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Concepts for Building Inter-Organizational Systems in Healthcare: Lessons from Other Industries

John P. Glaser, PhD; and Helen G. Lo

ABSTRACT

A centerpiece of the nation’s healthcare information technology vision is the implementation of health information exchanges (HIEs). HIEs have the significant potential to improve the quality of patient care, reduce care costs, and enhance patient safety. These kinds of exchanges are new to healthcare in the United States. While more than 200 communities are in various stages of implementing them, there is little mature experience with the factors that contribute to the successful formation and sustainability of these exchanges.

The creation and management of mechanisms to support the exchange of data between organizations has been used in other industries. There are many examples of inter-organizational systems that have been established in industries as diverse as banking, manufacturing, government, and retail. This paper examines some of these experiences and attempts to glean the concepts and guidance healthcare can learn from other industries.

KEYWORDS

- Interoperability
- National health information network
- Regional health information organizations
- IT strategy
- IT standards
- Collaboration

A centerpiece of the nation’s healthcare information technology vision is the implementation of health information exchanges, which is defined as the mobilization of health information electronically across organizations and disparate information systems within a region or community.1 The Center for Information Technology Leadership estimates that the national implementation of healthcare information exchanges and interoperability would result in $77.8 billion in savings each year after such mechanisms are fully implemented.2

These exchanges, aiming to support care delivery, are new to healthcare in the United States. While more than 200 communities are in various stages of implementing them,1 there is little mature experience with the factors that contribute to the successful formation and sustainability of these exchanges.

The creation and management of mechanisms to support the exchange of data between organizations is not new to other industries.3 Nor is the concept completely new to healthcare, where the industry uses exchanges to support...
provider-payer and provider-supplier transactions. However, these exchanges are not intended to support the delivery of patient care.

There are many examples of inter-organizational systems (IOS) that have been established in industries as diverse as banking, manufacturing, government, and retail. Several of these systems leverage the Internet as the data communications media and are referred to as business-to-business systems. The experiences in building these systems provide concepts and experiences that can guide efforts in healthcare.

While diverse, IOSs tend to focus on one of two major value propositions, either scale economies or process improvement. The type of value being sought often determines the attributes of an IOS. Those who provide an IOS must fulfill several roles. Some roles are consistent across all IOSs, but many are determined by the IOS value proposition and attributes.

"While diverse, IOSs tend to focus on one of two major value propositions, either scale economies or process improvement."

IOSs confront common issues as they form and are managed. However, the specifics of these issues vary by value proposition, attributes, and the unique characteristics of each IOS. At times, regardless of how well the issues are addressed, the IOS will encounter barriers that hinder its full adoption by industry participants.

These general observations about IOS experiences across industries, while not serving as a "how-to" guide for healthcare, provide important insights and guidance for those engaged in HIE formation and management.

Definitions and Examples

An inter-organizational system is an information system that is shared by two or more companies. Several variations on this definition exist. A collaborative IOS has been defined as collaboration between three or more participants who shape, develop, and manage a common infrastructure. Business-to-business systems are characterized as having three or more organizations that have a formal agreement to collaborate on some aspect of their business using the Internet.

IOSs are just as diverse as the organizations and industries they serve.

Enterprise. Enterprise Rent-a-Car represents an IOS built from the supplier side. In the early 1990s, Enterprise created the Automated Rental Management System to help insurers coordinate car repairs and find rental cars for clients involved in accidents. With the tool, auto body shops can send direct updates to insurers, while insurers can initiate and track rentals from Enterprise through direct electronic gateways.

RosettaNet. RosettaNet is the name for both the IOS and the not-for-profit consortium behind the product. The consortium was launched in 1998 by 400 global leaders in IT, electronic components, semiconductor manufacturing, and solution providers. It publishes free guidelines for document exchanges and business processes performed using XML. Traditional RosettaNet implementation, however, can be costly and complex for small businesses, and RosettaNet Automated Enablement was created as a specially adapted set of business processes to enable a wide range of suppliers to participate in standardized exchanges.

Covisint. During the dot-com boom of 2000, DaimlerChrysler, Ford Motor Co., and General Motors launched a business-to-business marketplace dubbed Covisint. The intent was to tap into the supply chain by providing suppliers with forums to post catalogues, reverse auctions to bid on automaker project requests, and tools to manage quotes and assets. However, supplier resistance against process change and distrust of a buyer-driven portal limited the evolution of Covisint as an IOS. Having sold off its auction-services business in 2003, Covisint was eventually acquired the following year by Compuware with no further financial interest from automakers.

CapWIN. Government has recognized the potential of IOSs as exemplified by the creation of the Capital Wireless Integrated Network. During 9-11 and a major traffic gridlock of 1998, poorly linked communications were major impediments to effective agency responses. As a joint effort between the states of Maryland and Virginia, the District of Columbia, and the federal government (the U.S. Department of Transportation and the U.S. Department of Justice), CapWIN has become the first wireless network to integrate transportation and public safety data with voice communication systems across multiple states.

IOS Attributes

IOS form, function, and management can be variable. This variability can be described by a limited set of attributes. A particular IOS will have some combination of these attributes.

Collectively owned vs. privately held. Participants can own the IOS. Many regional health information organizations are non-profit organizations that are owned by regional provider and payer participants. The IOS can be privately held, for example, owned by one organization. Privately held IOSs come in two major forms. The first involves an IOS that is offered by an organization that uses the IOS to leverage its core business, such as a medical supplier IOS that links to a hospital’s materials management system. The second involves an IOS that is offered by a company as a
service to participants, for example, WebMD.

**Closed vs. public.** An IOS can be utilized by a limited number of organizations, and the use of the IOS is restricted to them. For example, a manufacturer's exchange may be limited to that manufacturer and its suppliers. On the other hand, an IOS can be open to essentially any organization. For example, many e-markets are open to any buyer and any seller.

**Horizontal vs. vertical.** The IOS can be assembled by organizations that are similar in what they do. For example, a collection of banks can participate in an automated teller machine network. Or the IOS can be assembled by organizations that are more vertically integrated, such as organizations that exist along a supply chain.

**Sporadic vs. systematic.** The IOS can serve spot market needs or be used only occasionally and sporadically by participants. For example, an organization uses the IOS when it is looking to purchase a specific good that it needs from time to time. The IOS can support systematic interactions between organizations. In other words, there is an ongoing process between two organizations; for example, the determination of patient eligibility for services is an ongoing process between providers and payers.

**Proximal vs. remote.** A proximal IOS involves participants that have personal relationships with each other. These relationships can result from a common geography; for example, the participants have worked together because they all live in the same city. The participants also can have a relationship because they are members of an affinity group—for example, they may be members of a consortium of academic health centers. By contrast, a remote IOS involves participants for whom there is no or little relationship. For example, buyers and sellers on an e-market exchange may never meet.

The intent of the IOS will govern the attributes chosen. If the intent is to achieve a competitive advantage, the IOS is likely to be privately held and closed. If the mature form of the IOS is unclear because the participants have little experience with exchanges, then the IOS is likely to be proximal as participants interact frequently during IOS formation. The diversity in attributes is a result of thoughtful management strategies and actions.

Most RHIOs are collectively owned, public, vertical, systematic, and proximal. A hospital that integrates its systems with physician practices that are frequent admitters establishes an IOS that is privately held, closed, horizontal, systematic, and proximal. A research study adverse event reporting system for adverse events is privately held, public, vertical, sporadic, and remote.

While not all combinations of attributes are viable and no one industry will see the full array, healthcare should expect that health information exchanges will be achieved by a wide range of IOSs with diverse attributes. It is very unlikely that healthcare will see only one major type of IOS; no other industry has experienced this homogeneity. As the nation pursues the development of health information exchanges, this diversity of IOS attributes will occur, and it is acceptable for this diversity to exist.

**The Nature of IOS Value**

All IOSs involve the exchange of data. However, an IOS can derive its value in one of two major ways—scale economies and process leverage. Any IOS will attempt to achieve both types of value to a degree, but it will emphasize one type of value.

“**Virtually all of the nation’s RHIO efforts are directed toward achieving scale economies. On the other hand, virtually all provider efforts using IT to strengthen clinical relationships are directed to process improvement.”**

**Scale Economies.** The value of an IOS can be primarily based on economies of scale. In other words, the value of the IOS to each participant increases as the number of members participating in the IOS increases.

A classic example of this source of value is the automated teller machine networks. Consumers use ATMs to deposit checks, move money between accounts, and withdraw cash. ATM networks, such as Yankee and Cirrus, are routinely shared by multiple banks. For a bank, sharing an ATM network enables them to amortize the cost of the ATM and the supporting infrastructure across multiple banks. In addition, a bank may be able to provide ATM service to a location in which it has insufficient customers to justify its own ATM. By sharing costs, the banks are able to provide more extensive geographical coverage and improve service to, and use by, their customers.

Scale economy not only reduces the cost of providing a service, but it also can lead to an increase in revenue-generating use of the service.

HIEs also can leverage scale economies. If several hospitals utilize a shared exchange infrastructure, not only will their exchange costs be reduced but they also may see increased use of the exchange by physician practices, reference laboratories, and payers.

**Process Leverage.** A core intent behind any data exchange is often the improvement of processes within an organization. These processes can involve inventory management for a manufacturer, specialty care referral, or the movement of passenger luggage between connecting airlines.

An organization’s internal processes can be made more
efficient and less error-prone by electronically receiving data from business partners. Moreover, the real-time nature of this data may enable an organization to react more quickly to changes in external conditions or partner needs.

However, organizations often have selected business partners with whom they have significant and multi-faceted business relationships. For example, many manufacturers do not purchase their parts from anyone, but rather have preferred suppliers. Not all relationships are created equal.

With these preferred partners, an organization is willing, and may need to, develop shared processes that are more integrated than those processes that they will have with less important partners. For example, an academic medical center may be more willing to develop more integrated referral processes with a physician group that is a source of many referrals than it would with a group that only occasionally makes referrals.

With preferred partners, the exchange will involve a more extensive and feature-rich IOS. In addition, the IOS is likely to involve significant integration with the organization’s application systems and deeper changes in surrounding operational processes. These preferred IOSs will be exclusionary; they will not be available to all potential participants.

If process leverage is the primary intent of an IOS, then participants will be less interested in including large numbers of other participants, which may, in fact, diminish the value of the IOS. Because each participant is likely to have different application systems, data definitions, and integration competencies, the incremental cost of adding a new participant may be higher than the value delivered by that participant.

Virtually all of the nation’s RHIO efforts are directed toward achieving scale economies. On the other hand, virtually all provider efforts using IT to strengthen clinical relationships are directed to process improvement. This duplicity of goals will create persistent clashes between those interested in achieving economies of scale and those interested in process improvement. Scale economies threaten to commoditize process improvement efforts. Process improvement efforts can result in some organizations not participating in scale economy efforts. This tension may never be resolvable.

The Roles of the IOS Provider

The IOS is provided and managed by some organization that can be created by the participants and operated as a consortium. This organization also can be a commercial concern whose business is based on providing IOS services.

In all cases, the IOS provider must ensure that the information technology necessary capabilities are delivered, appropriate standards are utilized, legal and regulatory requirements are met, and means exist to support participant implementation of the IOS. However, the additional roles of the IOS provider can vary significantly and depend on the IOS attributes and the nature of the value to the participants (see Table 1).

Many collaborative IOSs in healthcare now believe that participants can assemble the talents, organization, and staff needed to fulfill the roles cited above. In some cases, this self-reliance will prove to be possible and effective. In many cases, this self-reliance will not be a credible or
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<table>
<thead>
<tr>
<th>Issue Category</th>
<th>Specific Types of Issues</th>
</tr>
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<tbody>
<tr>
<td>Political</td>
<td>Two types of events can catalyze the formation of the IOS; preparatory events that develop relationships between key participants and precipitating events that spawn a collaboration. Political, organizational, financial and technical champions are necessary to propel and sustain the IOS through turbulent times. Legislative and regulatory requirements can either facilitate or hinder IOS formation.</td>
</tr>
<tr>
<td>Organizational</td>
<td>Governance mechanisms and structures must be formed to create and manage the IOS. The goals and objectives of the IOS must be clear and shared by all participants. Changes in the organizational processes and relationships of the participants need to be defined and implemented.</td>
</tr>
<tr>
<td>Financial</td>
<td>Initial capital funding must be obtained to start the IOS and a sustainable model for the IOS must be developed that enables the IOS to be sustained.</td>
</tr>
<tr>
<td>Technical</td>
<td>The IOS will need to be integrated with participant legacy systems. The ability of these systems to be integrated can facilitate or retard IOS effectiveness. Issues regarding data management must be addressed; decisions regarding data sources and definition, ownership, access rights and restrictions, privacy and stewardship. Standards must be defined for data, communications, security and access methods. Decisions must be regarding the adoption of open source or commercial software.</td>
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Table 2. IOS Formation and Management Issues.

desirable goal.

If a community or region turns to a third party to fill HIE roles, the skills and experiences required to affect an IOS that centers on process improvement are different than those required to achieve scale economies. Recruiting and retaining multiple participants is a different task than defining and implementing deep process change across a limited set of participants.

**IOS Formation and Management**

Adequately addressing a series of issues that confront all IOSs significantly affects the ability of the IOS to thrive. Based on analyses of several IOSs associated with the federal government, Fedorowicz et al. developed a useful framework of four major categories of issues (see Table 2).

Political issues center on the events that facilitate IOS formation and the establishment of IOS champions. Organizational issues address the processes and structures needed to manage the IOS. Financial issues focus on startup and sustained funding of the IOS. Technical issues address data, standards, and integration challenges.

This framework, and the issues it describes, will apply to
all HIEs. The nature of each issue is influenced by the attributes of the IOS; for example, the organizational mechanisms for a RHIO are different than those for an IOS sponsored by a hospital for its physician community. Additionally, variations will exist within HIEs that have similar attributes; for example, participants engage in constructive preparatory activities in some regions, while participants dislike each other in other regions.

Despite these variations, all HIEs should use this framework to guide their efforts to form and affect their IOS. The nation’s HIE efforts are intended to address these issues. The Office of the National Coordinator’s efforts on standards harmonization and the National Health Information Network prototypes are directed at technical issues. Incentive programs, such as ones offered by Bridges to Excellence, address financial issues. Certain states have launched strategies to target political issues. Resource centers, such as those offered by the eHealth Initiative, share lessons learned in each issue category.

### Barriers to IOS Adoption and Use

In a review of multiple studies of IOS formation and use, Markus identified several barriers preventing many industry participants from adopting, integrating with, or properly using an IOS. These barriers are compounded by inabilities or failures to address the issues discussed above, particularly when there are no precipitating events that bring potential IOS participants to the table.

Prominent barriers include the following:

- The cost of setup is too high in absolute terms.
- The IOS will deliver few transactions, and therefore, the benefits are limited.
- There are too few participants in the IOS, reducing its value to any one participant.
- The lack of standards or closed membership limits the IOS’ use by business partners of the participant or makes it too costly for a participant to sustain multiple IOSs.
- There is a lack of internal systems that can connect to the IOS.
- Inferior or non-integrated systems make IOS integration difficult or impossible.
- There is a lack of in-house knowledge and expertise for integration.
- Staff has insufficient training in how to use the IOS.
- There is an absence of process changes or other concessions by the IOS initiator that would give participants meaningful incentives to use the IOS.

Many of these barriers are particularly salient to healthcare. The national HIE agenda focuses on connecting physician offices. However, the vast majority of these offices have no internal systems, no integration expertise, and limited ability to handle the costs of setup.

While there are notable efforts to address these barriers, such as the Doctors Office Quality IT initiative, it is not clear that the country has developed a comprehensive approach to addressing these issues for the small practice, hospital, or nursing home. As a result, these barriers will thwart participation in HIEs by large segments of the healthcare industry.

### IOS Observations

While there is great diversity in IOSs across and within industries, the experiences of these IOSs can lead to several broad observations and conclusions. These observations complement and extend the conclusions and observations discussed above. The observations also integrate several of the sections.

“Invariably, one organization dominates a privately held IOS, and its desires often are dictated to the rest of the participants. This can be a problem for participants, forcing them to undergo IT investments and process changes that are not central to their own strategies.”

#### Governance

It is very difficult to establish and sustain an efficient and effective IOS governance. This is true regardless of the source of IOS value or IOS attributes.

Collaboratively owned IOS confront governance challenges because of the number and diversity of participants. Being inclusive can be important in developing a community-wide exchange, but the result can be board meetings with large numbers of attendees. In addition, a wide range of cultures, intentions, and skills among the participants can often breed conflict.

Invariably, one organization dominates a privately held IOS, and its desires often are dictated to the rest of the participants. This can be a problem for participants, forcing them to undergo IT investments and process changes that are not central to their own strategies.

The less powerful participants also can use influence. Many dominant participants have encountered a form of mass uprising by other participants, causing them to back off of efforts to force standards and IT investments. A privately held IOS requires a continuous management of an often uneasy peace.

#### Standards

Developing industry consensus-based standards is a time-consuming and lengthy process. Standardization often takes years, and sometimes, it never occurs.

In the absence of accepted industry-wide standards, one
dominant organization, or a collaboration of a small number of dominant organizations, will attempt to dictate standards that meet their needs. Their market clout can be sufficiently strong that these standards become de facto industry standards. Wal-Mart’s attempt to establish RFID standards is an example of an effort by one organization to create a standard. Covisint is an example of an effort by a small number of dominant organizations to set standards.

IOSs that are able to force standards can potentially control the evolution of a standard so that it reflects their business interests and interests in emerging technologies. In these cases, the consensus process can become irrelevant or placed in the awkward position of blessing a forced standard.

“To achieve IOS value, some process redesign must occur. Changes in processes can range from modest to significant. Failure to make these changes can significantly reduce the value of an IOS.”

At other times, because of the absence of accepted standards or dominant organizations, various IOSs in industry adopt IOS-specific standards. Clearly, this creates challenges for an organization that participates in multiple IOSs. In these cases, the industry muddles through a present and a future of multiple “standards.”

Industry-based standards development is greatly hampered when an industry is fragmented. Achieving consensus from various industry participants is exquisitely difficult, and no dominant organization, aside from the federal government, has sufficient market power to dictate a standard. Healthcare is particularly challenged by fragmentation.

Fusion of value. Many organizations will pursue both economies of scale and attempt to bring about significant process improvement with major business partners. While they may focus on major business partners, these organizations also will find value in connecting to less important partners. While significant investments in these connections are less worthwhile, implementing a second IOS that delivers economies of scale will make good business sense.

One example would be a hospital that implements a privately held IOS for physician practices that are frequent admitters and utilizes a RHIO, a less sophisticated IOS, for other providers in the community.

Multiplicity of IOSs. Many organizations will participate in multiple IOSs, which can reflect the fusion of value. It can also reflect the specialization needed by specific inter-organizational interactions, such as one IOS for supply chain needs, another IOS for provider-payer transactions, another IOS for transactions with banks, and another IOS for connectivity to loosely coupled regional providers. Providers and payers will be challenged to manage this diversity.

In addition, IOSs dedicated to process improvements with important business partners can assume multiple forms. The most common form is centered on achieving an acceptable degree of integration between the legacy systems of participating organizations, for example, for supply chain support. Significant internal process change and ongoing meetings between participants are required to develop inter-organizational functionality.

However, another form involves one organization extending its systems into other organizations for use by all IOS participants. For example, several providers involved in a joint oncology program may all use an oncology electronic medical record that is owned by one of the participants.

A third form involves the pooling of data by organizations to improve each other’s understanding of mutually interesting issues or opportunities. For example, a provider and payer may integrate data from medication claims with the provider’s electronic medical record data. This merged set of data enables both organizations to examine medication compliance or misuse and jointly develop strategies to improve care.

Competitive Behavior. Competitive behavior is a fact of life in any industry. An IOS can be directly targeted at improving competitive position. Competitive behavior will also be quite apparent in collaboratively owned and public IOSs.

Privately held and closed IOSs that pursue process improvement will have a faster implementation rate than collectively held and public IOSs. Organizations are more willing to devote resources to those IOSs that hold the promise of competitive gain. This differential pace of implementation is likely to result in a gap between the connected “haves” who have IT resources and the unconnected “have-nots” who have limited IT resources. In addition, community-based HIE adoption is likely to lag adoption of IOSs sponsored by a specific provider or payer.

Other competitive behaviors will be evident. Choices of technologies, data standards, and process changes will have proponents and opponents whose support or resistance is based on organizational interests.

While there are many examples of IOSs that have delivered significant organizational value, true IOS win-win situations for all participants are not common across industries. Invariably, one or some organizations gain more than others, and frequently, many organizations are disadvantaged or see no advantage. When a dominant organization forces its IOS on all parties, dependents will be disadvantaged by technical and process change necessary to keep
doing business. IOSs rarely “raise all boats with the tide.” At other times, those participants in the IOS discover that gain has occurred, but not for them. Banks that participate in ATM networks have not seen expected reductions in bank tellers or bank branches. While banks’ operating costs have not been lowered—and have actually increased because of the cost of participating in the ATM network—customers have realized the value of the networks because banking is now more convenient.

Relationships and re-engineering. IOSs that focus on process leverage are an element in a series of actions that an organization will take to improve the efficiency and effectiveness of important business relationships. The IOS may be necessary, but it is insufficient. Important business relationships are maintained through personal contact, efforts to address process problems between participants, and sharing of information about plans and contracts that respect the need of participants to thrive. The IOS is never a substitute for the normal steps that an organization will take to maintain and strengthen its relationships with others.

To achieve IOS value, some process redesign must occur. Changes in processes can range from modest to significant. Failure to make these changes can significantly reduce the value of an IOS. In this regard, an IOS investment is no different than any investment in information technology; the value results from effective change in business and clinical practices.

Conclusion

Health information exchanges provide great promise in national efforts to improve healthcare delivery. The lessons of other industries to create and sustain inter-organizational systems can provide guidance to the emerging efforts in healthcare.

There will not be a homogenous approach to IOS development in healthcare. There will be a variety of IOSs that differ along several attributes, such as privately held vs. collectively owned, public vs. closed, horizontal vs. vertical, and proximal vs. remote. Regional health information organizations will manage one type of IOS, and there are multiple flavors of RHIOs. The healthcare IOS landscape will be a lot messier than is portrayed in National Health Information Network discussions. Healthcare IOSs will pick one of two fundamental goals, either scale economies or process improvement. These two goals will frequently conflict.

Depending on fundamental goals and attributes, the roles of the IOS provider will vary. Many collaborative IOS efforts will be challenged to fulfill these roles.

IOS formation and sustainability requires that participants address a series of political, organizational, financial and technical issues. The specifics of these issues will be different across IOSs with different attributes and goals, and they will be different within IOSs that are similar in attributes and goals. Addressing these issues is the focus of the federal government and national healthcare information technology associations. In some cases—such as political catalyzing events, guidance on governance structures, legal agreements on data management and standards—solid national strategies are emerging. In other areas, such as sustainable business models and associated process changes, the national approach is immature.

There are many barriers to IOS adoption and use by participants. These barriers center on costs, value of IOS participation and the capabilities of potential IOS participants. Many of these barriers confront the nation’s small providers. There is a big risk that they will be unable to participate in the full spectrum of IOS opportunities.

Several additional observations can be made about IOSs. Governance is very difficult. Standards development sometimes never occurs and at other times is “dictated” by organizations with significant market power. Most organizations will pursue both types of IOS value and participate in multiple types and forms of IOSs. Competitive behavior will be a fact of life amongst IOS participants. And, finally, relationships and process redesign are generally critical contributors to the realization of IOS value.

About the Authors

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FOCUS: Integration and Interoperability


*Note from page 54: Nor are data exchanges new to healthcare. The healthcare industry uses exchanges to support provider-payer and provider-supplier transactions. However these exchanges are not intended to support the delivery of patient care.

Every other job was just a warm up.

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