HiMSS
transforming health through IT

The Business Case for Interoperability and Health Information Exchange

Analysis and Recommendations

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Transformation in Business

Transformation in an industry occurs when existing methods and processes are maximally efficient, and emerging disruptive changes offer the prospect of new gains that accelerate efficiency and reduce costs, driving adoption of those changes. Transformation can also be driven by the evolving characteristics of an industry, such as changes in demand or public policies that facilitate adoption of new methods and processes required for viability.

In his study of industry transformation, Harvard Business School professor and leader in the research of innovation through transformation Clay Christensen[i] sees this process as both predictable and repeatable. Initial higher costs and lower performance are noted with innovators and early adopters, and optimization decreases cost and increases efficiency until a future disruption occurs to again move the industry forward.

Christensen provides significant data in his studies to support this pattern, including graphics which clearly reflect how performance and cost over time have been recognized and applied across many disciplines, industries, cultures and populations. **APPENDIX A** provides a discussion and figures illustrating the diffusion of new technologies and lessons learned from other industries.

Healthcare, now in a transformational state, is a business moving from an analog, disconnected system to a digitized, integrated system. This transformation is being driven by both technological innovation and evolving public policies in the shape of payment reform and direct subsidies of public monies under the Meaningful Use program.[ii] The early costs of this transformation are high due to the costly nature of the industry; however, as is recounted in all major industries, eventual improvements in performance and efficiency will follow from the ongoing investment in transformation.

Healthcare IT faces these challenges as well. IT standards are created and adopted to deliver information to the point of care for improved decision making by all stakeholders. Early adopters of the new standards for internally integrated/digitized healthcare delivery systems—such as large healthcare systems like Intermountain Healthcare, Geisinger and the Veterans Affairs Health System—have the ability to implement new technologies before smaller organizations that have more limited resources.

The challenges facing healthcare at the time of this writing, such as high initial investment and fixed costs to fund transformation, have been successfully addressed and overcome in other industries that, in the end, reached levels of economy and efficiency no one could have envisioned at the start.

Terms, Concepts and Definitions

Interoperability and Standards

The healthcare industry is moving from the initial sharing of analog information to the mature goal of semantic interoperability, or sharing of data and documents that retain their meaning as they are moved from one organization/system to the next. The HIMSS Interoperability and Standards Committee reviewed the many existing definitions of the term "**interoperability**" to establish the following baseline definition, which was adopted by HIMSS in April 2013:

> *Interoperability describes the extent to which systems and devices can exchange data, and interpret that shared data. For two systems to be interoperable, they must be able to exchange data and subsequently present that data such that it can be understood by a user.[iii]*

Standards exist in many industries to facilitate operations across organizations, vendors and customers. Examples such as HTML5, LTE and 801.11g facilitate use of tools and movement of data and information across the industry.[1] Emerging standards for healthcare include Consolidated Clinical Document Architecture (CCDA),[iv] HL7 messaging, and the new approach of Fast Health Interoperable Resources, or FHIR®.[v] (See **APPENDIX B** for detailed information on the various categories of data standards used in healthcare.)

Definitions of Health Information Exchange

Health Information Exchange (HIE) is generally recognized as having two definitions, one as a verb and the second as a noun. The verb "HIE" is the sharing action between two or more non-affiliated organizations with an executed business/legal arrangement that have deployed commonly agreed-upon technology with applied standards for the purpose of electronically exchanging health-related data between the organizations. Federal and state policies have been created to encourage the verb health information exchange, an approach supported under the State Cooperative Agreement Grants awarded by the Office of the National Coordinator for Health Information Technology, or ONC.[vi]

"HIE" in the noun form is a catch-all phrase for the **health information exchange organizations (HIOs)** providing data exchange under the legal arrangements described above. This includes private exchanges, state HIEs, regional health information organizations (RHIOs), quality information organizations (QIOs) and some accountable care organizations (ACOs).[2]

Concepts

For the last 20 years, the idea has been widely accepted that the exchange of patient information between healthcare organizations has intrinsic value. Beginning in the 1990s, the concept of community health information networks (CHINS) gained adoption in many parts of our country. These kinds of initiatives were unsuccessful, however, primarily due to the high cost of ownership, the lack of

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[1] HTML5: Hyptertext Mark-up Language. LTE: Long Term Evolution (related to mobile broadband). 802.11g = wireless specification.

[2] *See* HIE 101: HIE Organization Types *in the* HIMSS/NACCHO HIE Toolkit for Public Health *for further information on different HIOs:*
http://www.himss.org/ResourceLibrary/genResourceFAQ.aspx?ItemNumber=28880

incentives to get competing organizations to work together, and the creation of proprietary networks that excluded others.

When the American Recovery and Reinvestment Act (ARRA) was enacted in 2009, it contained a section of law named the Health Information Technology for Economic and Clinical Health (HITECH) Act[vii] that substantially addressed the primary reasons that healthcare information exchanges did not succeed in earlier attempts. The HITECH Act provides incentives for the meaningful use[viii] of health information technology, which includes the exchange of information among competing organizations as well as funding to encourage healthcare providers to implement systems and processes to accomplish the goal of exchanging health information securely and efficiently.

Within the business of healthcare, the immediate need is to establish an information highway that facilitates movement of information to all consumers of that information for the benefit of the stakeholders. The many stakeholders may include the patient and their caregiver; the provider team of physicians, nurses, technicians and office support personnel; the organization's administration; and anyone else involved in the care of the patient. Once the information is accessible within the system, the results can be dramatic. There are improvements in care delivery, increased patient safety, reduced costs, improved data quality, the ability to use data for predictive analytics, improved diagnostics and treatments, and effective use of the healthcare system.[ix] Interoperability and standards are the glue to fit these and more disparate efforts together.

The initial conception of a Clinical Document Architecture (CDA) or Continuity of Care Document (CCD)[3] predicted a data package that would allow patients and providers to have a care summary document as a starting point, rather than re-creating the information at each encounter—whether in the hospital system, at the emergency department, or when presenting for care in a new system. Building on this concept, specific implementation has changed over time through the process of describing the use case to development of an implementation guide and subsequently pilot testing the guides for practical use. This is the work of the ONC Standards and Interoperability Framework, which is depicted in the graphic on the following page.

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[3] *See* HL7 Standards – Section 1: Primary Standards *for additional information.* http://www.hl7.org/implement/standards/product_section.cfm?section=1
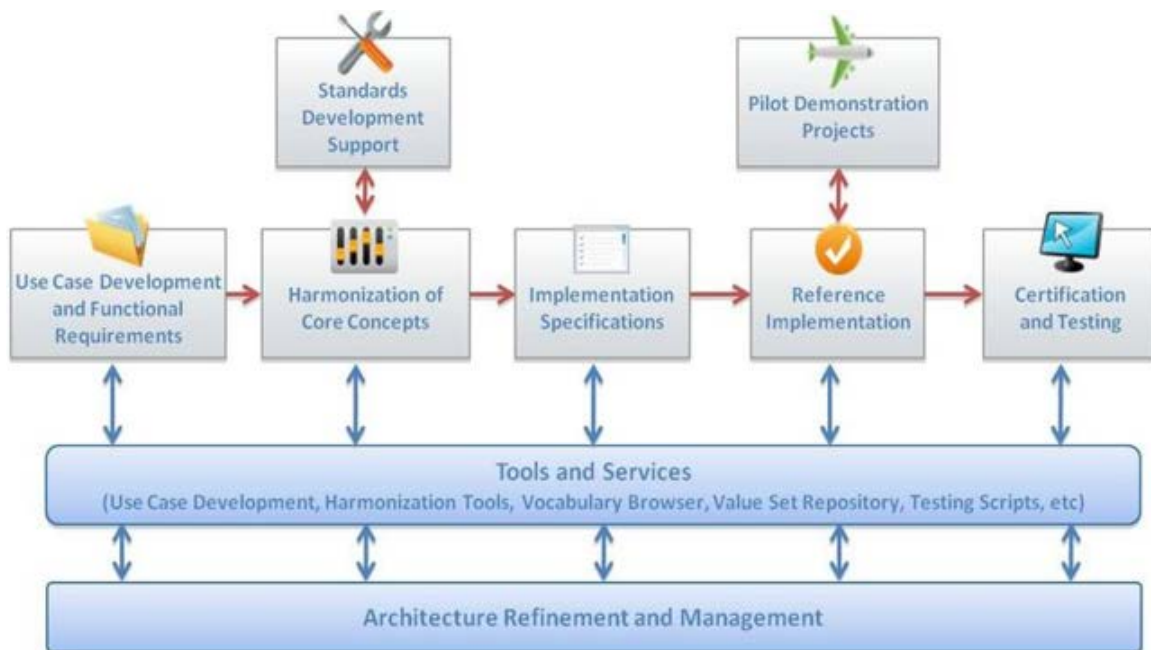
FIGURE 1 - ONC S&I FRAMEWORK FUNCTIONS[x]

Healthcare is a regional business, delivered locally and typically defined by a medical trade area. Each region has its own characteristics, including a history of competition and cooperation. Prior to the HITECH Act, HIE initiatives were attempted in many markets with very limited success. For example, HIE sustainability proved elusive for CHINs in the 1990s and regional initiatives during the decade before HITECH due to four primary problems:

1. The lack of agreed upon standards to support interoperability
2. Unwillingness to share data with competitive providers
3. An absence of value propositions associated with exchange under a fee-for-service system
4. Privacy and security concerns[xi]

HITECH

Prior to the HITECH Act and related payment reform initiatives, most HIOs failed because they could not justify a long-term sustainability model with a subscription fee or other revenue models.[4]

Through funding under HITECH, requirements under the Affordable Care Act (ACA), and the establishment of standards for exchange, the healthcare industry is addressing these problems. Within HITECH, funding was provided under Cooperative Agreement Grants to states to support HIE in their region, as well as to support interstate exchange. The funds were allocated based upon population within the state, and each state selected a State-Designated Entity (SDE) to manage the grant, the rationale being that state leadership is closer to the stakeholders and that the dynamics of regional markets could better allocate the funds than a federal approach. The mandate was to use the funds to maximize health information exchange, the verb, not necessarily to sustain HIE organizations.

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[4] *For additional information about sustainability and early HIE organizations, see* Early CHINs and HIE Organizations: Lessons for the Next Evolution. HIMSS. August 2013. http://www.himss.org/ResourceLibrary/GenResourceReg.aspx?ItemNumber=22067

Each state approached this funding opportunity with a different strategy. Some built state-wide networks using a public utility model. Others funded regional initiatives. The result is a fragmented and highly regional market structure for health information exchange. Funding under the Cooperative Agreement Program ended February 7, 2014, but as with other industries that have undergone such transformations, new entrants to the HIE industry will continue to bring both successes and failures as the industry evolves.

The Rise of Private Health Information Exchange Organizations

Private HIOs may be Integrated Delivery Networks (IDNs), ACOs or provider networks that are exchanging data with non-affiliates. As of October 2013, there were approximately 315 health data exchange initiatives across the nation, less than half of which would be considered community-based organizations.[xii] Evidence indicates that private HIOs are the faster growing segment, with 2 to 2.5 times as many private HIOs as public HIOs.[xiii] Once again, the characteristics of each region—including incumbent entities, first-mover advantage, and historical relationships—will define the nature of health information exchange. Payment reform and population-based reimbursement will require the active exchange of data, and will advance the viability of exchange within these evolving markets.

Known Challenges and Barriers to Adoption

Health IT standards have been an important component of the industry for many decades, focusing on areas such as transport, medical devices and images. Between 2009 and 2014, the healthcare industry, incentivized by the provisions of the HITECH Act, made significant strides to develop and implement key standards on the national roadmap toward improved interoperability and health information exchange with the Triple Aim in mind:

The IHI Triple Aim

1. Improving the patient experience of care (including quality and satisfaction);
2. Improving the health of populations; and
3. Reducing the per capita cost of healthcare[5]
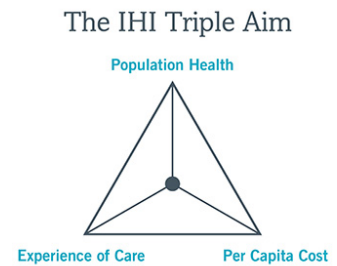
In 2004, President Bush's Executive Order 13335 declared that electronic medical records (EMR) should be available to every patient by 2014, and named Dr. David Brailer to be the first National Coordinator for Health Information Technology.[xiv] Several key initiatives were announced, including development of the Nationwide Health Information Network (NHIN), which was designed to accelerate that process. This national focus on advancing the use of electronic health record (EHR) technology and standards-based exchange by physicians and health systems resulted in increased participation across all healthcare sectors, including vendors, investors, providers and the standards community.

Since that time, there have been many resource-intense public-private collaborations focused on identifying, developing and implementing key standards to advance interoperability (see **APPENDIX C** for detailed information on this topic).

Despite all this activity and the significant progress that has been made, the healthcare industry remains worried about slow advancement toward the Holy Grail of "interoperability." Significant issues still must be addressed, such as:

- There are conflicting and competing standards that need to be resolved
- There is a lack of community consensus on best models for improved clinical workflow and payment reform
- Obtaining the funds to manage the high costs of developing, implementing, and getting widespread adoption of integrated patient-centered healthcare information has proven to be a nearly universal challenge

All of this creates an atmosphere where success remains elusive.

Providers today use multiple vendors and disparate products for their EHRs and registries. The emerging HIE marketplace is still fragile and contains no widely-accepted central models for exchange. The cost and complexity of interfacing remains high and is a significant hurdle for cash-strapped physician practices and hospitals.

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[5] *The Triple Aim was developed by the Institute for Healthcare Improvement (IHI) and adopted by the Centers for Medicare & Medicaid Services (CMS). Learn more on the IHI website:* http://www.ihi.org/engage/initiatives/TripleAim/Pages/default.aspx

Example: Meaningful Use Immunization Reporting Objectives

HIOs at the state and local level are working with physician offices, health systems, state public health departments and EHR/registry vendors to implement the basic connectivity required to support Meaningful Use public health reporting objectives for immunization, syndromic surveillance and state reportable laboratories. This seemingly simple integration and interfacing is surprisingly expensive and complex. Support for the standards varies across states and territories, within the vendor-product community, and within the HIOs themselves. One perfect example of this is immunization requirements and tracking.

Sending immunization information presents challenges for vendors because they need to address variations in content, transport and vocabulary across the 50 states. Immunizations may not be a high priority on the development lists of vendors, who are not used to paying anything to the states for transmission of immunization data. However, HIOs cannot remain in business if they are expected to provide free services, and must find a way to cover these costs.

As proposed under Meaningful Use Stage 3 voluntary standards for 2015, providers are required to receive immunization histories and forecasts from the state immunization registry for all of their patients.[xv] Providers do not like the current labor-intensive process of manually updating state immunization websites for their patients. On the other hand, providers generally have small profit margins and are not anxious to pay more for this connectivity. Moreover, many physician organizations have providers with several EHR and registry vendors. Costs multiply for each instance of connectivity and testing, leaving the "simple" goal of sending immunization reports time-consuming and expensive.

Additional barriers to sending immunizations may include:

- Lack of standardization across neighboring states for patients who live near a multi-state border
- Lack of support from vendors for development of software to eliminate manual entry of immunization data
- High connectivity costs
- Lack of clarity on the emerging structure and standards for histories, forecasts and other related activities
- Ability to access information for all patients within the practice versus one-at-a-time retrievals

Total Cost of Ownership

The first step in determining the benefits of health information exchange and interoperability requires examination of the costs of implementing functionality. As with most technology deployments, these costs fall into some fairly familiar categories. Most of these components will consist of an initial cost plus ongoing operating expenses.

> **Hardware**
> For most providers, the cost of hardware will be relatively minimal, since they will likely have working EHRs in place. If they do not, then an investment in servers, workstations, storage, printers and peripherals (such as navigational devices, wireless cards, speech recognition

microphone, documents views, card scanners, wireless access points and docking stations) will need to be taken into account.

Software
Again, assuming most providers would have a functioning EHR, the only potential cost would be in the form of the actual software, as well as any associated licensing costs for operating systems, interfaces or other third-party software. In the case of HIE organizations that exist as a public utility, software costs would primarily be for the interface to the HIE system itself.

Implementation and Ongoing Training
This is an area that does not often receive the proper amount of attention when considering costs, mostly due to the fact that some of these expenses are considered to be normal and customary operating expenses. For instance, the following considerations should be made when looking ahead to the costs that can be expected around HIE implementation:

- Vendor expenses will include their related implementation costs such as consulting, travel, training, support and other services.
- A third-party consultant is often required.
- Internal costs will likely include the need for a project manager as well as IT staff, depending on the type of implementation (Software as a Service, or SaaS, vs. internal) that has been chosen.
- There will likely be temporary costs for space, furnishings, scanning, data conversion and other needs. Some of these costs could be accounted for by a shift in the workforce, such as transferring obsolete roles to new or modified roles.
- The cost of incorporating patient opt-in / opt-out paperwork is also an important consideration, and can be both time-consuming and variable across states.
- The cost to maintain existing systems while staff is being trained on the new system is often just considered a normal part of an operating budget, and may or may not be included in the total cost of ownership.
- Decreased productivity may also be a cost consideration, with either increased overhead to provide additional care delivery or reduced revenue due to lower productivity.

It should also be noted that one of the most important aspects of the implementation will be the redesign of specific workflows to accommodate the integration of the HIO and its data into the clinical workflow. HIMSS has created a supporting document in this regard entitled "Integrating the HIE into the EHR Workflow."[xvi]

Maintenance
Besides hardware and software maintenance, there may be ongoing fees for telecom, Internet Service Provider (ISP), participation, network monitoring tools, etc. Additionally, ongoing education and training will undoubtedly be necessary.

Staffing
It is possible to incur the need for HIE-specific IT support which requires the addition of permanent staff to operate the system. HIMSS, in collaboration with AHIMA, conducted a

useful study on staffing trends for HIOs that identifies key technical and business positions as well as challenges in finding skilled staff for these organizations.[xvii]

Additional Barriers

Most of the challenges described earlier as facing the healthcare industry around immunization reporting extend to other aspects of HIE, presenting similar hurdles that must be overcome by different agencies, organizations and healthcare professionals. The following items present further significant barriers to achieving simple, cost-effective and widespread health information exchange:

Lab Data Transmission Standards
State referral labs have reported that the standards for transmission of lab data for public health use cases, lab results and lab order use cases are not complete. For instance, there may be different requirements from different state departments of health for the content and reportable conditions based on the systems they use to accept lab results. Although these standards are quite mature for healthcare, there remains a need for national standards that can be used across all state departments of health.

Privacy and Security
The privacy and security issues associated with patient identification continue to be a major hurdle and a significant cost factor. Until this is resolved, it will be increasingly difficult and costly to exchange health information across the continuum of care, and patient safety will be an ongoing concern.

Long-Term Care / Behavioral Health
The long-term care and behavioral health communities lack advanced automation, even as the adoption of EHR technology in the provider and hospital markets continues to move forward. Standards for exchange of data between these communities are challenged by these varying levels of automation. For example:

- Many Long Term Acute Care (LTAC) organizations still rely heavily on fax machines to transmit health care data.
- Standards for patient consent vary dramatically across states.
- Automation does not yet easily support some of the nuances for secure and private exchange of behavioral and mental health data.
- The lack of an agreement within the behavioral/mental health community on what should or should not be shared in a privacy-sensitive discipline remains a major hurdle for this segment of the healthcare industry.

Standards for exchange of clinical information between these entities present a very real problem due to the prevalence of paper-based, unstructured electronic data. The cost of adding automation to the long-term care and behavioral/mental health communities is steep. The cost of adopting standards and beginning information exchange is also very high, and there are few payment incentives to encourage this much-needed change. Good work has gone on in the S&I Framework on LTAC, and several state-level HIEs have been working on legal and technical aspects of patient consent with the Substance Abuse and Mental Health Services Administration (SAMHSA) as well as their states. Much work remains, but if the healthcare industry is going to have a significant impact on issues like the cycle of unnecessary

re-admissions between hospitals and other care settings, interoperability and standardization is critical, as is the basic infrastructure to support this health information exchange.[6]

Semantic and Syntactic Interoperability

Increasingly, HIOs and large health systems are turning to terminology vendors to provide assistance with semantic and syntactic interoperability. Vocabularies like SNOMED-CT, ICD-9 and ICD-10, LOINC, RxNorm and other required terminologies[7] may exist in unstructured patient notes and clinical summaries, but not in structured code that meets the standards for exchange. This translation can be very expensive in the short run, but is essential to effectively exchange health information for the patient. This technology may also be employed by HIOs looking to help their participants with quality measure reporting.

Competing and Conflicting Document Standards

There is continuing debate over the use of C-CDA, CDA and the emerging FHIR®. This will be settled over time, but in the interim, development will continue on multiple fronts with attendant high costs and delays in delivery for user implementation.

Summary of Challenges and Barriers

In summary, the following challenges represent significant barriers to the achievement of nationwide health data exchange, and must be addressed before the adoption of HIE can be considered a success:

- Creation, adoption and harmonization of standards
- Lack of community consensus on clinical workflow
- Slow adoption and implementation of HIT products by provider practices
- Total costs of ownership, such as hardware/software, implementation and training, maintenance and staffing
- Costs to integrate (infrastructure, connectivity, testing, etc.)
- Differing interstate regulations
- Lack of consistent implementation guidance
- Privacy and security concerns
- Lack of automation, such as EHR adoption and use, and the need for additional privacy and security in behavioral health communities
- Slow progress in achieving semantic and syntactic interoperability
- Competing and conflicting document standards
- Establishing financial sustainability

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[6] *For additional information about behavioral health and HIE, see the presentation on the Behavioral Health Information Network of Arizona (BHINAz) from the Winter 2014 HIMSS HIE Community Roundtable:* http://www.himss.org/ResourceLibrary/genResourceDetailWebinar.aspx?ItemNumber=28059

[7] *For more information about the various terminology and vocabularies used in health information exchange, see the U.S. National Library of Medicine:* http://www.nlm.nih.gov/hit_interoperability.html

Known and Expected Benefits to Adoption

Whether an HIE service provider is public or private, or some hybrid of both, the importance of demonstrating a Return on Investment (ROI) is essential. The following section explores factors to demonstrate the benefits of health information exchange.

The Benefits of HIE

The potential benefits of health information exchange have been discussed far and wide. A number of papers have been published demonstrating clear benefits across the country related to participation in health information exchanges.[8] Web sites such as HealthIT.gov, HIMSS.org,[9] AHIMA.org, CHIME.org, HealthAffairs.org, NEHII.org, HIEWatch.com and NHINWatch.com provide rich sources of ROI research. There are also many state-based exchanges that have commissioned and published ROI studies through neutral third parties to examine this issue.

HealthIT.gov, for example, lists the following HIE benefits:[xviii]

- Provides a vehicle for improving quality and safety of patient care by reducing medication and medical errors
- Stimulates consumer education and patients' involvement in their own healthcare
- Increases efficiency by eliminating unnecessary paperwork
- Provides caregivers with clinical decision support tools for more effective care and treatment[xix]
- Eliminates redundant or unnecessary testing
- Improves public health reporting and monitoring
- Creates a potential loop for feedback between health-related research and actual practice
- Facilitates efficient deployment of emerging technology and health care services
- Provides the backbone of technical infrastructure for leverage by national and State-level initiatives
- Provides a basic level of interoperability among EHRs maintained by individual physicians and organizations
- Reduces health related costs

Cited case studies include the MedAllies study, the Coastal Women's Healthcare study, and the Lewis and Clark Information Exchange (LACIE) study.[xx]

In a study by HIMSS in 2005, it was estimated that there is a potential for approximately $94 billion in steady-state benefits nationally from optimal use of HIE.[xxi] A state like Arkansas, for example, which represents about 1% of the US population, would realize $940M in benefits in an optimal situation. In a separate study commissioned by the Arkansas state HIE (SHARE), Gartner estimated this would conservatively translate to at least $49-65M for the state.[xxii] (See **APPENDIX D** for additional details on these two studies.)

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[8] *For instance, see the HIMSS Enterprise HIE Toolkit's "Value Proposition" section:*
http://www.himss.org/resourcelibrary/TopicList.aspx?MetaDataID=1555

[9] *For instance, see* "Care Management and HIE," *published in May 2014 by the HIMSS HIE Committee*:
http://www.himss.org/ResourceLibrary/genResourceDetailPDF.aspx?ItemNumber=30274

The following sections provide a summary of the many benefits achieved by hospitals, physicians, patients and HIOs.[10]

Physicians

1. Reduced administrative burden for collecting, managing, and distributing medical records.
2. Reduction in chart pulls, leading to a more efficient workflow.
3. Aggregation of healthcare data at the point of care, improving the efficiency and quality of care delivery, increasing patient safety by reducing the opportunity for medical errors, and helping to eliminate waste related to unnecessary or duplicative tests.
4. Easier pre-authorization.
5. Ability to access patient data outside the clinical setting.
6. Faster access to lab results and radiology reports.
7. Streamlined access to patient histories and discharge summaries.
8. Community-wide and statewide connectivity.
9. Automated physician referral and consult processes.
10. Reduced administrative and overhead costs.
11. HIPAA-compliant data-sharing with other healthcare providers.
12. Local connectivity for rural providers, enabling delivery of data from referring hospitals to meet rural physicians' immediate needs.
13. Business and clinical information exchange between HIOs and key trading partners like health plans, referral networks and public agencies in a less costly, complex or risky way.
14. Qualification for Meaningful Use incentive payments, which require electronic exchange of health information.
15. Relationships with ACOs, which involve sharing data to better coordinate patient care and improve outcomes.

Hospitals

1. Medication reconciliation, including the ability to automate this function that is now performed by one or more pharmacists.
2. Electronic submission of all reportable conditions and vital statistics.
3. Enhanced workflow processes and reduced courier costs.
4. Strengthened relations with physicians resulting in increased referrals and laboratory revenues while improving clinical decision-making and patient care with more timely information.
5. Reduced administrative burden for collecting, managing and distributing medical records.
6. Prevention of unnecessary 30-day readmissions.
7. Easier admission process.
8. Increased efficiency and decision-making by providing more complete patient information at the point of care.

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[10] *Sources for the benefits listed are referenced in* APPENDIX E.

9. Enabling hospitals to take a team approach with other providers outside of their systems to provide coordination of care.
10. Enabling more streamlined physician referral processes and care transition.
11. Enhanced relationships between patients and families by improving communications and the sharing of data.
12. Enabling relationships between hospitals and other healthcare providers to improve the quality and efficiency of healthcare and improve patient safety through use of data analytics and development of standards of care.
13. Prevention of unnecessary re-hospitalizations by providing discharge plans to care settings across the spectrum of healthcare delivery that will enable effective follow-up treatment plans.
14. Reduced adverse drug events resulting from drug interactions and allergies by providing improved access to a more complete medication and allergy history.
15. Providing more complete patient data from a multitude of settings and emergency departments.
16. Utilization of complete health information at the point of care from a variety of facilities such as lab orders, imaging, and prescriptions.
17. Accommodating Meaningful Use requirements to qualify for reimbursements.
18. Providing Master Patient Index (MPI) functionality to enable health systems to transmit information electronically from clinics to hospitals.
19. Serving as a cross-check for data integrity to the individual facilities.
20. Acting as the universal portal for any entity seeking electronic access and sharing of ePHI.
21. Addressing ongoing maintenance, support, and security concerns of portal functionalities.
22. Enabling the identification of fraudulent practices by providers and consumers.

Benefits for Payors (shared with physicians and hospitals)
1. Avoidance of unnecessary or duplicative testing.
2. Increased compliance with formularies through e-prescribing.
3. Decreased costs for processing referrals and pre-authorizations.
4. Reduction in avoidable adverse drug events.
5. Improved transitions of care and prevention of unnecessary 30-day readmissions.
6. Ability to aggregate information about patients across various care providers, increasingly positioning themselves to fill the gap for clinicians at the point of care.
7. Data analytics may be available that support consistency and accuracy for claims; could provide clinically important information to support or refute data present in the clinician's EHR.

Benefits for Patients and Their Families
1. Enhance residents' and patients' active participation in their health care.
2. Reduced time away from work or home to receive additional unnecessary tests or images.
3. Reduced wait time between appointments while medical information is transmitted between providers.
4. Reduced time waiting if information is lost, or incomplete information is retrieved.

5. Reduction of preventable readmissions to hospitals due to ineffective transitions of care.
6. Reduction in time spent on the above for caretakers of patients.

Additional Information

Based on further studies, additional benefits can be noted:

From AHRQ[xxiii]
- Indiana Health Information Exchange (IHIE) sends daily alerts to health plan members who visit multiple ERs in selected area hospitals within 24 hours.
- The health plan uses the information to assess who might have been best served by primary care instead and educates them.
- Results of a pilot:
  - Non-urgent visits to ER dropped 53%
  - Primary care visits increased 68%
  - Savings of $2-$4 million over six months
- The study also identified two primary reasons for out-of-network visits: Insufficient specialists and location.

From HEALTHeLINK[xxiv]
A study through New York's HEALTHeLINK shows HIE savings are achievable via fewer duplicate CT scans:

- HEALTHeLINK found 2,763 CT scans were unnecessary duplicates over an 18 month time period
- 90% of duplicate CT scans were ordered by physicians who don't usually use the HIE
- 50% of the duplicates were for patients who already consented to have data accessed
- 95% of the scans were done in a hospital
- Opportunity for savings was $1.3 million

Conclusion

Many HIOs are flourishing because they have demonstrated value and benefit for their participants. The need to increase the footprint of individual HIOs will continue until we have reached a critical mass of provider participation from which there is no turning back. In addition, funding models must be put in place whereby there is a sharing of costs by both payers and providers that is directly relative to the benefits derived by each. It is important to focus on business needs and deriving concrete value for participants. To be successful, HIOs should focus on very specific, achievable goals that will advance them toward the larger goal of achieving interoperability and implementing health information exchange.

Recommendations: *Tasks to Move the Needle Forward to Realize Value*

The imperative of health information exchange is now, but in the drive to move from EHRs to information exchange, several tasks still lay ahead. HIMSS envisions a world where we move from static data to a liquid interoperable future, but to advance interoperability toward this goal, there are still challenging tasks ahead. Many of these tasks will require consensus building within the healthcare industry and the development of new policies, laws and ideas that have not yet been conceived or imagined. Each task towards recognizing the business value of HIE also requires an understanding of the problems of the current status quo within health information technology, and a change in the U.S healthcare system to a "culture" of interoperability.

The tasks that lie ahead for HIE can be framed at a high level as follows:

- Advocating to improve the mismatch of regulation and policy that hinder and delay clinical interoperability needs
- Defining a clear path to a data economy – an ecosystem where data is liquid but protected
- Correcting the perception of HIE as financial overhead, and building alignment of HIE to new payment models
- Ending the use of proprietary architectures as healthcare innovation and technology accelerate

Advocating for Policy and Regulatory Adjustments

The current landscape for HIE is mixed. While many see the value of the HIE and espouse interoperability as a policy goal, few incentives exist to make this "cheerleading" a reality. Much of the focus of the HITECH era has been on accelerating the adoption of EHRs and providing the regulatory and fiscal incentives to make this adoption occur. However, little of the regulatory and policy activity has focused directly on adoption of a "culture of interoperability" by vendors, payors, clinicians and others involved in the healthcare ecosystem. A major task towards realizing the value of HIE is correcting that imbalance, moving incentives away from the EHR alone and more toward HIE organizations and the associated services that provide for interoperability.

It will not be enough to simply change policies and laws already in place. There will also need to be a shift in the business case of information exchange from government-funded business models that are constrained by policy, to newer models that are centered on meeting providers' needs directly and drawing from the early successes and lessons learned from past HIE efforts. This newer model of sustainability would be supported by a realignment of financial and policy incentives to support HIE, shifting away from the current system of provider incentives to purchase and implement EHRs and towards rewarding those providers, vendors and other stakeholders within the health marketplace who actively design for interoperability and demonstrably prove its value in practice.

The focus would be on shifting policy levers from data capture to data interoperability, establishing requirements that incentivize providers to work with HIE organizations in promoting interoperability. Much of the focus of current regulations such as Meaningful Use, ICD-10 and other government healthcare IT regulations is on the capture of data in structured and unstructured formats within a computerized system. This has led to overwhelming focus on the EHR as the center of healthcare transformation, at the expense of the healthcare data the EHR contains and how that data is ultimately

shared and utilized. This also has put much of the current focus of health IT's benefits on EHR vendors and their products, with increasingly mixed results reported by clinicians.

With the overwhelming focus of Meaningful Use incentives on the area of the EHR, there is limited incentive for vendors, clinicians or others in healthcare to meet defined goals for interoperability. While Meaningful Use Stage 2 takes an initial baby step towards the business case for interoperability, it contains measures that don't necessarily align to clinicians and the value they would potentially gain from sharing data. This stage of Meaningful Use does not include an imperative for vendors to design interoperability into their products, forcing many HIE organizations to spend an inordinate amount of their capital and energy on "re-designing" their environments to support the many types of systems that need to interoperate and share data as prescribed. With little financial backing to support these data transformations, public HIE organizations will wither on the vine.

A newer model would also support the concept of integrating clinical, administrative and billing data, which to date has been difficult to achieve. Policy and regulatory adjustments would level the playing field among private HIOs, many of which are concentrated in the payer space, and public HIOs. While some current privately based HIOs have been able to achieve clinical and administrative data integration due to their ability to concentrate and aggregate data, public HIOs struggle mightily to attract the necessary financial and customer interest to sustain such a model. So how can this be done?

It is not clear yet what types of applications will use the integrated clinical and administrative information of the future, but this proposed new model of incentives would need to eventually drive the reframing of this long-time challenge towards a widening availability of patient-controlled data on both public and private HIOs. For instance, one approach may involve giving patients the ability to specify providers whom they trust to hold their data. This might include providing the ability for patients to create a private cloud of data that includes data from all their providers and specialists, including a secure personal health record that can then be accessed by other HIOs dependent on patient permission. This format, of course, creates the need for robust security and access controls which may also require ongoing operational and maintenance costs.

The value derived from this newer model is predicated on recognizing that clinicians will need to become the primary drivers of HIE success, with support from consumers in driving this part of the equation. Current policy and regulation dictates incentives that skew HIE into being viewed as financial overhead that practices must implement, severely impeding the development of the "culture" of interoperability by leaving the impression for many clinicians that EHRs are only about data capture in the clinical workflow. While interoperability is viewed as overhead in many clinical settings, it is viewed as essential in other industries. The culture of those industries has adapted to the needs of their customers and recognized that, while there may be many competitors (such as provider vs. provider and vendor vs. vendor) within an industry, it is in the interest of all industry participants to have a core culture of functionality that is interoperable.

The business case for health information exchange exists – it will require a change in policy and regulatory incentives to further bring it to life.

Recommendations to Achieve Value
- Promote a culture of collaboration between healthcare and government, where the primary focus of policy is on interoperability.

- Produce specific briefs on policies and regulations that are hindering HIE development and interoperability to educate stakeholders, with recommendations on how to overcome hurdles.
- For Meaningful Use Stage 3, recommend specialty-specific measures and goals that support interoperability, and support only new goals and objectives that have a clear interoperability focus.

Creating a "Healthcare Data Economy"

HIE entails an initial amount of overhead that is proving to be a major roadblock for many information exchange organizations to demonstrate a return on investment. With the amount of overhead expended for HIOs through public funds drying up, it is difficult to obtain additional funding through revenue models HIOs have traditionally relied on, such as grant funding. Many HIOs are struggling to find models that would work to support their continued existence, in an environment where the sharing of healthcare data is still a relatively unknown concept to healthcare consumers. That is why there needs to be an alignment of need between patients, consumers of healthcare information, and HIE organizations.

A key task in fostering this alignment is creating the concept of a "healthcare data economy" that is understood and advocated by all. **Healthcare data economy** would mean that healthcare data is considered an asset – something that:

- people are willing to pay for and to sell,
- stakeholders could control and exchange with others, and
- has an ecosystem surrounding it.

The focus of many HIOs is establishing revenue models that focus on HIE as a utility, causing them to become reliant on taxes and other forms of subsidies to exist, and to become heavily dependent on the surrounding political environment. To make this economy a reality, there is a need to first modify outdated anti-kickback laws that prevent healthcare organizations from charging for the secure transmission of medical information so that healthcare data can become a currency controlled by patients. Through this patient-controlled approach, vendors and other organizations can provide value-added, revenue-raising services that enhance and enrich this data.

In this economy, the data costs should be negligible and the mechanism for "generating currency" would become the value-added services HIOs can provide that are aligned to the needs of healthcare consumers. The burden to make data liquid should not be borne through HIOs alone, and this type of economic model could achieve that goal. The issue of HIE sustainability increasingly appears to be similar to a concept called "the fear of fire" – HIOs need to act now because an "approaching fire" is certainly a different situation than a "present fire." In other words, HIOs need to prepare for the change that is coming instead of reactively responding to the fire that is already occurring surrounding sustainability. The fear for HIOs is loss of relevance, and the fear for clinicians is that EHR investments go to waste as data gets locked into siloes and the clinical backlash to EHRs becomes problematic.

Similar to previous investments that have been made throughout American history, the target for this type of economic change often dictates the effectiveness of how that change ultimately is implemented. For instance, it could be viewed as a flaw in the current implementation of HIE that

HIOs are regulated to provide specific services that are mandated by the federal government, versus allowing the market to spur HIOs to provide new services using healthcare data. Part of the distortion in the HIE business model is caused by incentives to EHR vendors who have no incentive for information to flow freely across different EHR systems. Instead, the current economy of healthcare data is set up to invite EHR systems to lock vital information within proprietary data silos, similar to other stakeholders in the healthcare system.

Another unaddressed problem is the quality of the data. As most data are collected for billing and not clinical use, the clinical applications are lagging because the data is not liberated for analysis. Once it is, it will be apparent that the data is lacking in quality, therefore limiting its use as-is.[xxv] When the feedback loop is complete and clinicians see what their billing-focused data generates, as well as the lack of data uniformity, there will be an opportunity to address these issues and start getting the desired return on data input. The first investment of HITECH did not address interoperability, so that task remains and the follow-on investment in interoperability will be necessary to move forward. Because a silo system was purchased through incentives, it left the work of interoperability as a separate investment, much like the railroads having to retrofit their gauges after investing in the initial infrastructure.

Private HIOs do not necessarily have sustainability issues, as they can sustain large investments from commercial vendors, many of which are flush with cash from Meaningful Use implementations and other mandates that have led to subsidies and incentives from the government. Thus, a dichotomy has grown between private HIOs that are based on proprietary architectures and closed silos, and public HIOs that are trying to provide a more open environment for sharing healthcare data. The task for the industry is how to utilize the upcoming fear of HIE sustainability to create the necessary momentum to identify and sustain radical changes in the HIE business model for the future.

A utility model may be more sustainable than looking for profit by providing basic infrastructure. The opportunity for profit lies in the services and value generated by utilizing a commonly supported infrastructure. Terminology services and data structure/architecture should be defined by agreement and supported by the community, and not left to the marketplace to determine. The appropriate role for government regulation and policy is to set a level playing field that the community can use to drive value and services.

Change can start with advocating for a stronger policy focus on interoperability within other aspects of healthcare reform. These advocates are not necessarily the same as the regulatory and policy advocates cited previously, but are focused on the advocacy needed from patients and providers to push harder on their vendors to build their products for interoperability and the coming economy of healthcare data. Additional statutes passed through Congress speak of "mandating interoperability," but do nothing to implement through policy action a model of sustainability for HIE organizations – this type of action must ultimately come from stakeholders in the healthcare system.

Another imperative for a "data economy" is developing measures of interoperability that are meaningful to patients and clinicians. The liquidity of data is not complete without all healthcare data being available in ways that can be felt and appreciated by those it is meant to serve. Taking an example from the financial services industry, if consumers could only see their banking information but not their investment accounts, they would not feel they had a complete view of their financial health. Right now there are few measures in place that can show the business value of interoperability, as

there are for other industries. The industry and its stakeholders need to be at the forefront of defining these measures and measuring progress towards interoperability.

The same challenge exists for integration of clinical, billing and administrative data. The type of data liquidity needed to enable the full value of HIE organizations cannot be achieved without strong integration between data generated through determining enrollment, eligibility, authorization and payment, and data associated with all stages of the clinical workflow. As of now, there is little progress on measuring the integration of clinical, billing and administrative data across communities. The proposed recommendation for this type of measurement is to create a staged "maturity model" of interoperability – taking into account factors such as commonality across multiple vendors or organizations, ease of implementation, and other relevant criteria – for public and private HIOs to align to, similar to the HIMSS EMR Adoption Model®.

As with all information exchanges that may be proposed in the "healthcare data economy," there is also the challenge of how to actually exchange the currency of data while complying with patient's rights – another area where effective standardization is needed. Data cannot always be exchanged in an open fashion despite efforts to release data, as there may be at least one reason that would prevent the exchange from happening and it is most likely not a technical limitation. One way to deal with this challenge is to promote HIE models that directly allow for patient control of their data while giving the HIE the option to be the trusted service provider for the patient's data. This needs to be an ongoing discussion in defining the value of health information exchange, as the business case for HIE and interoperability cannot survive without addressing this challenge.

There is a social good associated with anonymous use of clinical data that has been used in the past in limited ways, such as infectious disease reporting to CDC, although that was complicated by the HIV/AIDS outbreak and epidemic. Trust is a critical aspect of clinical data use, and policies must re-enforce trust and promote instances that demonstrate the good that results from use of shared, anonymous data. Similarly, education about the negative impacts resulting from a lack of trust – and the resulting reluctance or refusal to share data – will help to move the larger population toward a culture of voluntary data sharing, both for improved healthcare delivery and personal health, and for the advance of medicine.

In summary, a new healthcare data economic model would be predicated on the HIO becoming the host for data that the patient wants to share with others. The data would be continually updated and fed by the stakeholders involved in their care. This model, which might tentatively be called a "patient data cloud," would allow patients to maintain control of their data, establish that control through an HIE service provider that they trust, and allow for HIOs to provide patients with value-added services dependent on medical condition and demographical data (such as sharing medical apps associated with different female age groups).

Recommendations to Achieve Value
- Establish a Data Economy Pledge for vendors and payers to take at HIMSS 2015.
- Form a partnership between HIMSS, WEDI and X12 to promote administrative and clinical data interoperability, including conference events and roundtables.
- Conduct interoperability surveys and ratings similar to KLAS ratings.
- Establish a staged interoperability scale similar to HIMSS EMR Adoption Model®.

- Feature synchronized whitepaper and briefing activities between multiple HIMSS committees on interoperability issues.
- Publish HIE vendor evaluation criteria and update regularly.

Incentives through Payment Models

Providing incentives for health information exchange is imperative. But what form should such incentives take?

One immediate area where new incentives for HIE could have an impact is in directly supporting new and current health reform payment models. The current fee for service (FFS) payment model is improved upon through the implementation of EHRs, but this model does not require or incentivize anyone in the healthcare ecosystem to build products and design healthcare delivery models that are focused on interoperability and designed to support cost reductions. If anything, several studies have shown that EHRs alone can lead to potential over-coding of diagnoses and procedures.[xxvi]

Little focus has been given to leveraging HIE to promote clinical data transformation and integration by promoting interoperability of healthcare data stored in EHRs in support of newer payment models. Initial successes have been identified in payment models such as Accountable Care Organizations (ACOs), where HIOs have been stakeholders in implementation of the ACO model. For example, recent studies have highlighted clear business value for HIOs in promoting the real/virtual integration of local delivery providers needed in support of the ACO environment. This concept allows ACO stakeholders to establish the HIE environment as an entity that most closely mirrors their own way of doing business. These types of successes have not necessarily been promoted through further development of the policies of health reform and represent a possible path to promoting additional business value for HIOs.

An example of an area where policy incentives could directly impact ACO and Patient Centered Medical Home (PCMH) implementation is the availability of medical registries through an HIO. As part of ACO and PCMH implementation, the use of medical registries to assist in the development of guidelines, performance measures and quality improvement tools is a dominant principle to ensure consistency in care coordination. HIOs serve as an excellent foundation for managing and linking these registries in a technical foundation that is easily usable and accessible to ACO and PCMH participants.

Achieving this type of progressive implementation will require additional incentives in these payment models to align specific incentives of proposed health reform models to use HIOs. This type of alignment would include adding specific interoperability measures to ACO and PCMH requirements to tie even larger cost savings to interoperability, and would also include interoperability measures for payment models that are similar to capitation models, such as comprehensive care payment and episode-based care. This approach could also be reversed to provide further funding to HIOs, which could earn a portion of the cost savings achieved by ACOs, PCMHs and episode-based payment models if they can support cost savings and care coordination with these entities.

Current reimbursement models are heavily weighted to offer incentives to providers to support the implementation of EHRs, for example, ensuring use of EHRs in an ACO. This has allowed for the capture of a large amount of structured and unstructured data, but has not provided incentives for that data to be shared with others within the payment model, such as other members of the PCMH, or with

other hospitals and specialists who may also work in an episode-based payment model. There is a clear business case to provide additional reimbursement incentives to those payment models that demonstrate clear use of interoperability through an HIO. The reimbursement system that is most favorable for HIE success is one wherein providers and stakeholders frame what problems they want solved and will pay for. This is an area of value for HIOs in building their sustainability.

To do so will require support from HIMSS and other professional organizations that will not only provide education, advocacy and incentives for providers to work with an HIE organization and establish expectations for the necessary level of interoperability, but will also promote use of public HIOs as an alternative organizational mechanism at a state and local level. This is the type of payment model where HIOs are most successful – a more open model than the current focus of payer-specific HIOs in support of existing payment models.

To effect this level of change, there will also be a need to change the current requirements that many public HIOs face through tying incentives to value-added services. While the decrease and elimination of grant funding has limited the future level of federal involvement in public HIE development, there are still government requirements over the funding that has already been provided. This will require an untethering of policy and regulatory expectations set by ONC through its State HIE program so that the public HIE organizations can focus on those areas where there is demonstrated need and demand. Public HIOs will need to be allowed to branch into different paths of operation dependent on local conditions, and be given the creative freedom to try different approaches in their effort to establish interoperability.

One way to support this would be to provide HIOs with challenge grants and demonstration grants for specific innovative models of interoperability, such as those outlined in this section for new health reform payment models. In this way, public HIOs would have an opportunity to try innovative approaches to produce a specific health-related outcome in their communities, and have the freedom to try whatever approach demonstrates value.

Recommendations to Achieve Value
- Advocate for additional regulatory and policy guidance through HIMSS and other professional association advocacy channels to provide incentives for health information exchange as part of new payment model demonstration projects.
- Work with medical societies to establish official lists of medical registries that can be integrated into existing public HIOs.
- Advocate through Congress for challenge grant funding to provide public HIOs the opportunity to serve as innovation test-beds for specific interoperability approaches.
- Offer incentives to HIE vendors and service providers that design and deliver their products specifically to benefit HIE stakeholders and support upcoming regulations.

Open Standards through Shared Knowledge

While many of the standards that are proposed in Meaningful Use Stages 1 and 2 move the needle on interoperability, they do not necessarily go far enough in promoting the overall exchange of health information. Measures associated with sharing patient information, laboratory results and care summaries are all worthy goals but they do not establish context and they do not alone build a culture of interoperability. Vendors do not inherently have the incentive to build interoperability into their products, and will follow the requirements set forth by provider organizations. Many people have

begun to promote the concept of "open standards" as a way to allow for this level of interoperability design. If providers purchased equipment based on adherence to open standards, the vendors would follow suit.

What is becoming apparent in the implementation of Meaningful Use Stages 1 and 2 is that the supporting infrastructure is not yet built. Stage 1 was easier to achieve, as it was less about interoperability than the potential to serve information from a digital platform. Meaningful Use Stage 2, however, requires a higher level of interoperability that was not incentivized by the ARRA/HITECH policies and therefore is difficult to attain, given the current ecosystem. In light of this, ONC is moving to a more facilitative role as they see the challenges they have not envisioned or accommodated to date. An adjustment of roles, funding and goals is necessary to move the industry in the right direction and save precious resources in so doing.

A common misunderstanding with the term "open standards" is tying openness to the organization that creates or maintains the standard. This gap has created a misunderstanding in the healthcare community of how standards work and how they are developed. Much of the work in interoperability standards is open for use and implementation by vendors, and many vendors have chosen to build these interoperable standards into their products. The disconnect with "openness" lies more in the level of understanding and education for standards, specifically as Meaningful Use requirements and other mandates tied to health IT (such as ICD-10 and quality reporting) have introduced more products into the marketplace.

What currently constrains implementation of interoperability is the design of health IT products which, lacking specific guidance and in the face of competing standards, do not consistently apply interoperable principles.[11] This can be changed through the development of consistent interfaces and architectures across the industry, with consistent implementation guidelines. Thus, the task ahead may be to reframe the debate to be focused on the lack of open architectures and open product designs in healthcare, not the lack of "open standards."

As noted in the policy and regulatory disconnect for HIOs, the regulatory model used for HIE would have to be focused not on the development of regulations but on the development of consistent requirements for all HIE vendors to apply in their products. This is the key lever that re-characterizes the cost of HIE overhead into a foundational cost of doing business. The industry-wide urgency to implement interoperability as an underlying foundation of technology requires the urgency of clinicians, who will need action through behavioral incentives to successfully adopt a culture of interoperability.

Here is where the appropriate bill payer must be identified and the task focused so that it is done once and for all, rather than expected that everyone goes it alone. There is too much shared interest to leave this to the marketplace and the U.S. healthcare system is a mix of government supported common good, non-profit enterprise and for-profit investment. Expecting pure market forces to deliver the common good is asking for perpetual failure, as has been demonstrated by the lack of sustainability with HIE endeavors to date.

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[11] *For instance, although the DIRECT service is intended to enable interoperability at a basic level across a wide range of stakeholders, there are many ways to implement DIRECT and these varied approaches are not necessarily interoperable.*

One action industry stakeholders could offer is the development and widespread use of resources focused more on the implementation of a modular strategy for health information exchange. This would put the focus on developing reusable building blocks as best practices and guidelines learned directly from the field. Ideally, this could be a crowd-sourced approach that would leverage the urgency of interoperability into an open platform for all stakeholders to share what works – and abandon what doesn't work. Value would be drawn from reusable components and guidelines that can be applied across multiple HIE settings, including both public and private HIOs. The strategy could include the piloting of reusable modules and components that could be available through a common repository, creating a knowledge library that would draw from existing sources of specifications and models and focus on reuse. In addition, the industry could continue to focus on education and emerging standards.[12]

Recommendations to Achieve Value
- Formally educate the industry on both endorsed and emerging standards for enabling health information exchange.
- Develop industry-wide Open Interoperability Standards Guides – a series of informative guides to educate industry stakeholders on emerging standards.
- Develop an industry-wide Interoperability Repository to serve as a single source for interoperability innovations that can be reused by the HIE community.
- Develop an industry-wide Interoperability Applications Store to further showcase innovative interoperability applications that developers can submit directly through a central organization. As the infrastructure is established and matures, the marketplace for such apps will follow.

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[12] *Two recent initiatives that warrant industry education include the Blue Button+ standard and the FHIR® standard.*

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Appendices

APPENDIX A: Diffusion of New Technologies and Lessons Learned from Other Industries

Early adopters of technological innovation usually experience a decrease in efficiency and increase in cost based on the resources needed to implement the new methods and processes with the prospect of significant gains for their operations. Investing too early with inadequate resources can lead to sunken costs that are never recovered (and from which others can benefit – for instance, engineers at Epic record label wanted to work with images so they essentially created the CT Scanner but could not market it and distribute it, so GE bought the solution for a song and became the initial manufacturer and distributor of CT Scanners), or arriving too late and missing the boat (as Kodak did with digital photography).

Graphics used to illustrate the process are the "S" curve, a log conversion of the "S" curve that results in a linear progression, and the "J" curve, illustrated below. These characteristics of adoption—an S-shaped curve reflecting performance and cost over time–have been recognized across industries, cultures, and populations and are used in many disciplines. Sociologist Everett Rogers first identified this phenomenon in the 1940's. The S-shaped curve was subsequently incorporated by economists and marketing professionals with the segmentation categories depicted in Figure 2 below.
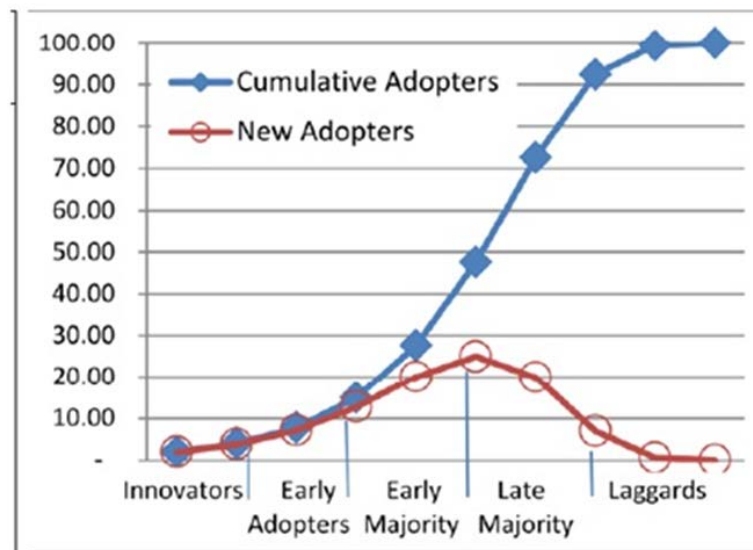

FIGURE 2: DIFFUSION CURVE

Thomas Friedman chronicles the changes that moved the global economy from the Industrial Age to the Information Age with a discussion of ten "flatteners" that enabled the transition resulting in significant productivity and economic gains. Once a disruptive change is introduced, it must be integrated into existing methods and processes through education of the workforce, production of the means of change (materials, manufacturing processes and so on) to effect change in a way that moves an industry to efficiency and economy that were unheard of but possible through a combination of advances in key areas for the industry to transform.

Transformation of an industry inevitably occurs. Joseph Shumpeter referred to this as creative destruction, or the ceaseless evolution in how businesses operate through new processes and

technologies replacing existing ones. Eric Topol popularized this context in healthcare when he wrote *The Creative Destruction of Medicine*. His premise is that medicine is undergoing a massive restructuring based upon the convergence and use of digital technologies. Standards and health information exchange are required enablers of this convergence.

Figure 3 depicts the introduction of new technologies during the 20th century and their adoption rate. Note that each of these technologies demonstrates a logarithmic curve, although the rate of adoption over time varies. In terms of healthcare, this diffusion curve (or rate of diffusion) is shaped by economics as much as by technology and standards. There is a perceived economic disincentive in sharing patient data with competitors under a fee for service structure.
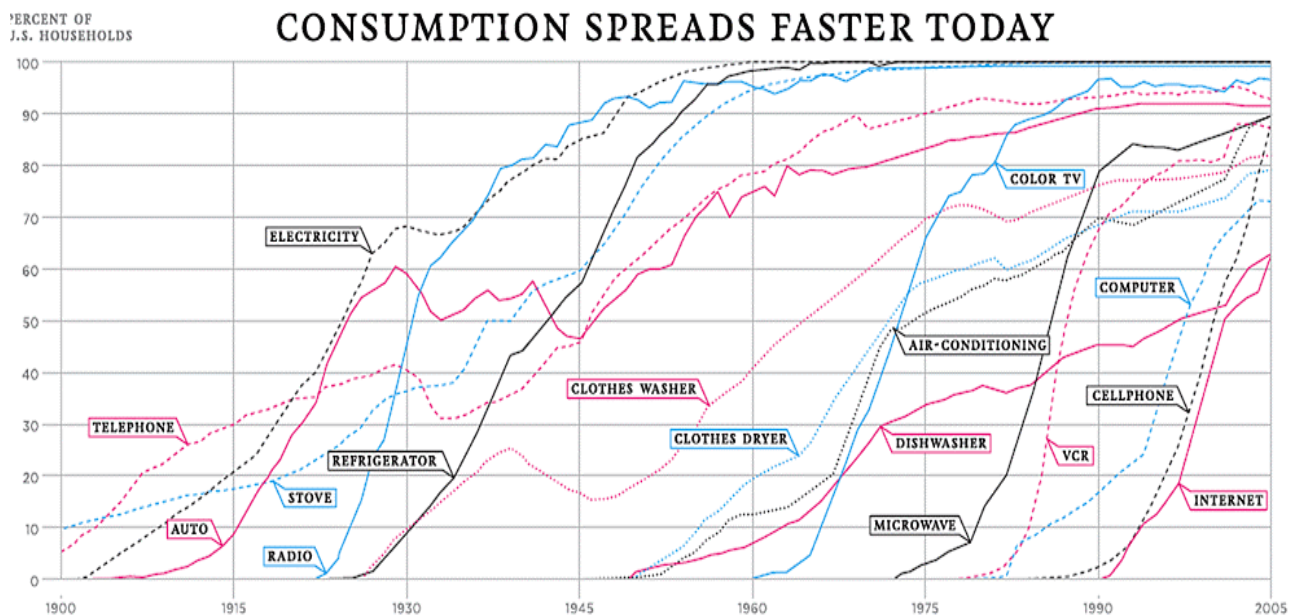
FIGURE 3: EXAMPLES OF TECHNOLOGICAL INNOVATION

When discussing healthcare transformation, other industries are often used for comparison, such as financial services, railroads and telecommunications. These are highly relevant to health information exchange since they are network-based industries.

The banking industry is an example of digitization that has resulted in significant improvements in access to money, loans, and so on. One no longer has to go to a bank and wait in line to deposit money or a paycheck or to apply for a loan (though you can if you would like, in most cases). Now you can have your check automatically deposited by your employer, obtain cash from ATMs around the world, and use your smartphone to deposit a check – all efficiencies resulting from a shift away from face-to-face encounters with a teller at a physical bank toward accomplishing these tasks through electronic, integrated networks.

The banking industry has realized efficiencies and weathered the cost of transformation to deliver services at a significant decrease in time and resources to its customers. Figure 4 (below) demonstrates the number of live bank tellers vs. the number of automated teller machines (ATM). The key to success for financial institutions was an early recognition of the need for interoperability and standards through the Society for Worldwide Interbank Financial Telecommunication and the establishment of the SWIFT network, or SWIFTNet. SWIFTNet provides a secure, standardized and

reliable connection. The same will happen as transformation takes hold in the healthcare industry, and there is early evidence that it is already taking place.
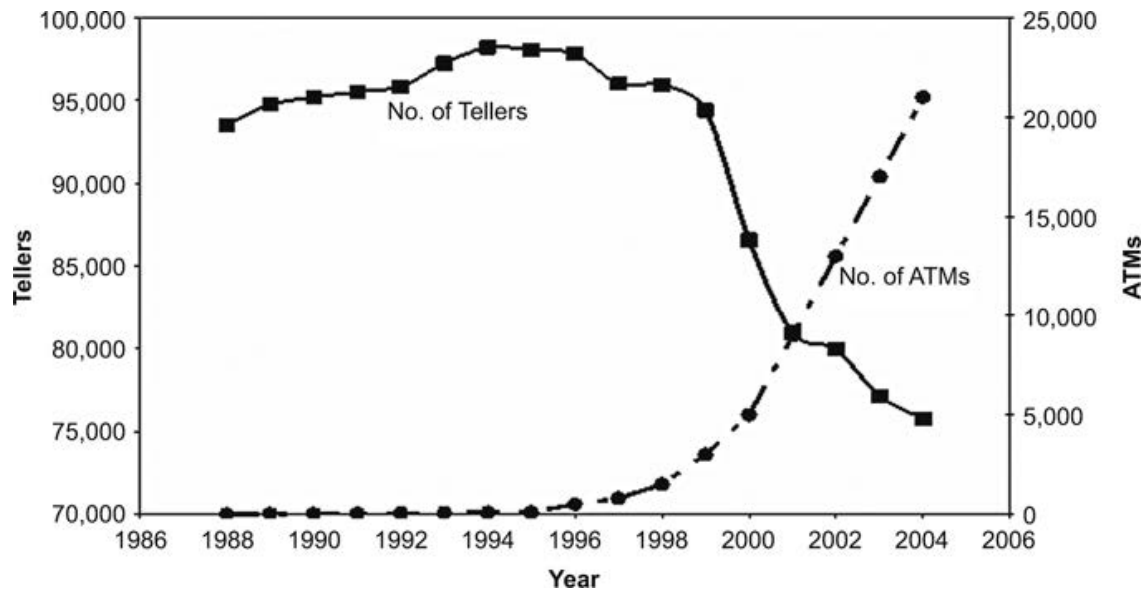
FIGURE 4: EXAMPLES OF TECHNOLOGICAL INNOVATION

The telecommunications industry has benefitted from standards, interoperability and ubiquity. The original wireline industry took decades for interoperability and standards to evolve during the earlier part of the 20th century with an eventual evolution to the Bell System. This industry faced creative destruction beginning in the 1970's from competing microwave networks, such as those offered by MCI and Sprint. A second evolutionary wave occurred with cellular telephony based upon frequency reuse standards. Interoperability between all of these networks was achieved through standards of interchange even though there are three different multiplexing standards used by cellular providers and handset vendors. The critical factor is the interconnection provided by the network. Thus, standardization in the telephone industry allows users to make calls to each other without regard to their carrier or type of phone. Fees were also structured on a non-discriminatory basis to encourage use across networks.

Transportation was transformed when railroads were built to move goods across the country. The initial concept of building railroads in each state or territory met with a realization that additional gains would be had if all users had standardized equipment (highlighted when the railroad of one state or territory met that of another and the gauges were different). Once the realization came that standards were required to further optimize the new method, an investment was made to re-engineer railroads across the country to be compatible and realize increased efficiency from uniformity.

Healthcare is in this state now as it transforms from an analog, disconnected system to a digitized, integrated system. This transformation is being driven by both technological innovation and evolving public policies in the shape of payment reform and direct subsidies of public monies under the Meaningful Use program. The early costs of this transformation are high due to the costly nature of the industry. However, as is recounted in all major industries, the eventual performance and efficiency will follow in healthcare from the ongoing investment in transformation.

APPENDIX B: Health Data Standards Categories

Four broad areas are identified to categorize health data standards (Department of Health and Human Services, 2010):

- **Transport standards** are used to establish a common, predictable, secure communication protocol between systems.
- **Vocabulary standards** consist of nomenclatures and code sets used to describe clinical problems and procedures, medications, and allergies.
- **Content exchange standards** and value sets are used to share clinical information such as clinical summaries, prescriptions, and structured electronic documents.
- **Security standards** are used to safeguard the transmission of health data through authentication and access control.[xxvii]

APPENDIX C: Examples of the Creation of HIO Standards

In 2009, ONC was codified under the U.S. Department of Health and Human Services. The previously mentioned Federal Advisory Committee Act (FACA) HIT Policy Committee (HITPC) and HIT Standards Committee (HITSC) were formed, and the ONC established the Standards & Interoperability (S&I) Framework and the Federal Health Architecture (FHA). In 2010, the American National Standards Institute's (ANSI) Healthcare Information Technology Standards Panel (HITSP) closed, moving their efforts under the influence and resources of the ONC and FACA Committees. HITPC and HITSC also formed many work groups and task forces to accelerate the work on increasing interoperability and Meaningful Use (MU) of EHRs.

Led by ONC, there has been close coordination with federal department/agency standards regulating authorities (e.g., NIST, FDA, DEA, CMS, CDC), with international standards groups like HL7, IHE and W3C, and with U.S. and global standards- and technology-focused associations like HIMSS, ASTM, the Kantara Initiative, IEEE, WEDI, HFMA and the OMG. Throughout this process, technology vendors and the public have been actively engaged through groups like the EHRA and the EHR/HIE Interoperability Work Group, which represents a collaborative of 19 states, 21 EHR vendors and 22 HIE vendors whose goal is to "create an integrated marketplace of EHR capabilities, in which the interfaces between EHRs and HIEs will be compatible more easily across and between states."

In March 2014, CHIME announced a partnership with HL7 to advance interoperability. The S&I Framework has completed a significant number of pilot projects to improve standards in functional clinical areas like Transitions of Care and Long Term Care. HL7 has also announced the FHIR®, designed to accelerate interoperability by leveraging the lessons learned through implementation of HL7 standards – HL7 v2/v3, RIM and CDA – and emerging industry web service standards.

These efforts, as with most activities around interoperability and health information exchange, are made stronger through the input of a diverse range of stockholders. For instance, in the medical imaging space, providers demanded DICOM compliance and vendors provided it. Most imaging vendors can connect two imaging systems in a couple of hours or less using DICOM; however, the same process would require days of work using HL7.

APPENDIX D: HIMSS 2005 Study

The HIMSS study detailed the $94 billion in annual steady-state benefits from optimal use of HIE nationally. A state like Arkansas, for example, which represents about 1% of the U.S. population, would realize $940 million in an optimal situation. In a study commissioned by the Arkansas state HIE (SHARE), Gartner estimated this would conservatively translate to at least $49-65 million for the state.

This was quantified as follows:

Value that is Financial and Measurable	$49,584,242
Prevent Unnecessary 30-day Readmissions	$11,059,707
Reduce avoidable Adverse Drug Events (ADEs) –Inpatient	$2,935,910
Avoid Duplicative Testing and Imaging	$19,286,400
Avoid Duplicative Consults	$1,655,571
Reduce Length and Complexity of Stays	$3,469,712
Reduced burden for collecting, managing and distributing medical records (providers)	$4,448,349
Reduced burden for collecting, managing and distributing medical records (hospitals)	$6,728,594
Value that has Multiple Dependencies or is Difficult to Measure	$15,642,202
Reduction of inpatient costs by allowing stays in less expensive settings	$3,925,013
Increase in patient load per provider	$8,633,249
Increase in Patient Empowerment (Inpatient)	$2,021,977
Increase in Patient Empowerment (Emergency Department)	$1,061,963
Total ($49.8 +$15.6)	**$65,226,444**

This value was transposed to constituent groups as follows:

Annual Benefits

Payers	Carrier / ASO	$13.4M	27%
	Medicaid	$10.0M	20%
	Medicare / Other Public	$7.9M	16%
Providers	Hospitals	$6.7M	14%
	Healthcare Professionals	$4.4M	9%
Others	Uninsured	$7.0M	14%
Total		$49.6M	100%

APPENDIX E: Benefits Achieved by Hospitals, Physicians and HIEs

Nebraska HIE

- http://nehii.org/index.php?option=com_content&view=article&id=30:stakeholder-value-propositions&catid=2:disclosure-docs
- http://www.nehii.org/index.php?view=article&catid=30%3Avalue&id=92%3Ahospital-value-statement&tmpl=component&print=1&page=&option=com_content&Itemid=89
- http://nehii.org/index.php?option=com_content&view=article&id=30:stakeholder-value-propositions&catid=2:disclosure-docs

Colorado Regional Health Information Organization (CORHIO)

- http://corhio.org/for-providers.aspx

For Rural Providers

- http://www.nhinwatch.com/perspective/engaging-rural-providers-emr-adoption-hie-connectivity

One Health Port (Washington state HIE)

- http://www.onehealthport.com/HIE

Hospital Work-Flow

- http://downloads.vertmarkets.com/files/downloads/fd1ea95b-129f-49bf-8f35-462d726f4e00/brief_roi.pdf

Medication Reconciliation

- Source: Conversation with Arkansas-based hospital group

Enhanced Workflow Processes and Reduced Courier Costs

- http://downloads.vertmarkets.com/files/downloads/fd1ea95b-129f-49bf-8f35-462d726f4e00/brief_roi.pdf

Strengthened Relations with Physicians

- http://downloads.vertmarkets.com/files/downloads/fd1ea95b-129f-49bf-8f35-462d726f4e00/brief_roi.pdf

Easier Admission Process

- http://www.nehii.org/index.php?option=com_content&view=article&id=30%3Astakeholder-value-propositions&catid=2%3Adisclosure-docs&Itemid=72

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