the existing and new Indiana HIT companies were spending to expand operations. Sales tax receipts declined 19% in 2010, likely reflective of economizing due to the recession. Overall, the combined Indiana tax base, as defined by these two measures, shows a rebounding HIT sector. Further strengthening in withholding tax and sales tax receipts is likely to happen as the economy improves.

Figure E

Indiana Programs Receiving HHS Federal Funds for HIT

Source: IBRC and ONC

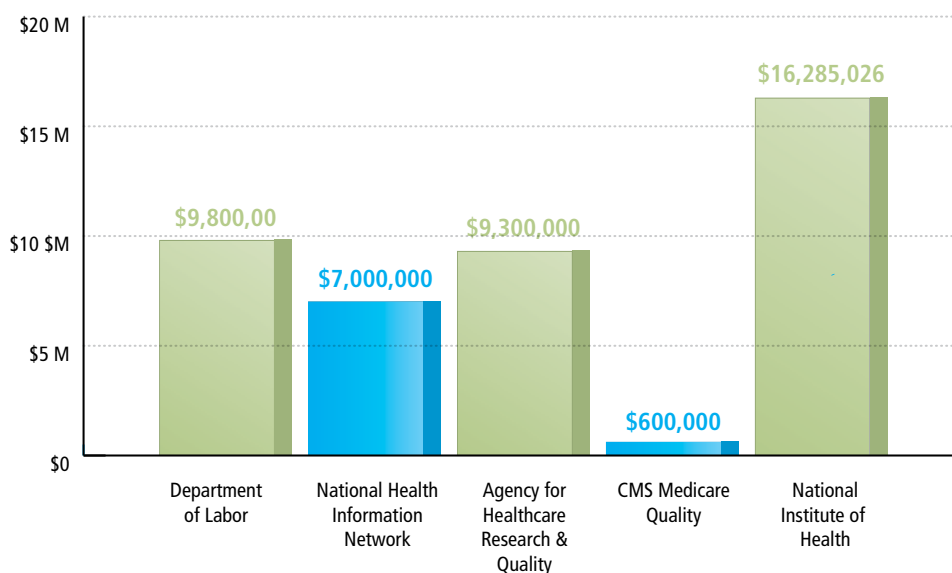


In 2011, several large U.S. Health and Human Services (HHS) federal grant programs will be implemented. In combination with grant investments from five other federal government agencies and national organizations, these funding measures demonstrate the advanced capabilities and related high expectations of Indiana's HIT sector. Federal HHS funding from the Health Information Technology for Economic and Clinical Health (HITECH) Act grants awarded in 2010 (totaling over \$50 million) is now starting to be distributed to sub-awardees (Figure E - Indiana Programs Receiving HHS Federal Funds for HIT), and the Centers for Medicare and Medicaid Services (CMS) Electronic Health Record (EHR) Meaningful Use program will also begin distributing millions of dollars of incentive payments in 2011 to Indiana hospitals and physician practices.

Figure F

Other Recent Federal Grants to Indiana HIT Sector

Source: BioCrossroads



Indiana's highly collaborative public/private HIT infrastructure is heavily engaged in building HIT capabilities and accessing resources. The federal government has recognized this capability and has invested HITECH and other grant program resources in the state to showcase and leverage our leading strengths. The following section summarizes the grants that Indiana stakeholders have received in the past three years:

State Health Information Exchange Cooperative Agreement Program (SHIECAP) (\$10.3 million) Grant to the State of Indiana through a new state-chartered non-profit entity, Indiana Health Information Technology, Inc. and its current network of five health information organizations, including IHIE, to further enhance the quality and reach of the state's health information exchange capabilities.

Central Indiana Beacon Community (\$16 million) One of 17 highly competitive awards nationwide of grant funding from ONC to implement programs to enhance information connectivity, reduce unnecessary tests and hospital visits, and improve preventive care for such chronic conditions as diabetes and coronary artery disease through the meaningful and secure use of electronically communicated and privacy protected patient information.

Indiana Healthcare Information Technology Extension Center (\$12 million)

The Indiana Healthcare Information Technology Extension Center (I-HITEC) at Purdue University has the mission to advance the adoption and meaningful use of EHRs among Indiana providers, with an emphasis upon serving primary care providers in small-group practices or practices that treat rural, uninsured, underinsured, underserved, or other at-risk populations.

Ivy Tech Community College (\$5 million) U.S. Department of Labor's "Health Care Sector and Other High Growth Emerging Industries" grant, will train 1,200 individuals in several industries, including IT and HIT, advanced manufacturing, transportation, and distribution and logistics.

EmployIndy (formerly Indianapolis Private Industry Council) EmployIndy received two DOL training grants in 2010 that apply to HIT: PriorITize and the Health Care Careers Initiative.

PriorITize (\$2.9 million) Initiative will provide 300 unemployed and underemployed citizens the training they need for career positions in Information Technology, Healthcare IT, and Security Systems Technicians.

Health Care Careers Initiative (\$4.9 million) Initiative will provide training at no cost to approximately 1,100 individuals, approximately 600 of which will enter healthcare-related training, including HIT positions.

Indiana University (\$1.4 million) The Indiana Health Information Technology Training Collaborative (I-HITTC) will be a resource for improving local training for health informatics, public health and research in Indiana by addressing the workforce needs of qualified health IT workers over the next several years.

Office of National Coordinator for Health Information Technology (ONC) Challenge Grants (\$3 million) A \$1.25 million ONC grant to NoMoreClipboard.com will help develop data exchange standards that will be piloted by healthcare providers in both urban and rural areas throughout Indiana. In addition, ONC granted \$1.7 million to IHIT to support the goals of improving the quality and efficiency of care as well as population health.

This significant and ongoing public investment in Indiana health information technology infrastructure and programs will generate growth in HIT economic activity as companies in the state work to create new products and services.

Moving Forward

Powerful forces are at work in America today, moving healthcare delivery organizations closer to a future where interoperable healthcare systems securely deliver customized patient health history information in real time to physicians as they treat patients in every healthcare setting. Health information technology will be used to communicate treatment guidelines to physicians and care reminders to patients so that all can benefit from the practice of evidence-based medicine. Patients will have electronic copies of their medical records and will understand better the care they receive from doctors, hospitals, pharmacies, and other healthcare delivery organizations. Academic researchers, health plans, and public health departments will have access to full disease population databases for studies to identify the highest quality treatment plans and the practices that deliver the best patient outcomes. In addition, they will be able to monitor for drug adverse events and public health and safety. All this will be done using HIT infrastructure that enables a reduction in medical errors, eliminates the duplication of unnecessary tests and treatments, and reduces costs across the U.S. healthcare system. And Indiana is at the forefront, implementing many of the pieces of this national vision.

BioCrossroads believes that these forces will grow stronger and drive healthcare organizations to adopt and continuously upgrade HIT in the pursuit and delivery of a modern electronically interoperable healthcare system. For at least the next five years, and probably far longer, healthcare delivery organizations will increase spending on HIT systems that capture and use patient-centric data, and on other HIT systems and services, as these organizations themselves undergo a period of rapid change, consolidation and growth. These developments will create an economic opportunity for companies currently operating in the HIT sector, and for a range of new and existing companies entering a new and highly promising field. Indiana's HIT sector is growing rapidly and sparking economic growth. Leveraging its HIT assets, expanding collaborations between existing and new stakeholders and setting ambitious goals for the effective use of clinical information will enable Indiana to meet the ongoing challenge of improving health outcomes for patients through the utilization of information technology. For Indiana, and potentially, for many regions across the United States, such success in the electronic delivery of better patient care should also lead to success in realizing a whole new set of economic opportunities in the 21st century.

APPENDIX: Indiana's Health Information Technology Infrastructure

Electronic Medical Record Systems

The Regenstrief Institute and RMRS The Regenstrief Institute developed the hospital-based Regenstrief Medical Record System (RMRS) over 35 years ago and has been conducting research and development activities to improve the system ever since. RMRS is the EMR system running at all the Indiana University Health system hospitals (IU Health Methodist Hospital, IU Health University Hospital, and Riley Hospital for Children at IU Health), Wishard Hospital, and all Wishard Community Clinics.

Additionally, in 1994 Regenstrief expanded RMRS to cover all the major hospital systems in Indianapolis, creating the Indiana Network for Patient Care. These systems either now run RMRS or have implemented interface tools to enable interoperable electronic communication. Indianapolis is served by five major hospital systems - Community Hospitals Indianapolis, St. Vincent Hospitals and Health Services, St. Francis Hospital and Health Centers, Indiana University Health (formerly Clarian Health), and Wishard Health Services. These five INPC hospital systems operate a total of 11 different hospital facilities and more than 100 geographically distributed clinics and day surgery facilities. Collectively these systems admit 165,878 patients, and serve more than 390,000 emergency room visits and 2.7 million clinic visits per year.

All INPC participants now deliver registration records, all laboratory tests, and all UB92 records (diagnosis, length of stay, and procedure codes) for hospital admissions and emergency room visits to separate electronic medical record vaults in a central INPC server located at Wishard Hospital. The computer system standardizes all clinical data as it arrives at the INPC vault, laboratory test results are mapped to a set of common test codes (LOINC) with standard units of measure, and patients with multiple medical record numbers are linked. Each institution has the same file structure and shares the same term dictionary which contains the codes, names (and other attributes) for tests, drugs, coded answers, etc. When a patient is seen in any of the 11 emergency rooms operated by the consortium hospitals, and the patient consents, the information from all of these institutions about that patient can be presented as one virtual medical record.

This Indianapolis-focused EMR extension integrates clinical information into a common platform of repositories and can deliver a full patient history to the emergency department of any of the participating institutions. The common platform also gives Regenstrief a powerful database with which to conduct additional research and develop improvements to RMRS. For example, "over 32 million physician orders have been entered into the computerized provider order entry system of the RMRS that provides unique clinical decision support and guidelines. RMRS has a database of 6 million patients, with 900 million on-line coded results, 20 million full reports including diagnostic studies, procedure results, operative notes and discharge summaries, and 65 million radiology images."

The participating hospital systems in the INPC that use RMRS have been leaders leveraging HIT to improve patient care quality and outcomes for many years. And Regenstrief is committed to continue the decades-long refinement process through academic research and development. This formula for success with hospital EMR systems serves as a model for other healthcare organizations and EMR vendors, and has also established a platform for electronic health information exchange.

Medical Informatics Engineering Fort Wayne-based Medical Informatics Engineering (MIE) has been a pioneer in ambulatory electronic health record systems since its founding in 1995. In 1998, MIE introduced WebChart EHR, a browser-based, interoperable, flexible, scalable electronic medical record (EMR) system. WebChart allows practices to house scanned medical records and integrate transcription, faxes, digital radiography, dictated audio, and photographic and coded data. MIE has been a national innovator in applying application service provider and SaaS cloud-based technology to EHR systems. It also pioneered health information exchange in Northeast Indiana, and benefits from this experience in seamlessly integrating information from different systems into its EHR products.

iSALUS Healthcare Indianapolis-based iSALUS Healthcare was selected by the Indiana Healthcare Information Technology Extension Center (I-HITEC) at Purdue University as one of three preferred EMR vendors as it supports Indiana primary care physicians' adoption of EMR systems. iSALUS met the I-HITEC criteria of having three or more years of SaaS and ASP EMR experience, 300+ accounts, and integrated practice management functionality in a web-based system.

GEMMS, Inc. Indianapolis-based GEMMS introduced its GEMMS ONE cardiology specialty integrated EHR and practice management system solution in 1997, and remains one of the top specialty-focused EHR systems. GEMMS ONE incorporates patient flow management, a clinical dashboard and medical record page, clinical document repository, ePrescribing, PQRI quality reporting, and claims processing functionality in this comprehensive server-based system.

KeyMedical Software, Inc. KeyMedical Software, located in Lebanon, Indiana has been producing its EMR and practice management solutions since 2002, and its management team has been in the practice management and EMR business since 1983. It offers both server and SaaS based specialized ophthalmology EMR and practice management solutions, including the KeyChart® EMR system, the KeyMed® practice management system, the KeyOptical® billing, ordering, and inventory management solution, and the KeyScribe™ ePrescribing module. KeyChart® has CCHIT certification.

Exporior Healthcare Systems Exporior Healthcare Systems, based in Ft. Wayne, has been a leader in developing and commercializing server-based practice management and ambulatory surgery center systems. Their SurgeON™ modular system provides a comprehensive range of solutions, including scheduling, case costing, materials management, patient accounting, and eight other functions. Their ExpertPM™ practice management system is divided into account management, financial management, and paper chart management systems. Both platforms can be interfaced with EMR systems from other vendors.

Personal Health Records

The personal health record (PHR) is at the nexus of three driving forces affecting the development and use of information technology in healthcare delivery. First, consumers as a whole are continuing to become more sophisticated in using information technology in all aspects of their lives. Their use of the mobile smartphone for information gathering, shopping, banking, and other daily functions has accelerated their control over and use of information. Second, momentum is increasing for the healthcare delivery system to adopt HIT to collect, analyze, and use patient health information to improve treatment outcomes. This progress is being accelerated by the third force – the federal government's EHR meaningful use reimbursement programs. In particular, the core requirement that physicians and hospitals must provide patients an electronic copy of their health information, upon request, will make the existence of this electronic information obvious to the patient, and desirable to have.

NoMoreClipboard.com has built a pioneering and well respected personal health record based on this concept. NoMoreClipboard.com is recognized as one of the top personal health records on the market, based largely on its ability to help consumers compile, manage and share personal health information with physicians and other care providers. NoMoreClipboard.com is able to deliver PHR data directly from the application in a format that integrates with existing provider workflow. PHR data can be delivered electronically using secure, interoperable data standards, or on the specific paper registration forms used by each individual provider. NoMoreClipboard.com also has a secure messaging function that allows two-way communication with the physician. Physicians can use this feature to securely and electronically communicate health information to patients, thereby meeting this meaningful use core requirement. Finally, the NoMoreClipboard.com PHR is also integrated with the Google Health platform and has connectivity with the Microsoft HealthVault, enabling both systems to communicate patient health information to healthcare providers.

Health Information Exchange (HIE)

The driving forces for adoption of HIT will affect the need for establishing interoperable health information exchange across the United States. HIE provides the capability to assemble a full longitudinal patient record for each patient regardless of which provider or healthcare delivery system cares for the patient. Armed with this full health history, physicians and other caregivers can improve treatment decisions and avoid medical errors and costly duplicative tests. HIE also delivers the capability to aggregate patient treatment and outcomes information into disease and co-morbidity based populations, and to study in real time each full population to determine the most effective treatment path and to monitor for adverse events and public health issues and trends. Physician societies, academic medical systems, health plans and government entities can use these aggregated data to adopt better treatment guidelines, design population health interventions, and create public health improvement programs, all with the goal of improving treatment quality and outcomes for patients.

Indiana is a leader in establishing and operating effective sustainable HIE systems. While most states are in the planning or early implementation stages for their HIE programs, Indiana has developed one of the strongest and most robust health information (exchange) sectors in the United States. Extensive research, conducted by Regenstrief and other leading research university programs, and early research and development leadership from five private sector Health Information Organizations (HIO): HealthBridge, HealthLINC, Indiana Health Information Exchange, Med-Web, and Michiana Health Information Network (MHIN), have led to the establishment of successful health information exchanges that have emerged as nationally recognized models. Indiana's exchanges have been built to provide services that create value for a defined group of Indiana healthcare providers that are willing to provide financial compensation. As a result, the five Indiana HIOs, while diverse in many aspects of their organizational structures, focus, and operations, all offer defined services to Indiana's healthcare community that provide long-term sustainability and growth for the HIOs individually and the state collectively.

Through these five exchanges: (1) more than 6.3 million clinical messages are exchanged every month; (2) more than 15,000 physicians statewide are part of Indiana's HIE networks; and (3) more than 12 million patient records are part of Indiana's HIE networks. Due to this innovative approach, Indiana is the only state in the nation with multiple organizations awarded a Nationwide Health Information Network State/Regional contract, a Nationwide Health Information Network trial implementation contract, a Medicaid Transformation Grant, an HIE Bio-surveillance contract from the Centers for Disease Control, two Regional HIT Extension Center grants, a Beacon Community Cooperative Agreement Program grant, a competitive award for the training of an HIT skilled workforce, and a grant to train nurses and allied health professionals in HIT, in addition to the State HIE Cooperative Agreement Program grant.

This HIE leadership has been established by the five HIOs operating in the state. Each HIO has unique programs and strengths that, when combined, facilitate a very robust HIE system. Additionally, the leadership of IHIT will use the grant resources of the State HIE Cooperative Agreement Program to expand services to every corner of the state and establish full interoperability to enable healthcare providers to meet Stage 2 and 3 Meaningful Use requirements.

Indiana Health Information Organizations

HealthBridge has offered operational health information exchange since 1998. Its mission is to build a collaborative network of organizations and technology to improve the quality and efficiency of healthcare delivery. With 33 full-time employees, HealthBridge serves a primary service area in the Greater Cincinnati tri-state area that includes four Indiana counties. HealthBridge has more than 10,000 physicians in its provider directory and 2.5 million patient records in a population area of 2.2 million people. HealthBridge serves approximately 5,500 physicians in the tri-state area, of which 250-300 physicians (with an estimated 80,000 patients) practice in Southeast Indiana and the surrounding counties. HealthBridge also serves as a consultant and collaborative partner to many other HIEs around the country, including HealthLINC in a multi-county area centered in Bloomington, Indiana, and operates the Tri-State HIT Regional Extension Center (REC) serving 19 counties in Indiana, 37 counties in Kentucky, and 11 Ohio counties. HealthBridge is the nation's leader in sustainability, with less than 3% of its operating revenues over 10 years coming from grants or charitable sources. For the last five years, HealthBridge has recorded revenue exceeding expenses while growing its operations and service area significantly and making key investments and upgrades in its technology infrastructure. HealthBridge's accomplishments include:

- ◆ Achieving an 85% subscription rate among physicians and hospitals participating in HIE in the tri-state region;
- ◆ Offering a broad range of services, including clinical messaging and electronic results delivery, community EHR interface library for results delivery, ambulatory order entry, electronic disease reporting and public health alerts, and web-based eligibility and claims status checking. In limited production are pilots for e-Prescribing, disease registries, and quality reporting and improvement tools;
- ◆ Planning several service expansions, such as immunization information, summary record exchange, and personal health record integration/patient communication tools;
- ◆ At this time, HealthLINC, HealthBridge and IHIE have interoperability among their respective exchanges.

HealthLINC is a four-year old, community-based organization that has offered operational health information exchange to healthcare stakeholders in Lawrence, Monroe, Orange and Owen counties. Headquartered in Bloomington with four full-time employees, HealthLINC has more than 200 South Central Indiana physicians actively using the system; 175,000 patient records in a population area of 367,000 people; and 130,000 exchange results per month. HealthLINC has developed expertise in running a self-governed HIE that benefits from outsourced technology infrastructure and selected business operations in a pre-franchise model. This model gained national attention when it received an award (with its partners HealthBridge and Clark and Champaign Counties (Ohio) Health Information Exchange) from the e-Health Initiative in 2008. This approach is beginning to demonstrate that semi-rural communities can operate and sustain a HIE based upon regionally generated revenue. HealthLINC has:

- ◆ Achieved a rapid level of adoption and growth in HIE services in South Central Indiana with more than 90% of physicians participating in HIE;
- ◆ Established a highly cost-effective and award winning Collaborative Communities Model which facilitates self-governance in the context of ASP hosting with HealthBridge;
- ◆ Offered clinical messaging and electronic results delivery, EMR interface results delivery, public health alerts, and e-Prescribing;
- ◆ Planned service expansions include immunization information, summary record exchange, and personal health record integration/patient communication tools, and quality reporting via partnerships.

Indiana Health Information Exchange (IHIE) is a tax-exempt, non-profit corporation founded in 2004 by a unique collaboration of 13 institutions representing Indiana hospitals, healthcare providers, researchers, public health organizations, and market development groups. IHIE is nationally recognized as the largest and most advanced HIE in the U.S. Now a 62-employee organization, IHIE is a leading provider of scalable health information exchange services with demonstrated and sustainable technologies and processes. IHIE's vision is to use information technology and shared clinical information to: (i) improve the quality, safety, and efficiency of healthcare; (ii) create unparalleled research capabilities for health researchers; and (iii) exhibit a successful model of health information exchange for the rest of the country.

In recognition of this success, the Office of the National Coordinator for HIT (ONC) awarded IHIE a \$16 million Beacon Community Cooperative Agreement Program grant to build and strengthen central Indiana's HIT infrastructure and exchange capabilities. Through this cooperative agreement program, IHIE will demonstrate the vision of a future where hospitals, clinicians, and patients are meaningful users of HIT, and together the community achieves measurable improvements in healthcare quality, safety, efficiency, and population health. IHIE's many programs include:

- ◆ DOCS4DOCS, a self-sustaining, community-wide clinical messaging service being used by over 15,000 physicians in Indiana within a network of 39 hospitals, delivering over five million messages per month. This provides a single source for clinical results including laboratory, radiology reports, transcriptions, pathology and admission, discharge and transfer information.
- ◆ The Indiana Network for Patient Care, the nation's largest inter-organizational clinical data repository, which currently is in use at over 130 sites in Indiana, storing data on over six million patients and utilized by approximately 15,000 active users. Each data source organization maintains control over its own data while IHIE and its technology partner, the Regenstrief Institute, manages and administrates the databases. (IHIE has expanded the INPC from its original base in Indianapolis to hospitals and physician practices statewide.)
- ◆ Quality Health First (QHF), which allows for robust reporting to providers on their patients, focusing on chronic disease management. QHF incorporates the use of claims information from participating payers with real-time clinical data. In addition, QHF provides reports to the payers on how well physicians are supplying quality care for all patients for whom they have responsibility. Payers in turn reimburse those physicians at higher levels based on their quality measures.

Michiana Health Information Network (MHIN) was formally established in 1999 with the mission to provide single source, secure access and delivery of medical information. Today MHIN has a team of 18 staff members that serve over 1,000 physicians and 400,000 patients across Northern Indiana and Southwestern Michigan with a variety of products and services which include, but are not limited to:

- ◆ MHIN CDR – A community data repository service which securely stores clinical information from all sources into one longitudinal patient record;
- ◆ MHIN Messenger – The community-wide, web-based clinical messaging and results communication platform for sending, receiving and managing clinical information (Powered by Axolotl);
- ◆ MHIN Interface – A single interface that delivers discrete digitized results from all participating institutions to any physician office or institutional EHR. The MHIN Interface engine is also used to connect disparate systems within physician practices;
- ◆ MHIN EHR – A fully integrated electronic health record that comes pre-populated with patient information and provides seamless electronic communication and clinical messaging with other healthcare providers (Powered by Cerner).

In addition, MHIN has significant technical resources in the areas of database administration, in particular Oracle and MS-SQL networking and technology planning. MHIN's management team has experience in building operations for large-scale capabilities to deliver service to the ambulatory environment, consolidated to support over 20,000 ambulatory sites. MHIN also offers product and market planning and business modeling. With nearly 10 years of historical results, the MHIN community data repository is deeply threaded into all aspects of care in the medical community and will continue to grow as MHIN continues to work with other HIOs in both Indiana and Michigan to facilitate the exchange of medical information across medical service areas.

The Med-Web created in 1995 by Medical Informatics Engineering (MIE), delivers approximately 1.5 million secure clinical messages each month, including more than 225,000 diagnostic reports and nearly 15,000 radiology studies. The Med-Web includes a directory of participating stakeholders, and intelligently delivers information in the format required by each provider. The success of this network led to MIE's development of a full portfolio of electronic health record products – including EMR, Document Management and RIS/PACS solutions. This “minimally invasive” EHR portfolio is used by physician practices and clinics, as well as Fortune 500 companies operating on-site employee clinics including Google and The Dow Chemical Company.

Educational Programs

Indiana's higher education institutions have established degree and certificate programs that support the state's growing HIT sector and the expanding paperless environment in provider settings. The Indiana University School of Informatics, Purdue University and Ivy Tech Community College, and several other universities have both certificate and degree programs specializing in HIT. IU's School of Informatics, for example, offers a Master's of Science degree in Health Informatics and a Nursing Informatics specialty program for students in the Nursing School's M.S. program. They also have an Informatics Doctoral program. In addition, several Indiana universities including Butler University, University of Notre Dame, Rose-Hulman Institute of Technology, among others, have degree programs in complementary fields such as computer science and software engineering.

From university students learning about HL7 standards to continuing education programs on HIT concepts designed for working nurses and physicians, Indiana employers and workers have educational and training opportunities that will enable them to prosper in this fast-changing sector.

Indiana Health Information Technology, Inc.

Indiana Health Information Technology, Inc. was founded as a not-for-profit corporation in 2009 when Indiana Governor Mitch Daniels designated it as the State Designated Entity for expanding health information exchange in the state. One of its first official actions was to submit Indiana's grant application for the State Health Information Exchange Cooperative Agreement Program. This program, authorized by the HITECH act and administered by ONC, provided \$457 million to states and territories to build and expand HIE services with coordinated nationally approved standards and specifications. In 2010, IHIT received approval of the application and a grant of \$10.3 million. The Governor named the IHIT Board members and the State's Family and Social Services Administration hired Andrew VanZee as the CEO of IHIT and the Statewide Health IT Director. Mr. VanZee and his staff, supported by a wide range of HIT stakeholders in Indiana, developed and submitted the Board-approved Strategic and Operational Plan for Health Information Exchange to ONC, and this plan was approved in early 2011 by David Blumenthal, then National Coordinator for Health Information Technology.

The comprehensive Strategic and Operational Plan describes the strategies, programs, and projects IHIT is implementing to achieve specific objectives and outcomes. A brief summary of these elements appears in this section.

IHIT Objectives and Outcomes

IHIT plays a significant and important role in establishing a collaborative approach to expanding HIE effectively in the state. Its goal is to work closely with the many established and new Indiana HIE stakeholders to achieve the following objectives and outcomes:

Objectives

- ◆ Develop an effective strategy for increasing HIE adoption in rural and underserved areas across the state, leading to statewide HIE coverage;
- ◆ Expand and develop additional health information exchange services necessary for achieving "meaningful use" of health information technology;

- ◆ Establish a governance structure that achieves broad-based stakeholder collaboration with transparency, buy-in and trust;
- ◆ Identify a path to continued sustainability by managing financial resources necessary to fund the State's HIE Strategic and Operational Plan;
- ◆ Expand the technical infrastructure capabilities that physically enable health information exchange in a secure and appropriate manner; and
- ◆ Facilitate the adoption of appropriate privacy and security frameworks for healthcare information on behalf of consumers, patients and providers.

Outcomes

This approach will generate three critical outcomes that will advance the quality of Indiana's healthcare delivery system:

- ◆ Expand HIE services to underserved areas;
- ◆ Demonstrate improvement in the continuity of care through statewide electronic access to patient healthcare information by various providers in the healthcare delivery system;
- ◆ Lower healthcare costs and improved patient safety through better care coordination, improved healthcare provider workflow efficiency, and the reduction of redundant clinical tests, paper-based administrative activity, and results reporting.

IHIT Programs and Projects

Connectivity Matching Grant Program will help to address the barrier that exists for access to HIE infrastructure in rural areas of Indiana. This project will incentivize eligible organizations to develop the interface infrastructure to link organizations to established Health Information Organizations with the goal of eliminating all the gaps in HIE coverage that currently exist in the state.

HIO to HIO Connectivity Project will build the statewide capability for each HIO operating in Indiana to build a longitudinal patient care summary containing the complete record of care given to the patient by any healthcare provider, using data from providers within that HIO's service domain, and from providers in every other HIO's domain. It will build on the established functional interoperability between IHIE, HealthBridge, and HealthLINC to avoid duplication of existing capabilities.

Data Mapping and Normalization Project will adopt, publish and maintain a preferred set of standards-based nomenclature in conjunction with the national standards for all health information exchange transactions.

Privacy and Security Policy Development Project will allow the IHIT Board and Councils to explore current policies, procedures, and practices of the HIOs and current state regulations and statues as they compare to federal privacy and security statues and the HHS HIT Privacy and Security Framework.

CHIRP Bi-direction HIO/EMR Interface Development Project. The Indiana State Department of Health (ISDH) Immunization Registry and CHIRP (Children and Hoosier's Immunization Registry Program) will partner with HIOs to implement bi-directional HL7 messaging between medical providers and CHIRP routed through the HIO to which the medical provider is connected. The HIO will serve as the preferred connection point for hospitals and providers to the immunization registry.

Web Communications Tool Project will establish important web-based, bi-directional communications tools to ensure that the value and benefits of health information exchange to Indiana stakeholders are clearly communicated, and that IHIT programs and projects receive timely stakeholder feedback.



