A White Paper for
Canada Health Infoway

Health Information Network (HIN) Leading Practices

November 2015
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Team

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dennis Giokas</td>
<td>Chief Technology Officer, Project Executive Sponsor and Chair of the Advisory Group</td>
<td>Canada Health Infoway</td>
</tr>
<tr>
<td>Hardy Sekhon</td>
<td>Executive Director, Business Integration Services</td>
<td>Canada Health Infoway</td>
</tr>
<tr>
<td>Alvaro Mestre</td>
<td>Regional Director, Architecture</td>
<td>Canada Health Infoway</td>
</tr>
<tr>
<td>Martin Geffen</td>
<td>Vice President</td>
<td>Gartner Consulting</td>
</tr>
<tr>
<td>Harmin Nouri</td>
<td>Consulting Associate</td>
<td>Gartner Consulting</td>
</tr>
<tr>
<td>Krzysztof Tworkowski</td>
<td>Consultant</td>
<td>Gartner Consulting</td>
</tr>
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</table>

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<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Affiliation</th>
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</thead>
<tbody>
<tr>
<td>Penny Rae</td>
<td>Chief Information Officer</td>
<td>Alberta Health Services</td>
</tr>
<tr>
<td>Perry Poulsen</td>
<td>Chief Information Officer</td>
<td>Manitoba eHealth</td>
</tr>
<tr>
<td>Liz Loewen</td>
<td>Director, Coordination of Care</td>
<td>Manitoba eHealth</td>
</tr>
<tr>
<td>David Thomas</td>
<td>Vice President</td>
<td>TELUS Health Solutions</td>
</tr>
<tr>
<td>Jennifer MacGregor</td>
<td>Managing Director, Canada</td>
<td>Allscripts</td>
</tr>
<tr>
<td>Donna L Davis</td>
<td>National Nursing Officer</td>
<td>Veterans Affairs Canada</td>
</tr>
<tr>
<td>Dr. Bill Clifford</td>
<td>Chief Medical Information Officer</td>
<td>Northern Health Authority</td>
</tr>
<tr>
<td>Peter Bascom</td>
<td>Chief Architect</td>
<td>eHealth Ontario</td>
</tr>
<tr>
<td>Marc LeBlanc</td>
<td>Interim Director Infrastructure Information Management &amp; Technology</td>
<td>Nova Scotia Health Authority</td>
</tr>
<tr>
<td>Dale Sanders</td>
<td>Executive Vice President, Software</td>
<td>Health Catalyst</td>
</tr>
<tr>
<td>Gary Folker</td>
<td>Senior Vice President, Canada</td>
<td>Orion Health</td>
</tr>
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Comments regarding this publication can be directed to Dennis Giokas at: dgiokas@infoway-inforoute.ca
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1. Executive Summary

Background and Context

In late 2014, Canada Health Infoway initiated a study to identify current best and leading practices for planners and implementers of health information exchanges in the form of a white paper.

This white paper describes those leading practices derived from interviews and materials provided by a number of organizations worldwide, as well as a number of related findings supported by published Gartner research and general secondary research related to health care and other industries.

While the leading practices may have been derived from countries with health care and regulatory schemas that differ from those in Canada, they can provide health care policy makers, who are considering the creation or operation of health information networks in their own jurisdictions, with valuable insights.

The study also resulted in a preliminary Capability Maturity Model discussion paper, which can be found here, that health care policy makers, planners and information exchange operators can use to assess their current state capabilities, determine a desired future state, and develop concrete plans to achieve the future state. This initial model, while generally applicable, requires further review and conversation with health care policy makers, stakeholders and key influencers in Canada to achieve acceptance and initiate its wide application.

Health Information Network Defined

Health information exchange (HIE) is a term used throughout the industry to refer to a number of concepts. It is used as a noun and a verb, and mostly is related to interoperability and exchange mechanisms. We have coined the term health information network (HIN) here to extend the concept to refer to an organization (or group of organizations) which provides a broader set of capabilities, functions and services, as depicted below:

Figure 1. HIN Core Capabilities

![Core Capabilities Diagram]

In the context of this white paper, we refer to those organizations which are focused specifically on health information exchange (mostly current HIEs) as “information exchange organizations.”
When we refer to a HIN, we are referring to an organization (or a group of organizations which have a single coordinating and direction setting governance structure) which provides the broader capabilities depicted above.

During the study, we saw few organizations in operation across the globe that fully met the definition of a HIN. The organizations that most closely approximate HINs are usually commercial organizations which provide a full range of services, but usually for a narrow range of transactions or care processes.

All current Canadian jurisdictional health information exchange organizations provide, or aspire to provide, information exchange and interoperability. None provides clinical and business process management, and few aspire to do so. Some provide, or aspire to provide, some health information services. And while none provides clinical analytics today, a small number aspire to add that as a set of services and capabilities.

**HIN Planning and Operations Best Practices Discovery Framework**

The discovery framework provides a long-list of areas that an organization would likely need to excel at when implementing and operating a HIN. It is not expected that any one organization will excel at all of the activities included in the framework.

The Discovery Framework was used to guide the investigation into leading practices, and going forward, it can be used by HIN planners and operators to frame their activities.

The discovery framework comprises eight key activity groups, with detailed actions for each group. Some of them are closely related to specific stages in the life cycle of a HIN, while others are relevant at all stages as depicted below.

**Figure 2. HIN Planning and Operations Best Practices Discovery Framework Summary**

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Detailed descriptions of the key activity groups and the detailed actions required for each group of activities can be found in the Appendix.

**HIN Leading Practices**

A leading practice is an observable set of activities and processes that directly influences the successful attainment of a set of desired outcomes, as defined by the primary stakeholders.

The leading practices identified in this study provide HIN planners and operators with guides to implement or improve a policy, process or set of activities that have been shown to deliver benefits and desired outcomes in other health information exchange organizations.
The study identified 11 leading practices in the health information exchange organizations consulted for this white paper. They can be grouped under the following categories that make up the HIN Planning and Operations Best Practice Discovery Framework:

**Governance**

1. Engage entrepreneurial executive leadership to drive implementations and operations
2. Plan for project AND operational sustainability up-front

**Stakeholder Engagement**

3. Focus stakeholders on practical and meaningful outcomes
4. Employ a clinical scenario (use case) based approach to determining development and deployment plans

**Implementation**

5. Define and regulate/mandate/incentivize data ownership and data sharing, and establish data ownership and stewardship roles throughout the entire system
6. Pursue a practical privacy and consent model
7. Interoperability through setting, and adoption of standards and implementation specifications is a means to an end, not an end in itself
8. Technical architectures and approaches must be adaptable, and must be responsive to the data sharing use cases established by the key stakeholders

**Operations**

9. Implement rigorous change management protocols and tools
10. Leverage existing technical and organizational infrastructure capabilities to achieve more rapid clinical adoption and faster return on investment
11. Obtain vendor compliance through making a market.

There were no leading practices observed for a number of the components of the HIN Planning and Operations Best Practices Discovery Framework. These are areas in which Infoway and its partners will need to forge new thinking and practices.

It should also be noted that the leading practices were not reviewed against Canadian jurisdiction statutes or health care delivery frameworks. As such, policy makers considering adoption of the leading practices would need to review them in accordance with all applicable legislation, regulation and policies in their specific jurisdiction.
Key Actions for Infoway and Canadian Health Information Exchange Organizations

At a high level, the leading practices indicate five key actions that are relevant to Infoway and the Canadian health care information network organizations:

1. Align interests across all stakeholder organizations and individuals (as identified in leading practices 1, 3, 4, 5, and 11)
2. Strengthen and operationalize governance and stakeholder engagement (as identified in leading practices 1, 2, 3, 9, and 11)
3. Focus interoperability efforts on clinical scenarios or use cases, and outcomes-based plans (as identified in leading practices 3, 4, 7, 8, and 10)
4. Operate the HIN using a business services model (as indicated by leading practices 2, 5, 9, and 10)
5. Widely publish process, outcome and benefits metrics derived from the consensus among interviewees of the importance of such items, but not widely seen in evidence (as indicated by leading practices 1, 2, 3, 8, 9, and 10)
2. **White Paper Background and Context**

In late 2014, Canada Health Infoway initiated a study to identify current best and leading practices for implementers of health information exchange organizations. Infoway engaged Gartner to: develop a comprehensive Health Information Exchange (HIE) Implementation Planning and Operations Best Practices Discovery Framework; identify a representative group of the leading HIE implementations across Canada, the United States and the global landscape; analyze, based on the HIE Implementation Planning and Operations Best Practices Discovery Framework, key success contributors; and develop a comprehensive assessment in the form of an HIE implementations Best Practices white paper.

During the study it became clear that while health information exchange (HIE) is a term used throughout the industry to refer to a number of concepts, it is used mostly to refer to the exchange of data among organizations. In this white paper, we use the term health information network (HIN) to refer to an organization that not only provides technology and services to enable the exchange of health information, but also provides a broader set of capabilities and functions described fully in the HIN Definition section below.

In the context of this white paper, we refer to those organizations which are focused specifically on health information exchange (mostly current HIes) as “information exchange organizations.”

When we refer to a HIN, we are referring to an organization (or a group of organizations which have a single coordinating and direction setting governance structure) which provides the broader capabilities described above.

In the course of this study, Gartner interviewed executive, clinical and technical leaders from 15 organizations in nine countries. These organizations were selected based on their success and/or leadership in modernizing access, sharing and use of patient records in their respective jurisdictions or regions. Appendix C provides the profiles of participating organizations, as well as some information regarding the national contexts within which many of them operate.

This white paper describes leading practices derived from interviews with, and materials provided by, the organizations worldwide, as well as a number of best and leading practice findings supported by published Gartner research and general secondary research related to health care and other industries.

While the leading practices may have been derived from countries with health care and regulatory schemas that differ from those in Canada, they can provide health care policy makers, who are considering the creation or operation of health information networks in their own jurisdictions, with valuable insights. That being said, it is important to note that the leading practices were not reviewed against jurisdiction statutes or health care delivery frameworks. As such, policy makers considering adoption of the leading practices would need to review them in accordance with all applicable legislation, regulation and policies in their specific jurisdiction.

With regard to the use of terms such as best or leading practices throughout this white paper, there is little consensus in the literature as to what a best practice is. Gartner defines best practices as “A group of tasks that optimizes the efficiency (cost and risk) or effectiveness (service level) of the business discipline or process to which it contributes. It must be implementable, replicable, transferable and adaptable across industries.” Some writers look to a more rigorous definition which includes such concepts as proven, measurable, certification-based practices which deliver optimal outcomes through the application of repeatable procedures.

Due to the embryonic state of clinical data sharing and cross-organizational coordination and collaboration facilitated by health information exchange organizations, for the purposes of this
Health Information Network (HIN) Leading / Best Practices

3. Health Information Network Defined

Health information exchange (HIE) is a term used throughout the industry to refer to a number of concepts. It is used as a noun and a verb, and mostly is related to interoperability and exchange mechanisms. We have coined the term health information network (HIN) here to extend the concept to include a broader set of capabilities, functions and services.

A HIN, in the context of this document, is an organization which provides three key sets of core capabilities:

1. Information Exchange and Interoperability

The HIN provides the facilitation and coordination of clinical information exchange among various stakeholders in a private and secure way, including transmission of information and the management of exchange among the health care stakeholders using standardized mechanisms. Information can be understood and used by the other systems in the exchange using common information models.

2. Clinical and Business Process Management

The HIN provides some of the end-to-end coordination of data-driven and event-driven processes among stakeholders across care settings. It supports the coordination and central management of process events, but it also (and to greater effect) provides support for a distributed system which operates according to rules, but without centralized control.
3. Health Information Services

The HIN provides information technology services as common, callable services that can be utilized by authorized users and systems, for example:

- Notification and alerting services
- Access to (and sometimes management of):
  - Data repositories such as a longitudinal, patient-centric electronic health record
  - Registries for demographic information such as client and provider
  - Registries for clinical information, such as immunization, and registries by disease
- Care coordination services such as electronic referral and chronic disease management
- Clinical decision support services
- Enabling technology services such as those for privacy and security
- Analytics capabilities that
  - Leverage relevant information to support care delivery by providing relevant information for improved assessment and care decisions during an encounter – a primary use of the data captured and aggregated by the HIN
  - Support health system management by providing relevant information for improved management, policy and investment decisions in support of protection, diagnosis and care – a secondary use of the data captured and aggregated by the HIN
  - Can range from providing a platform for analytics capabilities all the way through to providing actual analytics services

Figure 3. HIN Core Capabilities

The HIN is one of the key components of an information technology enabled health ecosystem. It supports clinicians, caregivers and consumers in the health system, and is broadly accessible to authorized users. In addition to their core capabilities, HINs will have three key distinguishing attributes:

A HIN Enables Extensive Reach across the Continuum of Care. A HIN is designed to enable care and collaboration across a broad health care continuum between hospitals and health delivery organizations, and across non-affiliated care organizations. This collaboration may be across disparate regions, provinces, states, cities or counties, as appropriate. Although the HIN may not support this cross-boundary collaboration today, its design enables it to provide this in the future.
A HIN Enables Improved Consumer Outcomes and Value. A HIN moves beyond clinical data exchange to provide clinical information exchange. This information supports clinicians, caregivers and consumers in the health system by delivering the right information in the right context, to enhance and improve consumer/patient outcomes. This includes the facilitation and coordination of clinical information to various stakeholders in a private and secure way. And, in turn, this ensures that patient information is accessed by the appropriate parties, at the right time, and within strict patient information sharing guidelines.

A HIN is Sustainable. From an operational perspective, HINs are sustainable organizations that can adapt to the changing demands of health care stakeholders. HINs can rapidly adapt functionally and technically to support the short and long-term needs of health care organizations, while remaining financially viable.

HINs in the Canadian Context

During the study, we saw few health care organizations in operation across the globe that fully met the definition of a HIN. The organizations that most closely approximate HINs are usually commercial organizations which provide a full range of services, but usually for a narrow range of transactions or care processes (e.g., Surescripts across North America, Excelleris in British Columbia, and Health-e-Link in New Zealand provide these services in medication management or lab reporting).

Most health information exchange organizations report that they have no intent to deliver the level of capability included in the HIN definition. All current jurisdictional health information exchange organizations provide, or aspire to provide, information exchange and interoperability. None provides clinical and business process management, and few aspire to do so. Some provide, or aspire to provide, some health information services. And while none provides clinical analytics today, a small number aspire to add that as a set of services and capabilities.

Canadian jurisdictions and regions that aspire to create and operate full-fledged HINs will necessarily need to comply with privacy and other applicable regulations in their jurisdictions, consult common understandings that may already be in place in Canada, such as those developed by Infoway’s Health Information Privacy Group, and to create some of their own leading practices. However, there are certainly a number of leading practices identified within current health information exchange organizations.

One of the key observations is that an effective HIN providing broad, ongoing value to the health care system and its stakeholders needs to be an “operating” organization (not an initiative, project or program), which has dedicated leadership and staff who are empowered to operate the HIN as an operating entity, with committed long term funding. This committed long term funding should, in turn, be linked or representative of long-term value.
Observed Deployment Models

The study found few examples of organizations which encompass all aspects of the HIN services and capabilities as defined. However, there are health information exchange organizations which address the needs and preferences of the communities they serve by providing some aspects of a HIN.

There appear to be four basic operating models that are delivering value, as described by HIE organization leaders:

- Localized “point solution”
- Regional platform build out and operations
- Sub-regional solutions built on regional platform
- National/regional solutions integrated with other public and commercial services.

There can be a migration from one of these models to another over time. For example, a simple localized point solution can become a regional platform, or a sub-regional solution can become an integrated national or regional solution. Additionally, these models can co-exist and evolve as part of a broader federated health ecosystem.

The deployment of the different models has been observed to be driven by three differentiating environmental characteristics:

- The original motivating force behind the model deployed
- The organizations and individuals who are the key motivators behind the scope and features of the solution
- The technology and organizational platform used to build and deliver the services.

Localized “point solution” – Local providers have a specific need and engage local resources to build and operate a HIE organization using locally agreed upon scope and standard specifications (examples include provision of point-to-point distribution of discharge notices from acute care institutions to primary care providers in health authorities and geographic catchment areas, telehealth and home health monitoring, etc.).

- Motivating force behind the solution: Meet clearly agreed-upon local need and timelines
- Scope and features driven by: Practitioners and end-users
- Technology and organizational platform: Local point-of-service systems connected by proprietary or local standards and implementation specifications, operated by local provider groups (sometimes with support of regional IT organizations).

Regional platform build out and operations – HIE organization created by public sector or group of private sector providers, creating a platform for sharing data among local providers (examples include United States HIEs, some Canadian national and provincial HIE organizations, and the Israeli national HIE, which is an example of a successful migration from a localized point solution to a well utilized regional platform).

- Motivating force behind the solution: Support jurisdiction direction, public funding, generally drive down costs, and enhance quality of care
- Scope and features driven by: HIE organization leadership (with input from providers and other stakeholders)
- Technology and organizational platform: Usually a centralized repository with a standards-based information exchange platform, operated by the HIE organization (often a subset of the public sector health policy and administration organization – ministry, agency etc.)
Sub-regional solutions built on regional platform – Local groups of providers utilizing the technology platform and operating services provided by the regional platform to create specific local solutions (examples include an emerging set of services built and operated by Local Trusts in the United Kingdom developed on the capabilities of the National Health Service (NHS), collaborative video consultations, e-referrals, and e-consultations that are operated over existing infrastructure in Canada and the United States).

- **Motivating force behind the solution:** Meet clearly agreed-upon local or regional need
- **Scope and features driven by:** Administration and clinical leadership within provider organizations, with support from regional HIE organization leadership and technical resources
- **Technology and organizational platform:** Leadership and specifications provided by provider organizations. Usually a centralized repository with a standards-based information exchange platform, operated by the HIE organization (often a subset of the public sector health policy and administration organization – ministry, agency etc.)

National/regional solutions integrated with other public and commercial services – Solution leverages encompassing public policy and legislation, technical infrastructure, identification and authorization, transaction models and behaviours (examples include the Estonian national digital infrastructure which provides exchange and collaborative cross-organizational operations for health, justice and banking).

- **Motivating force behind the solution:** Meet clearly agreed upon local and regional needs utilizing existing assets to enhance quality of care
- **Scope and features driven by:** Administration and clinical leadership within provider organizations
- **Technology and organizational platform:** Leadership and specifications provided by provider organizations. Usually a centralized repository with a standards-based information exchange platform, operated by the HIE organization (often a subset of the public sector health policy and administration organization – ministry, agency etc.)
4. **HIN Planning and Operations Best Practices Discovery Framework**

Prior to investigating HIN best or leading practices, the study project team created a discovery framework which describes the areas in which HINs would likely need to excel at when implementing and operating a HIN. It is not expected that any one organization will excel at all of the activities included in the framework.

During the study, the discovery framework was used as a reference model, or set of hypotheses, as to where best or leading practices may be implemented by existing HIE organizations. In the future, HIN planners and operators can use the discovery framework to guide their planning and operations efforts.

The discovery framework was developed through Gartner research into the application of best practices overall, and, specifically, into those around implementation and operations of transformational technologies. It incorporates accepted frameworks and methodologies for assessing the success and maturity of health information technologies, and it received and incorporates significant input from the study’s Advisory Committee.

The discovery framework comprises eight key activity groups, with detailed actions for each. Some of them are closely related to specific stages in the life cycle of a HIN, while others are relevant at all stages. For example, Regional Strategies and Incentives, Planning and Scope, Implementation, and Operations activity groups are relevant only at specific stages of a HIN deployment timeline. However, Governance, Benefits Realization, Skills and Resources, and Stakeholder Engagement are activity groups relevant throughout the life of a HIN.

The diagram provides a high level summary of what each of the eight activity groups entails. For a detailed explanation please refer to *Appendix – HIN Planning and Operations Best Practices Discovery Framework Detailed Activity Group Explanations*.

While it is interesting to note that all of the leading practices identified in this study can be categorized into four of the eight key activity groups, other areas (e.g., Benefits Realization) were not identified by the organizations interviewed.
Figure 4. HIN Planning and Operations Best Practices Discovery Framework Summary

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**Governance**
- Program and Project Management & Governance
- Overall Funding Strategy
- Implementation Projects Sequencing
- New Clinical Content Creation Governance

**Benefits Realization**
- Business Case
- Formal Benefits Identification and Framework
- Outcome Focused (Clinical Adoption, Quality Imp., etc.)
- Key Performance Indicators

**Skills and Resources**
- Internal Skills and Resourcing
- Training
- Third-party Services
- Maintenance and Support

**Stakeholder Engagement**
- Multi-Stakeholder Engagement
- Change Management (Including Communication Strategy)
- Role and Character of Executive Sponsor
- Gov't and Government Agencies
5. **Study Methodology and Approach**

A structured three-phase approach was used to develop this white paper. The first phase consisted of developing and agreeing upon a number of key definitions, developing a HIN Planning and Operations Best Practices Discovery Framework, and identifying leading HIE organizations. Building on the outcome of the first phase, the second phase included structured interviews with those HIE organizations, review of Gartner research, other available research, reports from other health information exchange organizations, and vendor literature. It resulted in the documentation of a set of draft leading practices. The final phase included review of the drafts and refinement of the findings.

### Figure 5. Study Methodology and Approach Summary

<table>
<thead>
<tr>
<th>Best Practices Definition and Framework Design</th>
<th>Assessment</th>
<th>Validation and Reporting</th>
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<tbody>
<tr>
<td>Develop Framework</td>
<td>Confirm Definitions and Leading Organizations</td>
<td>Develop White Paper</td>
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<tr>
<td>Industry Models Gartner Models Primary Research</td>
<td>Conduct Primary and Secondary Research</td>
<td>Advisory Committee Review</td>
</tr>
<tr>
<td>Identify Leading Organizations</td>
<td>Identify and Document Leading Practices</td>
<td>Refine White Paper</td>
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An Advisory Committee made up of well-recognized subject matter experts in the HIE organization field from across North America provided feedback and advice throughout this project. In addition, Infoway architects and executive leadership provided valuable insight and direction throughout.

With input from Infoway, the Advisory Committee, Gartner Research analysts, and web-based research, the study team identified a number of leading HIE organizations. After applying a structured evaluation mechanism, a short list of 20 organizations was identified. The criteria for selection of leading organizations included Advisory Committee nomination and voting, time in operation, alignment with the Canadian model of health care funding and delivery, and positive coverage of achievements in media and industry publications.

The study incorporates feedback from 34 interviewees in 15 organizations from nine countries. The interviews included a mix of input from executive, clinical and technical leadership in these organizations.

In the interviews, the HIE organization leaders were asked to describe:

- The components of a HIN that have been implemented in their region
- How they defined success for the HIE/HIN (what were their objectives)
- What success they achieved (and how they measured that)
- Which of the components in the HIN Planning and Operations Best Practices Discovery Framework were most important to their success
- What were the practices and tools that they applied in those areas to achieve their success.

A structured tool based on the HIN Planning and Operations Best Practices Discovery Framework was used to probe each of these areas and highlight practices that led to success.

Upon completion of each interview, interviewees were asked for supplementary materials or collateral they could provide in support of the topics discussed during the interviews.

Given the wealth of information available in the public domain, the project team reviewed existing documentation related to health care and other industries to supplement interview findings, and to derive additional best or leading practices that are applicable in the context of a HIN. Analysis of the leading practices against legislative frameworks was not included in the study.

Finally, Gartner’s large pool of research and analysis related to HIN implementation, and Gartner research products were used to further flesh out health care market trends, HIN definitions, and potential leading practices. This was used to inform and corroborate the analysis and selection of the leading practices.

The study also resulted in a preliminary Capability Maturity Model discussion paper that health care policy makers, planners and information exchange operators can use to assess their current state capabilities, determine a desired future state, and develop concrete plans to achieve the future state. The HIN Capability Maturity Model was built upon three key pillars:

- Review and analysis of Capability Maturity Models used elsewhere in health care and in other industries and contexts
- The Strategic Opportunities and Key Enablers identified by Infoway’s strategic planning efforts
- The HIN Planning and Operations Best Practices Discovery Framework developed in the initial part of this engagement.

The HIN Capability Maturity Model was built at the detailed level, and refined based on input from the Advisory Committee. A summary view was developed from the details. That Discussion Paper can be found here.
6. HIN Leading Practices

Definition

As described earlier, leading practices in this white paper are defined as an observable set of activities and processes that directly influence the successful attainment of a set of desired outcomes, as indicated by the primary stakeholders.

The leading practices provide HIN planners and operators with considerations to implement or improve a policy, process, or activities that have been shown to deliver benefits and desired outcomes in other organizations. It is important to note that leading practices identified in other countries may not be entirely applicable to the Canadian context. Organizations in Canada are required to comply with all applicable legislation in their jurisdiction and as such, organizations are encouraged to assess the applicability of each leading practice to their specific context.

The leading practices outlined are designed to provide a practical foundation, and execution advice about a HIN planning or operating concept to help HIN planners and operators:

- Diagnose potential problems in their organizations
- Avoid common mistakes
- Implement new activities or processes
- Improve existing processes
- Avoid pitfalls and achieve better results.

To support the effective application of the leading practices, they each include:

- Active statements describing what a HIN should do to apply the leading practice
- Opportunity statements indicating the potential outcomes addressed by applying the leading practice
- Challenge statements indicating the roadblocks that organizations may encounter in applying the leading practice
- Additional detailed observations and evidence supporting and explaining the leading practice.

In addition to the leading practices identified through the interviews, the study provides a number of best and leading practices utilized in other industries which are relevant to HINs. These have been developed through review and analysis of Gartner Research, and overall industry reports.

Summary of Leading Practices

The study identified a number of leading practices that were evident in the HIE organizations we consulted. They can be grouped into the main categories that make up the HIN Planning and Operations Best Practice Discovery Framework as follows:

Governance

1. Engage entrepreneurial executive leadership to drive implementations and operations
2. Plan for project AND operational sustainability upfront

Stakeholder Engagement

3. Focus stakeholders on practical and meaningful outcomes
4. Employ a clinical scenario (use case) based approach to determining development and deployment plans
Implementation

5. Define and regulate/mandate/incentivize data ownership and data sharing, and establish data ownership and stewardship roles throughout the entire system
6. Pursue a practical privacy and consent model
7. Interoperability through setting, and adoption of standards and implementation specifications is a means to an end, not an end in itself
8. Technical architectures and approaches must be adaptable, and must be responsive to the data sharing use cases established by the key stakeholders

Operations

9. Implement rigorous change management protocols and tools
10. Leverage existing technical and organizational infrastructure capabilities to achieve more rapid clinical adoption and faster return on investment
11. Obtain vendor compliance through making a market.

Each leading practice provides guidance for HIN planners and operators to enhance their ability to support various components for each of the previously described deployment models.

The leading practices can be correlated to the potential Health System Benefits and Outcomes as defined by Infoway, to the HIN Best Practices Discovery Framework, and to the HIN Capability Maturity Model.

Detailed discussion of each of these leading practices follows.
Leading Practice 1: Engage entrepreneurial executive leadership to drive implementations and operations

**Summary**

**Leading Practice Overview:**

- There is a clear need for engaged entrepreneurial executive leadership to drive implementations and operations of the HIE organization infrastructure and adoption.
- Key attributes for the executive leader are broad vision with a bias for action, and a positive attitude toward risk taking.
- Another key attribute of the leader is the ability to work within the regulatory constraints or to drive the required change to achieve HIN outcomes and benefits.
- Identify and recruit leaders who are entrepreneurial, have a good understanding of the health care system, have strong existing relationships, and demonstrate sustained commitment.
- Ensure leaders can leverage necessary tools such as an enabling regulatory and funding framework, and the authority to leverage that framework.
- Coordinate independent dispersed leaders.
- Apply the appropriate leadership style for the circumstance, which, more often than not, means leadership to build coalitions and consensus, and then top-down decision making to ensure actions and deliver outcomes based on agreed upon direction.

<table>
<thead>
<tr>
<th>Opportunities:</th>
<th>Challenges:</th>
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<tbody>
<tr>
<td>Bring stakeholders who have different, and sometimes conflicting, interests together to find solutions which are in the best interest of the overall system</td>
<td>Identifying, recruiting and retaining individuals with the necessary attributes, relationships and capabilities</td>
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<tr>
<td>Allow HIE organizations to creatively work within regulatory, organizational and structural constraints to achieve system-wide improvements</td>
<td>In Canada, it will be difficult to provide centralized, directive leadership in the delivery system which is fractured with regard to structure, incentives and governance</td>
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<tr>
<td>Coordinate efforts by a central organization which has had consistent, longer-term leadership</td>
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<tr>
<td>In regions with dispersed organizations with overlapping HIE organization responsibilities, it’s even more important that leaders designate a central entity which has accountability for HIN vision and delivery</td>
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**Leading Practice Observations**

While very little specific guidance was available from the HIE organizations interviewed, or from the literature regarding specific steps or tools, there are a few themes that can be identified.
Identifying and recruiting leaders with the necessary skills, capabilities and attitude:

- While it is helpful for HIN leadership to have a clinical background, it is not absolutely necessary
- Although technology knowledge and experience is considered important, it is less important than clinical, administrative and executive skills and experience
- Longevity is a key contributor to success. Organizations where the leadership has been in place over a number of years show greater ability to achieve outcomes that meet the disparate needs and interests of the stakeholders
- A wide range of capabilities were described. Many were reflective of the environment and structure of the health system, but some of the consistent attributes were:
  - Being entrepreneurial
  - Having a good understanding of the health care system (including legal and regulatory environment, financial structures and stakeholder groups)
  - Maintaining strong existing relationships with funders, the bureaucracy (policy makers and regulators), administration (operators and funders) and provider groups
  - Demonstrating a clear vision and the ability to communicate that vision to different stakeholder groups
  - Exhibiting the ability to develop sustained commitment to that vision across a wide range of stakeholders, so that disparate organizations and individuals find a way to meet their needs within the context of working toward a well-understood, common goal.

It is important to provide leaders with key tools that they can use to achieve desired outcomes, which include (but are not limited to):

- A coherent, consistent and enduring vision and strategy for the health system as a whole, which they can use to frame the actions required of all of the disparate internal and external HIN stakeholders
- A regulatory and funding framework that can be used to achieve the desired outcomes
- The authority to leverage all of the avenues that are afforded within the regulatory and funding framework
- Enduring sponsorship at a jurisdictional or regional level for their vision and for their ability to act.

Coordination of independent leadership which is dispersed across many organizations with little common interest or vision:

- Development of a widely held common vision is key. Most of the successful HIE organizations report that their stakeholders are engaged and consistently act in a way to achieve a greater results based on a common set of principles and a vision for the system
- The existence of a regulatory framework, and the ability and willingness to enforce it, enables strong leaders to bring the various stakeholders to the table to achieve adoption and compliance
- Similarly, funding levers are used by strong leaders to bring the various stakeholders to the table to achieve adoption and compliance.

Top-down vs. bottom-up leadership style:

- HIE organizations report that while both styles are appropriate under different circumstances, strong top-down leadership is a necessity
- In addition, recent literature reports that the more advanced northern European countries are characterized by a more top-down health system structure and leadership
• The same reports indicate that reaching agreement about eHealth strategies, and even much more so, implementing them, has proven to be much more complex and time-consuming than initially anticipated
• Experience so far shows that regions or countries with more than five to ten million inhabitants tend to encounter very protracted, or even initially failed implementation attempts, particularly when they do not feature a top-down health care system.

Key Evidence

All of the more successful HIE organizations either described this as an explicit driver for success, or demonstrated this in the way they described the leadership of the organization, the roles played and the path to success.

Some of the organizations where this was reported or observed include: Canada - BC, Interior Health; Denmark, MedCom; Estonia, Estonia eHealth Foundation; Israel, Israeli Ministry of Health; Israel, Clalit Health Services; USA - Colorado, Colorado Regional Health Information Organization (CORHIO); USA - Michigan, Michigan Health Information Network Shared Services (MiHIN).

In a number of instances (Israel, Estonia, and, to a lesser degree, in BC and Alberta) success was predicated on a leader who had a vision, and was prepared to “take action and apologize later,” or ask for forgiveness, rather than permission. That is, they were prepared to take a calculated risk with the best evidence available, and make key decisions to move forward (these include decisions on whether there was adequate legislation to cover data sharing, which set of standards to use, creation and deployment of implementation specifications, which stakeholders to engage, what use cases and data should be in scope, and when to implement it).

A number of instances (including BC, Estonia, and Alberta) attributed their success to a strong leader who developed key relationships with the clinical community to achieve adoption.

In no case was technical leadership seen as a prerequisite or driver for success. A few instances (Israel, Estonia, and BC) named a good vendor who provided thought leadership and commitment to execution as a key success factor.

In addition, a number of resources from the literature review support this as a leading practice. One relevant reference is:

• Developing national eHealth infrastructures – results and lessons from Europe, Karl A. Stroetmann, MBA, PhD, FRSM, Jörg Artmann, MA, Veli Stroetmann, MD, PhD., empirica Communications & Technology Research, Bonn, Germany
Leading Practice 2: Plan for project AND operational sustainability up-front

Summary

Leading Practice Overview:

- Successful HIE organizations operate as a business with staff, infrastructure, third party contracts, and well-defined operating processes
- Ensuring that there is a well thought-out sustainability model in place is critical to the long-term success of HINs
- Focus on design and implementation of the following factors that influence HIN sustainability:
  - Overall Business Model: Implicit or explicit rationale of how to create and deliver value, including structure, partnership arrangements, financial arrangements, and the core products and/or services provided by the HIN.
  - Funding: Consistent, secure base funding from the jurisdiction (state/province/territory or nation) in which the HIN operates. A number of HIE organizations in the US have received sustained funding to provide a “public good.” Very few organizations described themselves as completely self-funded
  - Operational Excellence:
    - Maintaining effective infrastructure operations to provide reliable and fast messaging, storage and access
    - Ensuring effective onboarding of new partners or participants.
    - Common data sharing and data use agreements
    - Subsidiary agreements governed by an overall agreement as required.
    - Rapid creation and rollout of new HIN services
  - Measure and manage operating environments by looking at such metrics as percentage penetration rates of different stakeholders, number of transactions processed, percentage of encounters that utilize the HIN products and services, time to get a new capability or service in place, etc
  - Design the revenue model and leverage the regulatory regime to create high user expectations which must be met by the organization
  - Ensure sustained access to the skilled resources required to design, build and operate a HIN, use contracted resources or vendors for design and build, but transition to using internal staff for design and delivery over time
### Opportunities:

- Enhancing overall effectiveness and benefits realization by mandating the HIE organization plan for sustainment of ongoing operations from the start
- By demonstrating operational excellence, Canadian jurisdictions and regions will increase the use of more and more services that are acknowledged to provide real value, thereby supporting ongoing funding and growth
- Including a consumer-oriented perspective in the service delivery model, targeted customers, and partner network will provide opportunities for a range of revenue and funding opportunities, and will create a strong market demand for the HIN products and services

### Challenges:

- Identifying and getting approval for a business model that is appropriate for the jurisdiction and region in question, including identification of the underlying mandate for the HIE organization, the initial and ongoing funding model, and the resourcing model
- Committed funding is not likely to be provided by users of the solution in the Canadian context
- In order to “operate as a business,” the funding needs to be provided not on a grant or project basis, but on a sustained basis

### Leading Practice Observations

There is much consideration of the revenue or funding model to sustain HIE organizations. While this is a significant issue, it is not the only one related to the sustainability of these organizations. Other factors that influence sustainability include the overall business model, operational excellence, resourcing and portfolio management.

### Overall Business Model

Although few of the sustained HIE organizations that have some longevity refer to it as their “business model,” they all have an implicit or explicit rationale of how they create and deliver value including structure, partnership arrangements, financial arrangements, and core products and/or services they offer or will offer.

They are mostly in the form of a platform business model as described by Mark Bonachek and Sangeet Paul Choudary in the Harvard Business Review. Bonachek and Choudary describe three forms as follows. The Toolbox creates connection by making it easy for others to plug into the platform. This infrastructure enables interactions between participants. The Magnet creates pull that attracts participants to the platform. For transaction platforms, both producers of content and consumers of HIN products and services must be present to achieve critical mass. The Matchmaker fosters the flow of value by making connections between producers and consumers. Data is at the heart of successful matchmaking, and distinguishes platforms from other business models. The most advanced of the health information exchange organizations studied had elements of all three.

Many HIE organizations focus on the funding or revenue model when they consider the sustainability of their business model. It is clear from the study that ongoing sustainability requires clarity and execution around more than just finance, but on other aspects of “running a business,” such as:

- Value proposition
- Resources and capabilities
- Service delivery model and service catalogue
- Customer relationships
• Target customer segments and customers – potential users of the HIN products and services
• Channels
• Partner network
• Cost structure
• Revenue model.

**Funding**

Most organizations studied received consistent, secure base funding from the jurisdiction (state/province/territory or nation). Even some of the U.S. organizations described a majority of committed ongoing funding from state-based funding due to recognition that HIE organizations are a “public good.” Some U.S. organizations described a combination of public funding and revenues from customers for initial implementation and ongoing operations. Very few described themselves as being completely funded by operating revenues, and there are a few that are stand-alone, for-profit organizations.

The study observed a number of funding models, including:

• State/provincial/territorial grants for all operations of the HIE organization
• Payers contribute most of the operating expenses
• Health plans pay to deliver information to providers
• Hospitals pay fees for transactions
• Physician practices pay fees
• Hospital subscription fees
• Provider subscription fees.

Jurisdictional legislation, national or regional culture, and the health care delivery model all shape the most appropriate funding model for a HIE organization. Some of the key consistent attributes, however, are:

• The existence of committed ongoing funding, so that there is not the uncertainty of relying on annual allocations or project-by-project funding
• An oversight process to ensure that there is appropriate planning for and approval of capital projects, service extensions and other investments
• A stakeholder engagement process which ensures that investments are aligned with perceived stakeholder value
• In the cases where there is revenue from the stakeholders, while there are a number of models, and there are many hybrid or mixed models, the subscription fee model was observed as the most popular
• There is little evidence of HIE organizations demonstrating quantified return on investment to support their value proposition
• While most describe enhanced care delivery as their value proposition, few can tie funding or investment to these outcomes
• In cases where funding/revenue is provided by payers, the value proposition is mostly in terms of cost savings achieved through reductions in services utilization
• In cases where funding/revenue is by providers, the main value proposition is reduced data distribution costs and increased staff productivity.

Regardless of the funding model, most organizations studied were stand-alone for-profit or not-for-profit corporations. Some were public-private partnerships, and some were provided a mandate by a government agency, but they were largely operating independently and not part of a government department.
Operational Excellence

A number of organizations studied reported that operational effectiveness was a key driver to success. They described the need to maintain effective infrastructure operations to provide reliable and fast messaging, storage and access.

Equally as important, they described the need for effective onboarding of new partners or participants and help desk support. To this end, stakeholders described the creation of implementation guides and toolkits for different users, and they described having resources out in the community who help providers make effective use of the solutions.

A number described the challenge of providing support in an environment with multiple players, technologies and vendors. Some described having agreements with their vendors to provide support, or delegation of support, to other organizations in the ecosystem.

Common data sharing and data use agreements were another key operational element that they described. These agreements governed the overall data sharing and data use practices. Some stakeholders created additional agreements for some of their customers or members, but this was governed by the overall agreement. This enables rapid onboarding and ease of creation and rollout of new services.

Similarly, many described a standard set of services with an overall master agreement for the use of those services. Some organizations created service-specific agreements, but again these were governed by the overall agreement.

One of the study participants described a legal and operating framework where the organization’s stakeholders:

- Sign once (agreement)
- Connect once (capability to connect to the network)
- Publish once (profile/preference – patients and providers)
- Report once (send something once, and never provide it again in the same or different format)
- Log on once (consistent access to all services in the solution).

Organizations measured and managed their operating environments by looking at such metrics as percentage penetration rates of stakeholders (e.g., percentage of hospitals, practices or other stakeholders such as organ donors), number of transactions processed, percentage of encounters that utilize the service, time to get a new service in place, etc.

A number of organizations reported that they were driven to meet high user expectations, and this drove a necessity for operational excellence. The need to meet these user expectations comes from the revenue model (i.e., funding from users and the need to show value), or the regulatory regime (i.e., a legislated responsibility to provide users with access to information in a timely manner regardless of location).

Resourcing

Sustained access to skilled resources is necessary for design, build and operations. Many organizations around the world develop and retain their own internal technical teams; this was observed to be the predominant sourcing model. In the U.S., there is higher reliance on vendors to build (and sometimes to operate) the solution. In the U.S., Canada and New Zealand, vendors operate some parts of the solution (e.g., medication management or distribution of lab results), the vendors internally resource these, and then they interconnect with other players in the ecosystem.
A number of organizations reported that they had started using contracted resources or vendors for design and build, but found that, over time, they could be more effective in design and delivery using internal staff. These organizations retain the planning and architecture roles.

Some vendors described a mechanism whereby they had gone through the necessary effort of identifying and contracting with a number of approved vendors or contractors who could be called upon quickly, and with little overhead, to engage in design, build or operations on an as-needed basis.

**Key Evidence**

Almost all of the European organizations reported providing a committed funding model using public funding while almost all U.S. organizations reported receiving some funding from public sources. Some, such as the New York eHealth Collaborative (NYeC), and all HIEs in New York State, receive committed funding for all of their operations.

HealthLink in New Zealand and Inland Empire HIE (IEHIE) in California reported being completely self-sustaining. Both have a mixed revenue model, but while IEHIE reports mostly funding from the payer groups, HealthLink reports a revenue model primarily from providers.

Organizations such as Colorado Regional Health Information Organization (CORHIO) in Colorado, Michigan Health Information Network Shared Services (MiHIN) in Michigan, MedCom in Denmark, Integrated Health Information Systems (IHIS) in Singapore, and Inera in Sweden reported starting with external contractors, and then creating an internal staff capability to achieve cost and delivery advantages.

Many of these organizations report having created a network of approved vendors with negotiated master agreements to allow them to rapidly and cost effectively respond to new demand.

Outside of Canada, the organizations studied were all standalone organizations that were expected to “operate as a business” – Inera in Sweden, MedCom in Denmark, IHIS, NYeC, MiHIN, HealthLink, and the HIEs such as CORHIO.

Contrast this with the experience in Canada, where the HIE organizations are largely within the mandate of a government agency with a limited direct mandate. For example, Netcare Alberta which is “the name for all the projects related to the provincial Electronic Health Record (EHR),” and “is an initiative of Alberta Health, in collaboration with Alberta Health Services and the colleges and professional associations of health professionals, and health information regulators.”

MiHIN described having master agreements and separate use case agreements. This turned out to be powerful, as it allowed stakeholders to sign up to use some use cases and not others.

Most European organizations also described a common legal framework including standard data sharing, data use, and overall participation agreements.
Leading Practice 3: Focus stakeholders on practical and meaningful outcomes

Summary

Leading Practice Overview:

- The most successful of the HIE organizations engage their key stakeholders to identify meaningful operational outcomes which support an overall vision
- They use this approach to specify the initial capabilities and services to be developed and delivered
- And they continue to engage this key representative group to determine priorities and to manage an ongoing “product release” or a set of “product and service portfolio management” processes
- Take a “business case approach.” For each proposed solution implementation, a clear outcome is identified in business or operational terms, while a sponsor enables one or more of funding, commitment to use, encouraging peers to use, and enforcement through regulation, licensing/certification, or other policy mechanisms
- Create practical and effective governance structures. That means ensuring representation from organizations (such as professional organizations, payer organizations, vendors and policymakers/regulators) and working groups created to address specific issues
- Continually engage with the groups to set direction and expectations, as there are no shortcuts or “silver-bullets,” and consistency and perseverance are necessary for build-out and ongoing operations
- Balanced application of bottom-up and top-down identification of initiatives: identifying and validating priorities through a mix of executive leadership and grass-roots stakeholder engagement
- Expand outcomes and benefits beyond health care delivery organization, providers and administrators, to include consideration of increasing consumer expectations and capabilities to access and use information, and to plan and manage their health
### Opportunities:

- Ensure value and achieve adoption by working on those capabilities, services and functions that are of the highest priority to key stakeholders.
- Provincial or regional HINs can enhance adoption and introduce business processes to support care coordination by creating focused working groups, tasked with identifying and addressing key challenges in their care domain, disease domain or demographic focus.
- Ensure that the HIN enables relevant advanced uses, and reduces effort for compliance.
- Transition of the HIN to a service model to maximize utility and benefits to clinicians and consumers.

### Challenges:

- Identifying the relevant stakeholders who can best articulate capabilities and their priorities.
- The sheer time and energy required to engage stakeholders, and to develop a reliable roadmap with the necessary approvals, funding and buy-in.

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### Leading Practice Observations

All HIE organizations reviewed stated that part of their success was a result of ongoing and active engagement of clinical stakeholders across the jurisdiction or region to develop a roadmap for what capabilities and services should be delivered, to participate in the definition of the data and specifications of the capabilities, and to promote the use of the functionality, features and services provided. When asked to describe practices, actions or tools, the almost universal response was that “there is no silver bullet, it takes a lot of time, a lot of work, and a lot of conversations.” Some themes emerged, however:

#### Taking a “business case” approach

Michigan Health Information Network Shared Services (MiHIN) provides the most extreme example of this with its *Use Case Factory* methodology and tools. In this case, an initiative is proposed by an organization or individual, who uses a structured set of tools to define and specify the desired capability or service. However, it is initiated and implemented only once a sponsor (or sponsors) who commit(s) to fund the implementation has/have been identified.

Less formal and less rigorous models can be observed. But in all models, a clear outcome is identified in business or operational terms. And sponsors are identified who will provide one, or more, of three key enablers:

- Funding
- Commitment to use, and commitment to encourage partners and peers to use the capability or service
- Enforcement of the use of the capability or service through regulation, licensing/certification, or other policy mechanisms.

Without a credible sponsor who can apply one of these levers, adoption and benefits realization will be low.

#### Creating a practical and effective governance structure
Three keys to creating practical and effective governance structures were observed. The first is to be inclusive of all relevant stakeholders. Organizations report including representation from:

- Providers’ professional organizations (such as professional colleges, professional associations, etc.), representatives from key provider organizations in a region, individuals who are recognized to be respected, and influential thought leaders
- Payer organizations, including industry groups, and representatives of key payer organizations
- Vendors, including industry organizations and representatives of key provider organizations
- Regulators and policy makers.

The second is to constitute working groups to address specific issues:

- Working groups are created as needed, provided with a specific mandate, and disbanded when they are no longer needed to address the mandate
- The working groups have representation which is as broad as necessary to get relevant inputs, and to enhance likelihood of adoption of the outcome
- They are working groups, so membership is constrained to those that have a real interest and capability to actively participate, and they are provided with a clear set of expected outcomes.

Finally, the effort requires consistency and perseverance:

- Stakeholders report that there are “no shortcuts and no silver bullets”
- Leadership of the HIE organization must continually engage with the groups to set direction and expectations
- Plan and budget for many interactions over extended time frames.

**Balanced application of bottom-up and top-down identification and prioritization of initiatives**

While most of the leading HIE organizations reviewed reported active stakeholder engagement for identifying priorities and timing for which capabilities to develop, many also reported that the management and leadership of the HIE organization provide direction for features and capabilities. In this case, it is most often provided by executive leadership, rather than the technology leaders or by the enterprise architecture team.

**Key Evidence**

A number of study participants reported specifically focusing working groups on key outcomes. The province of Alberta created The Advisory Clinical Working Group, which was a core group of 12 individuals with several subgroups consisting of 35 additional people who collaborated frequently on the strategy and tactics related to the HIN.

Alberta continues to facilitate a number of Strategic Clinical Networks (SCNs), which are networks of people who are passionate and knowledgeable about specific areas of health. The SCN is challenged to find new and innovative ways of delivering care to provide better quality, better outcomes and better value. There are currently 10 SCNs including Addiction and Mental Health, Bone and Joint Health, and Cancer.

Interior Health in BC reported that some of its early successes were driven by an extended local group that was very focused on discharge summaries.
The New York State eHealth Collaborative (NYeC) maintains specific workgroups that are focused on specific items, as did the government of Estonia and Integrated Health Information Systems (IHIS) in Singapore.

The Israeli national experience directed from a top-down perspective, but was built on a platform created by Clalit Health Services. So an example of success that had been built by, and had buy-in from a diverse health care system was replicated and extended using a top-down management approach.
Leading Practice 4: Employ a clinical scenario (use case) based approach to determining development and deployment plans

**Summary**

**Leading Practice Overview:**

- Success is achieved by clearly identifying and implementing practical and meaningful activities, processes and outcomes in the form of clinical scenarios or use cases.
- The scenarios or use cases need to factor in the unique and appropriate requirements for respective jurisdictions or regions.
- Foundational technology infrastructure and a base platform are necessary, but that is not sufficient to achieve adoption and benefits realization.
- Engage users to develop the scenario or use case (identify the desirable outcomes from care coordination, identify the expected players in delivering that outcome, and define the information and actions required by those players), and then build those capabilities on top of the interoperability and exchange platform.
- The most successful organizations demonstrated the following approaches to developing scenarios or use cases:
  - Locally developed methodologies supported by local governance structures.
  - Drove early success by focusing on a set of widely accepted initial scenarios or use cases.
  - Mostly focused on data sharing, and not very advanced with respect to process management.
  - Focused on locally derived scenarios or use cases in addition to national or regional scenarios or use cases.
### Opportunities:
- Provide sponsors and funders greater insight into what returns they can expect
- Address the challenge of user adoption and active utilization by communities of users
- Facilitate and expedite the achievement of critical mass and the realization of the network effect that is considered to be one of the critical success factors in deployment of the HIN
- Positively impact adoption by focusing on provider or domain-specific clinical information sharing use cases
- Extend the current state in which Canadian solutions largely provide view access to longitudinal records, and some push notifications
- Advance a number of the strategic initiatives and opportunities for actions, including increased data access and enablement of advanced uses, accelerated systems integration, and structurally ensuring that all stakeholders have a voice in clinical interoperability

### Challenges:
- Base level of technical interoperability and interchange infrastructure need to already be in place
- Identifying the highest value use cases and determining their sequencing

### Leading Practice Observations

Interoperability through setting and adoption of standards and implementation specifications is a means to an end, not an end in itself. The end is widespread adoption of HIN capabilities and services that enhance access, deliver better outcomes for the overall health system, and drive down costs.

The more successful and mature HIE organizations interviewed reported taking an outcomes-based approach to defining and agreeing on what services and capabilities to develop and deploy. Some of these organizations referred to the outcomes (what is shared, by whom, and to what end) as use cases. Non-technical stakeholders may consider these as real-world scenarios which describe the key players, their actions, automated processing, and initial and final conditions. Stakeholders describe these as a way of ensuring that real-world solutions are identified and delivered, and as a means to ensure uptake of the solution once it is deployed.

#### Locally developed methodologies supported by local governance structures

High levels of value and rates of adoption are reported to have been delivered in shorter time with the structured and disciplined application of use cases and user stories.

There are a number of effective methodologies and tools to identify, develop and manage the highest priority use cases, including documentation of those use cases, and development of a set of requirements that can be traced back to business functionally. Only one of the organizations interviewed identified a structured methodology for identifying and documenting the use cases to be delivered. All reported well understood processes which fit within their overall stakeholder engagement and governance structures.
This is corroborated by the well-understood need for disciplined testing and release management. Many of the organizations interviewed reported that part of their ongoing success (and no small degree of the ongoing operational challenge) is due to maintaining disciplined testing, change management and release management. Applying the same use case and test case-based rigor to the front-end of the product development process is as important here as it is to the back-end release and deployment process.

**Drive early success by focusing on a set of widely accepted initial use cases**

HIE organizations report a relatively consistent set of initial, high priority use cases. They include:

- Query access to some subset of data in a longitudinal health record (the data included varies quite widely among the early adopters, but they each reported having developed a constrained initial set of data and then expanding that based on: industry experience; regional, national, and international standards; and documented practical implementation specifications)
- Pushed delivery of discharge summaries to stakeholders who are pre-identified as having an interest and are authorized to receive the information
- Other types of pushed notification (e.g., immunization) to pre-identified and authorized stakeholders as determined by the working groups
- Pushed delivery of lab orders and lab results
- Parts of the medication administration cycle, starting with medication lists, and electronic prescriptions
- A variety of electronic referral support ranging from a message requesting an in-person consultation, through to a more complex process of conducting an initial electronic consultation, with supporting clinical information, to determine whether an in-person consultation is required, or if there is an alternative course of action.

Key stakeholders report that in the near future HINs must include use cases which are consumer-oriented and which consider existing and emerging devices and communication and collaboration platforms to provide patients and caregivers the ability to plan and manage their health and that of their families. They also point out that key future scenarios and use cases to be considered include: quality improvement, system improvement, practice improvement, and population health improvement.

**Use cases mostly focused on data sharing, and not very advanced with respect to process management**

A pervasive finding is that the use cases developed and in production focus largely on data access and sharing. There are few instances of use cases that focus on full business or clinical processes with multi-step workflows, and coordination or management of tasks among multiple stakeholders. There are some use cases which provide ordering type of functionality (e.g., e-referrals, lab orders, e-prescriptions) but they are usually one way, and single-step functionality. There is little evidence of process management which supports dialogue, data-based branching, or data or analytics-supported routing.

Most organizations (internationally and in Canada) explicitly saw their mandate as providing data sharing and data exchange, and not as providing business or clinical process management. These organizations provide little in the way of current or emerging leading practices to achieve this aspect of the HIN.
Focus on locally derived use cases in addition to national or regional use cases

There is some evidence that local organizations, while complying with regional or national functionality rollouts, will also work on developing use cases that meet the needs of their local stakeholders built on top of the national or regional infrastructure.

For example, while some local regions in Canada worked on delivering notifications that had a high priority for the providers, at the same time, they were working on view access to provincial registries. In the United Kingdom, there is evidence that some of the local Trusts are using locally developed capabilities, as well as capabilities provided by their common infostructure (i.e., Spine) to meet specific needs at the local level.

Key Evidence

MiHIN has created a trademarked methodology, Use Case Factory, which it applies with discipline. Other organizations including CORHIO, Estonia, MedCom and others described having working groups come together to identify priority use cases and then having their internal staff, or vendors, build them out.

HealthLink in New Zealand reported that focusing on delivery of lab results to primary care physicians drove their initial success. Other national efforts such as Estonia, Denmark, Inera in Sweden, and IHIS in Singapore also reported addressing specific, high priority use cases in addition to providing general view access.

Canadian regional efforts, such as BC Interior Health and Ontario groups like Champlain eConsult, report creating locally specified solutions, and there are industry reports that some of the United Kingdom Trusts are doing the same.
Leading Practice 5: Define and regulate/mandate/incentivize data ownership and data sharing, and establish data ownership and stewardship roles throughout the entire system

Summary

Leading Practice Overview:

- Coming to agreement on data governance and data sharing are impediments to rapid creation and implementation of new services, and to onboarding new stakeholders
- Develop standardized data sharing and use agreements with appropriate rights and responsibilities to achieve an accelerated adoption timeline
- Leading organizations create overarching agreements for data use and data sharing, provide a structure for creating subsidiary agreements for specific data and data domains, and provide this as an overall structure for their services
- Incentives are an excellent tool to move the market in a favourable direction, however, appropriate policy mandates have proven more effective when practical
- Leading organizations often need the support of (or direction from) national or jurisdictional governments, who must use their power to create the regulatory and policy framework which allows this approach to building and delivering HIN services
- In some jurisdictions this is supported by a culture and policy framework which mandates that the ownership of clinical data is clearly defined in law, thus requiring all the partners and customers of the HIN to agree to a consistent set of principles, standards and processes with regard to the use and sharing of patient data

Opportunities:

- Reduce the cost and time to deploy new services and to bring new stakeholders on board
- Obtain rapid uptake, expedited implementation and broad adoption through consistent and transparent trust relationships across all players who utilize the HIN’s services
- Increase clinical data access and enable authorized advanced uses of clinical data within a jurisdiction or region
- Provide the required foundation to help transition HINs to a service model in order to maximize utility and benefits to clinicians and consumers

Challenges:

- Aligning incentives and interests of diverse health care stakeholder groups
- Obtaining the necessary level of engagement at the policy and regulatory level, and creating the necessary regulations
- Developing comprehensive agreements which are simple to understand, implement and monitor is a complex and time-consuming undertaking
- While all provinces and territories have developed incentive systems to encourage adoption of EMR systems and sharing of data, operationalizing the exchange of information continues to be a challenge

Leading Practice Observations

Establishing an effective overall framework and agreement for sharing and protection of patient data among the key stakeholders in the HIN is critical to effective onboarding, implementation and adoption.
It is essential that a HIN define the broad rights and responsibilities that go along with having access to the HIN infrastructure, and determine the best way to define the required protection for specific data elements that will be shared via the HIN.

The leading practices study suggests that the more successful organizations define a common set of rights and responsibilities that go along with becoming a member of the HIN, and then augment with specific requirements related to specific use cases or clinical scenarios. The common agreement also covers the fiduciary responsibility of data quality so that the data can be relied on later downstream. This includes defining ownership, control and custody as well as right of access to personal health information. Without adequate attention to ensuring that the point-of-service systems enforce and validate data quality, the health care system’s stakeholders will quickly lose trust in the system and adoption will be significantly constrained.

**Key Evidence**

MIHIN has established a statewide data use and reciprocal support agreement that defines the accountability, terms and conditions and responsibility of each of the HIN participants. This document is then augmented by a series of specific agreements about the protections and use related to a series of supported use cases.

Israel Ministry of Health has established legislation that spells out the responsibilities of all stakeholders with respect to data stewardship and responsibility for protection of consumer health data. Each of the major health systems is accountable to protect the data and allow its sharing for purposes of treatment.

U.S. Office of National Coordinator within the Center for Medicare and Medicaid Services provides a template (referred to as a Data Use and Reciprocal Support Agreement - DURSA) that can be used for the state or regional HIE organizations to establish the trust relationship and role and responsibilities related to all stakeholders and participants. Each state then develops its own unique version of the agreement for the operating HIE organizations within its jurisdiction.
Leading Practice 6: Pursue a practical privacy and consent model

**Summary**

**Leading Practice Overview:**
- All successful HIE organizations studied have adopted an implied consent model, sometimes referred to as “opt-out”
- Organizations using a hybrid or opt-in approach cited this as a barrier to success.
- There appears to be ample support by citizens and regulators for the implied consent or opt-out model, in concert with tight restrictions on data access and/or use, including stringent penalties for misuse.
- All Canadian provinces and territories have implemented an implied consent model, and this approach appeared to have addressed patients’ concerns regarding the appropriate use of their clinical data in the course of diagnosis and treatment in most jurisdictions.
- There will be opportunities, as technology advances, to enhance the information exchange infrastructure with additional capabilities for more granular control for how, and with whom, the health care data is shared.
- A granularity approach focuses on restricting or managing access based on attributes such as provider, time range and purpose. The most prevalent model is granularity by provider that allows patients to exert some control, not over which data is shared, but how and with whom.
- Many organizations have a mechanism to manage the concept of an “active care relationship.” The solution manages access such that the only people who can get information are individuals who have an “active care relationship.” These can be declared or inferred in a number of ways. Management of “active care relationships” includes reporting access to information, reporting inappropriate attempts to access information, and the ability for patients to contest a declared “active care relationship.”

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<tr>
<th>Opportunities:</th>
<th>Challenges:</th>
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<tr>
<td>Overcome the monumental task of getting all key stakeholders to agree on how patients’ right to privacy of their clinical data should be protected, and develop a solution which allows the HIN to achieve the required critical mass and network effect</td>
<td>Working with the jurisdiction’s policy makers to establish a preference for an implied consent model, aligned with regulatory constraints</td>
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<td>Advance the achievement of such strategic drivers as increasing data access and reducing effort for compliance</td>
<td>Mentoring, training and coaching the clinical community to comply</td>
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<td>Establishing common infrastructure for province or territory-wide granular consent management to be used by all point-of-service systems</td>
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<td>Achieving agreement on an appropriate privacy and consent model can be relatively easy, but effectively applying it in practice poses a much greater difficulty</td>
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Leading Practice Observations

Proper privacy and security protection and suitable supporting infrastructure are fundamental to the success of HIE organizations. Yet, many organizations continue to struggle with the selection and implementation of the most appropriate consent models for their jurisdictions. Core consent options for HIE organizations include the following:

- **No consent** – Health information of patients is automatically included and patients cannot opt out
- **Implied consent (or opt-out)** – Default is for health information of patients to be included automatically, but patients can opt out completely
- **Implied consent with exceptions** – Default is for health information of patients to be included, but patients can opt out completely or allow only selected data to be included
- **Opt-in** – Default is that no patient health information is included and patients must actively express consent to be included, but if they do so, their information must be all in or all out
- **Opt-in with restrictions** – Default is that no patient health information is made available, but patients may allow a subset of select data to be included.

Choosing a consent model is often a difficult issue to resolve, in part because of economic, technical, cultural and legal considerations, but also because the various stakeholders involved have strong positions on the best approach. Determining when and how an individual’s consent should be obtained for the exchange of electronic health information is usually a complicated policy decision for most jurisdictions. It is one that requires consideration of a number of complex issues, and a determination of how to balance the needs of the participants along with desired societal outcomes.

There are a number of examples of HINs starting with an opt-in model and, after lack of success in achieving critical mass and conducting post-mortem studies, they developed a plan to move to an implied consent or opt-out model.

Since adoption and uptake of clinical information exchange is challenging for many jurisdictions or regions, in order to enhance patient participation, most successful HIE organizations have adopted an implied consent (opt-out) or no-consent model, in concert with tight restrictions on data access and/or use, including stringent penalties for misuse.

However, when it comes to sensitive data such as mental health, substance abuse and HIV/AIDS, most HIE organizations have settled on a conservative (i.e., more limited) interpretation of the laws related to the exchange of sensitive health information, and a determination of what is reasonable and procedurally and technically feasible to implement. This process has led many entities to a granularity approach that allows patients to exert some control, not over which data are shared via the exchange, but how and with whom.

**Granularity by Provider** – One way of addressing consumer concern about electronic exchange of sensitive health care data is to restrict information access to only those providers approved by the patient. This method is referred to as granularity of consent by provider. There are three main approaches for how this can be handled:

1. The patient is given the option to permit access to only specific individual providers
2. The patient is given the option to permit access to only specific provider or staff types (e.g., all MDs and RNs could be granted access, but not office staff)
3. The patient is given the option to restrict access at the provider entity level (e.g., primary care and cardiology practices are granted access, but the allergist is not).
Granularity by Time Range – Another possible, though rarely applied, granularity option involves the inclusion or exclusion of information based on the time/date associated with an element of clinical data. Theoretically, this method could be handled in a number of ways, and used for a variety of reasons.

Granularity by Purpose – A third granularity category involves segmentation according to the intended use or specified purpose for which data can be accessed via electronic exchange. With this type of consent, patients would have the option to consider the possible uses of their information that is available via electronic exchange (e.g., care delivery, quality improvement, clinical research, health services research), and then determine which uses would be acceptable to them (i.e., consent to use of information for specified purposes only). Of course, the latitude that any particular patient would have to deny use of his/her information for treatment purposes would be subject to the laws of the relevant jurisdiction and consent model policies established for the particular electronic exchange. The same would hold true for other purposes that may not require a patient’s consent, such as public health surveillance.

The most prevalent models observed in the organizations in the study were a version of implied consent or opt-out with exceptions, and granularity by provider.

Many organizations had a mechanism built into their solution which allowed for management of the concept of an “active care relationship.” This has different names in different organizations, and is defined and implemented somewhat differently in different organizations. But, essentially, the solution manages access such that the only people who can get information are individuals who have an “active care relationship.” These relationships can be declared or inferred in a number of ways, for example:

- Declared by the provider (physician, or provider organization)
- Declared by the patient
- Assigned by a health plan or other organization who has defined risk and care responsibilities
- Inferred by the system based on agreed upon rules and processes.

The management of “active care relationships” includes reporting of who has accessed what information, monitoring and reporting of inappropriate attempts to access information, strict penalties for inappropriate access, and the ability for patients to contest a declared “active care relationship.”

Key Evidence

The following observations and descriptions from the study interviews provide examples of how many facets of the leading practice described above have been put into successful use by the HIN planners and operators:

- A majority of the HIE organizations interviewed for this study cited an implied consent or opt-out model to have been instrumental in helping them achieve the success they were enjoying. This included HINs in countries as diverse as Estonia, Israel, New Zealand, Sweden and the United States.
- In Australia with the introduction of the Personally Controlled Electronic Health Record (PCEHR), planners and operators found that their opt-in privacy strategy is a significant obstacle to achieving consumer acceptance. So, after a national study in 2014, there is now expected legislation to move to an implied consent model.
- New York’s eHealth Collaborative (NYeC), which is a network of a number of regional HIE organizations in the State of New York, started with an opt-in consent policy, and eventually found that moving to an implied consent policy is a critical success factor for
the continued success of the organization.

- Denmark’s MedCom uses a verbal opt-in consent model, and was observed to have achieved great success and adoption due to its robust government e-services infrastructure, mandated use of e-referrals and admission, discharge and transfer (ADT) notifications and all-electronic billing/“no paper billing allowed” policy, but the direct positive contribution of the opt-in consent model to its success does not seem to be obvious.
Leading Practice 7: Interoperability through setting and adoption of standards and implementation specifications is a means to an end, not an end in itself

Summary

Leading Practice Overview:

- Leading organizations pull together a representative group of clinicians with different roles within the health care value chain to establish a minimum data set. That data set then serves as the basis for evaluating the most appropriate standards and implementation specifications for structure, content and code sets.
- Standards are not sufficient, as organizations must develop and implement detailed and rigorous implementation specifications based on those standards to enable effective implementation and interoperability.
- Leading organizations establish standards and implementation specifications for specific sets of care transition activities, on a use-case-by-use-case basis.
- Focus on the desired outcomes enabled by interoperability (e.g., improved care through coordination, reduced cost of managing chronic disease, reduced medication related errors, etc.)
- Include standards and implementation specifications for widely adopted consumer devices and platforms as well as for point-of-care solutions and repositories.
- Local standards and implementation specifications can be created if deemed to be faster or more appropriate for respective use cases, but most participants opted for international transport, technical services, content and structure, and vocabulary standards.
- Pursuing bottom-up agreement and top-down implementation was a prominent theme among successful implementers.
### Opportunities:
- Achieve exchange of commonly defined and mutually understood clinical data about a patient to achieve certain clinical outcome(s) or address a treatment need among independently operating health care professionals involved in the diagnosis and treatment of a patient
- Establish a minimum number of clinical use cases at the national level that must be implemented within a certain timeframe
- Support for the strategic drivers to increase data access, enable advanced clinical uses, accelerate systems integration, and reduce effort for vendor technology compliance

### Challenges:
- Even after data is shared, its definition and usage may be slightly different among the exchange partners, and not suitable for use in the recipient’s intended workflows
- Moving beyond standards definition to the development of implementation specifications requires significant dedicated effort of skilled technical resources
- Adoption and use of shared clinical data in the clinician’s workflow continues to be a challenge for a number of jurisdictions
- While some level of data sharing from the hospital to the primary care physician (PCP) in Canada is common, many regions still need to work at adopting the use of shared clinical data within clinicians’ workflows, while ensuring data is structured and consistent enough so that it can be interpreted in a dependable way

### Leading Practice Observations

Establishing standards and implementation specifications to achieve ubiquitous interoperability among independently developed and operated point-of-service systems has been a long-term goal of many in the health care sector. This desire for interoperability extends to all of the information systems and clinical data repositories within the health care ecosystem that may have relevant clinical data that is of benefit to properly diagnose and treat a patient. Examples of this include lab information systems, diagnostic imaging systems, drug information systems, and other specialized registries and repositories.

Many health care commercial-off-the-shelf system providers attempt to adopt and implement the most common standards within their systems. Yet despite the significant level of activity around making clinical information shareable and understandable among the systems and practitioners, there is a wide gap of clinical adoption and meaningful use of this shared information. This is partly due to the lack of detailed implementation specifications which drive effective and consistent application of the standards.

The primary success factor cited by a number of study participants was the significant collaborative work of a representative group of clinicians with different roles within the health care value chain, to establish exactly what minimum set of clinical data needed to be shared between two health care professionals who are engaged in mutual treatment or delivery of care to a patient, and how that data would be interpreted and used in the recipient’s next set of workflows.

Once an agreement was reached for a specific purpose and use case, an evaluation of all available international and local standards was made to choose the most appropriate standard(s) for structure, content and code sets to be used to achieve the purpose of the use case, and a set of specifications was developed for consistent application of those standards.
In many instances, local standards and implementation specifications were adopted or created, since that was considered to be faster and more effective to meet the use case(s) identified.

Interoperability through setting, adoption and implementation of standards and implementation specifications is a means to an end, not an end in itself. Based on the study findings, the focus of establishing standards and implementation specifications should be on the desired outcomes enabled by interoperability (e.g., improved care through coordination, reduced cost of managing chronic disease, reduced medication related errors, etc.).

The HIE organizations interviewed that demonstrated higher levels of clinical data exchange success took a use case driven approach to defining and agreeing on what specific data elements should be shared and to what end, typically at the transitions of care. An empowered, representative group of clinicians would then agree to use international, de facto, or local proprietary standards and develop specifications for consistent implementation to achieve the intended outcomes among the data sharing partners.

Most HIE organizations adopted the following standards in several key categories to facilitate adoption:

- **“Transport standards”** to establish a common, predictable, secure communication protocol between systems (Simple Mail Transfer Protocol (SMTP) RFC 5321; Secure/Multipurpose Internet Mail Extensions (S/MIME); Hypertext Transfer Protocol (HTTP) 1.1; Transport Layer Security (TLS) Protocol Version 1.2, RFC 5246; Simple Object Access Protocol (SOAP) 1.2, etc.).
- HIE “technical services standards” consist of infrastructure services and components deployed and used to accomplish specific information exchange objectives (e.g., ONC Direct; IHE XDS, PIX, PDQ, XDA, XCPD; FHIR; DICOM; IHE CSD, PHD; etc.).
- **“Content and structure (i.e., syntax) standards and specifications”** and value sets used to share clinical information such as clinical summaries, prescriptions and structured electronic documents (e.g., HL7 V2.x, V3, CDA R2, FHIR; NCPDP; etc.)
- **“Vocabulary (i.e., Symantec) standards and specifications”** consist of nomenclatures and code sets used to describe clinical problems and procedures, medications and allergies (e.g., SNOMED-CT, ICD-9 and ICD-10, LOINC, RxNorm, etc.).

A number of HIE organizations interviewed as a part of this study were very successful in meeting the objectives of their specific data sharing use cases when they elected to create their own set of standards and implementation specifications, where it served the purpose of expediting implementation and adoption.

**Bottom-up agreement and top-down implementation and enforcement**

A common pattern observed during the study was that successful implementations started with having the key stakeholders (clinicians, information system providers, research community, etc.) provide input for selection of the key data sets and clinical content standards, and development of specifications, choosing from international, industry or regional de facto standards, as well as defining the clinical document flow. Once region-wide agreements emerge, the role of the centralized HIE organization group leadership is to ratify and implement the centralized information technology infrastructure to enable each provider to be connected to the information network, and monitor compliance and proper use of shared clinical data by the community.

**Local/regional/proprietary vs. international industry standards and implementation specifications**

Regional, proprietary standards can work as well as international industry standards, as long as there are reasonable and cost effective technical solutions available to all stakeholders to
support the chosen standards, and develop and apply the implementation specifications across the full scope of intended participants.

**Certification of Clinical Information Systems for standards compliance**

Certification of point-of-service systems should be structured to allow for an open platform, and federated or distributed approaches to testing and validation, and a final acceptance testing with the central authority based on documented implementation specifications. The central HIE organization governance, and available resources, should not become a gating factor to new products and vendors demonstrating standards compliance and/or achieving certification.

**Key Evidence**

A number of study participants that reported high adoption and uptake of clinical data sharing among practitioners described how critical the early planning efforts around identifying and engaging the representative practitioner group was, and how the representative clinicians took great care to fully understand what clinical data was needed at the transition of care for the most commonly observed use cases:

- Estonia successfully engaged its key stakeholders to define a limited set of shared clinical data elements and clinical content standards leveraging the most prominent industry and local standards (HL7, SNOMED-CT, ICD 9, etc.). Then the central HIE organization planning group stepped in to build the technical infrastructure, and design the XML document containers to support the agreed to limited set of data that needed to be shared. Incentives and funding were then provided to all health care providers to adopt and implement the standard. The providers were encouraged to engage their Clinical Information System vendors to support the standards, through additional line item reimbursements (e.g., 2-5% of the procedure fees) for each activity or procedure billed.

- Similarly, Israel National Health built consensus at the clinician level on the use of proprietary standards developed within its major health systems, foregoing the need for migration to international industry standards. The centralized group then built the required infrastructure to allow each provider to connect by helping them transform the local data into the established proprietary standards within their edge server environment. In both cases, there has been significant adoption and use of shared clinical data in the providers’ workflows.

- With respect to encouraging and verifying vendor adoption or support for the selected standards, eHealth Ontario encountered difficulties working with clinical information system vendors due to the backlog of requests to test the vendor solutions for interoperability. Therefore, it is now exploring the implementation of a more federated and entrepreneurial approach to verification, compliance demonstration, and an enhanced certification process and centralized validation.
Leading Practice 8: Technical architectures and approaches must be adaptable, and must be responsive to the data sharing use cases established by the key stakeholders

Summary

**Leading Practice Overview:**

- There are three prominent models with respect to the management of shared clinical data: centralized, federated, and hybrid
- The initial choice of technology and/or vendor partners usually drives whether the HIE organization can support its stakeholders to “pull”/query the clinical data as well as “push”/direct the data to intended recipients, or support only one type of interaction
- Within that context, drive higher levels of success by implementing a number of detailed technical architecture practices described below
- Leverage national information technology infrastructure, and core identity and security management services, to accelerate successful deployment of HIN infrastructure
- Work closely and aggressively with the EMR vendor community to ensure that the point of service systems are able to interface with the HIN infrastructure, and automatically augment providers’ local records with that of the community EHR to support effective clinical workflow
- Tap into an existing national digital infrastructure to accelerate deployment and adoption of the HIN where possible

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<th>Opportunities:</th>
<th>Challenges:</th>
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<tr>
<td>• Leveraging existing infrastructure limits the resources required</td>
<td>• Initial technical architecture and deployed technologies can limit down-the-road capabilities if not aligned with future requirements</td>
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<tr>
<td>• Support strategic drivers such as increasing data access, enabling advanced clinical uses, accelerating systems integration, reducing efforts for vendor compliance, as well as enabling simple, open technical solutions in the pursuit of interoperability</td>
<td>• Defining current technology and architecture requirements based on known requirements, without losing sight of future and emerging requirements</td>
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<td>• Hybrid and adaptable approaches provide HINs with agility to create and deploy services rapidly and then mature them over time</td>
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**Leading Practice Observations**

A common practice for establishing a HIE organization is to choose among the possible technical architecture approaches and technologies available to the jurisdiction or region with respect to clinical data sharing that will be managed. Whether the HIE organization can support its stakeholders to “pull”/query the clinical data as well as “push”/direct the data to intended recipients, or support only one type of interaction, is usually driven by the initial choice of technology and/or vendor partners.

With respect to management of shared clinical data, there are commonly three models that are considered by most implementers: centralized, federated and hybrid.
In the centralized model, there is usually a logical/virtual clinical data repository that is made up of one or more physical data repositories (i.e., clinical history, prescription drugs, diagnostic images, lab results, etc.) that will be the shared master clinical record that will be managed by the HIE organization. All point-of-service systems within the jurisdiction or region would be required to forward the agreed-to clinical data to these repositories at an agreed-to frequency. Additionally, a set of Master Data Management tools and technologies such as a Master Patient Index is used at the point of data receipt to ensure that the information is properly matched to the patient records maintained by the central repositories.

The federated model is typically used to maximize the provider’s control over shared data and its level of currency. In this model edge servers (a replica of patients’ clinical data that will be shared) are deployed for each of the data providers, and the Master Patient Index and a Record Locator Service act as the pointer to all point-of-service systems that may contain relevant clinical data about the patient.

In the hybrid model, a minimum clinical data set (e.g., current medications, current diagnoses and allergies, etc.) is held at the central data repository, while additional detail and history is kept at the data providers’ edge servers. The hybrid model can be configured to address some of the challenges that may be encountered with the centralized and federated model implementations.

The more mature and successful HIN organizations that were interviewed as a part of this study had deployed some or all of the capabilities described above in response to the development and evolution of the support for the use cases defined by the clinician community. In larger and more diverse jurisdictions or regions, concurrent deployment and support of the push and pull capabilities, as well as support for hybrid and federated models, was seen as important to achieving the level of adoption desired by the jurisdiction or region.

Technical architecture approaches which appear to achieve higher levels of adoption and success over time include those that are responsive to the data sharing use cases established by the key clinical stakeholders, and those that can adapt to the maturity of the care coordination environment and the rate of standards adoption by the health IT solutions and vendors. Some of the technical architecture practices that were observed to have played a role in driving higher levels of success include:

- **Enable and support hybrid models of data management and technical architecture**
  – It is important to allow for hybrid and federated data architecture approaches to provide the required flexibility for the variety of stakeholders to achieve the appropriate level of data sharing. Limiting the data management architecture to a centralized model and repository based approach for the capture and sharing of clinical data can hamper and delay adoption. In larger and more diverse jurisdictions or regions, due to a variety of factors (e.g., control, data currency, regulatory compliance, etc.), many providers prefer to use only shared clinical data from their federated edge servers for specific use cases to meet the local needs.

- **The clinical data exchange infrastructure must support pull (query-based) as well as push (directed exchange) models of access to clinical data**
  – Based on the use cases defined by the representative clinical stakeholders, it is very likely that notifications and simple push of critical clinical messages based on patient episodes of care, will have to coexist with capabilities for sophisticated search based queries across a diverse and federated set of multiple providers’ clinical data repositories. This will be highly likely in jurisdictions or regions with large and diverse communities of practitioners and patients.
• **Patient portals are an important mechanism for access to be added to HINs** – A majority of the organizations interviewed to date intend to engage patients in their own care and data sharing consent and authorization process through deployment of portals. An informed and appropriately educated patient is a critical part of the strategy to encourage disease prevention, early detection, and promotion of an active and healthy lifestyle.

• **Enterprise Master Patient Index** – In large and diverse jurisdictions or regions with a variety of point-of-service systems, an Enterprise Master Patient Index is a critical part of the HIN technical architecture. A number of successful HINs have built and deployed their Enterprise Master Patient Index based on a national identifier number, and a significant number of jurisdictions or regions have leveraged their national IT infrastructure and core identity and security management services to accelerate their successful deployment of HIN infrastructure.

• **Clinical workflow impact** – A key lesson from this study is that the physician workflow cannot be negatively impacted due to the need for access to a community EHR, and HINs must work closely and aggressively with the EMR vendor community to ensure that the point-of-service systems are able to electronically interface with the HIN infrastructure, and automatically augment the providers’ local records with those of the community EHR.

• **Security and consent management architecture** – A significant number of study participants cited the ability to tap into an existing national digital infrastructure to accelerate deployment and adoption of the HIN as a key success factor. HIN planners and operators must take advantage of established and proven digital infrastructure within their jurisdictions or regions, and lead or support initiatives that look to establish a common and trusted IT infrastructure for all public sector related services.

• **Business intelligence and shared analytics architecture** – A significant number of interviewees discussed a desire to offer predictive modeling and health care analytics types of services. However, none of the study participants had yet developed any viable services or capabilities that were in production use by HIN participants.

**Key Evidence**

Many of the facets of the leading practice described above have been put into successful use by HIN planners and operators. Some examples include:

• Israel’s HIE organization found that there is a need to accommodate access to centralized clinical data repositories and distributed edge servers that maintain their own data sets.

• BC Interior Health Ministry found that it is not cost effective for all of its data sharing partners to join the centralized HIE organization model, so it adopted strategies to accommodate point-to-point data requests and replies directly from a certain number of partners.

• Almost all interviewees already had a patient portal in production, or were anticipating putting one in within a short planning horizon, to engage patients in a meaningful way.

• A majority of the interviewees in large and diverse jurisdictions or regions cited the implementation of an Enterprise Master Patient Index in the last three to eight years to properly populate the clinical data repositories and registries. A number of successful implementations were based on the leverage of a national identifier.

• Most interviewees had plans for some level of analytics capabilities, but few capabilities existed in their current infrastructure.
Leading Practice 9: Implement rigorous change management protocols and tools

Summary

Leading Practice Overview:
- Formalization of a rigorous technical change and release management process is the cornerstone of a strong HIN operation
- Identify and deploy tools, processes and roles to ensure consistency and accuracy
- Identify process integration points and hand-offs between technical change and release management functions, as supported by configuration management, to ensure consistency and accuracy
- Formalize operational processes and procedures, and drive adoption:
  - Enforce compliance
  - Ensure quality of service
  - Enhance operational efficiency
  - Adopt process methodologies

Opportunities:
- Address the challenge of coordinating a consistent technology change and release management process across the continuum of HIE organization service providers – often different IT operations groups within the jurisdiction’s health care ecosystem manage the key technology components needed to deliver the planned HIN services
- Support strategic drivers such as accelerating systems integration, reducing effort for vendor compliance, and supporting the rapid development of solution interoperability

Challenges:
- Securing the support of a disparate group of key stakeholders to define, implement and help with the adoption of a set of formal processes around coordination and approval of changes to the environment, and associated packaging and release management
- Accommodating service level agreements with all third-party service providers

Leading Practice Observations

Formalization of a rigorous change and release management process is the cornerstone of a strong HIN operation. Change and release management are different disciplines, but they have critical points of integration within a HIN operation. To create a leveraged outcome, their respective tools, processes and roles must be identified, developed and assigned to specific resources. They must work together to ensure consistency and accuracy by identifying process integration points and hand-offs between change and release, supported by configuration management. To ensure a HIN’s long-term success, the service must be trusted and used by its intended beneficiaries, and it’s critical to achieve this availability and continuity of clinical information exchange services.

A number of the leading practice study participants with mature operations and large number of provider organizations highlighted the need for well-developed and optimized change and release management processes. In a number of cases the HIE organizations had moved to bi-annual releases to ensure the stability of environment and adequate timelines for proper testing.
These types of policies were developed in response to instability and disruptions experienced in their environments due to a lack of well-defined and disciplined change and release management processes.

Change and release management should be on the top of the to-do lists of the infrastructure and operations leaders or the remote managed operations provider. Operational processes are heavily reliant on technology, and the IT groups need to formalize operational processes and procedures, starting with incident and problem management, and leading to change, configuration and release management. Incident and problem management are foundational to capturing what core issues may exist in the environment, and whether the changes to the information exchange infrastructure are causing any disruption to services. Four primary factors drive this focus for the HINs:

- Compliance
- Quality of service (QoS) for 24/7 availability
- Operation efficiency
- Adopting process methodologies.

**Compliance** – Often internal initiatives were required to respond to regulations which heightened the need for rigor of policy and documentation. The greater the commitment by the HIE organization to regulatory compliance, the greater the level of controls and audit documentation was observed of the IT operations. The compliance policies directly affected change and release management. For many HIE organizations, compliance raises the bar for change automation to enforce policy and avoid outages through standardization.

**Quality of service** - A highly available HIN service provides the participants with access to HIN services and applications for a minimum of 99 per cent of scheduled time, despite unscheduled incidents. Some HINs moved toward implementing IT service management (ITSM) best practices, starting to regularly measure and report their service performance. One way for HINs to become reliable service providers, and be more accountable, is to institute more process rigor in the areas of change and release management.

**Operational efficiency** – HIE organizations tend to struggle with operational efficiency, because changes are pervasive in all aspects of their operations. IT engineers, technicians and managers found that configuration modifications are a constant, daily occurrence, which grow with the pace of change in services offered.

A successful HIE organization overcomes challenges associated with configuration modifications that are constant, daily occurrences, and which grow with the pace of change in services offered.

**Adopting process methodologies** – A number of HIE organizations focused on process design, using the Information Technology Infrastructure Library (ITIL) as their guide. This is the most widely cited methodology for change and release management process implementation.

The experience of study participants suggests that a HIN’s change and release management should not be executed as solo initiatives. Process and policy coordination is a must, as is standardization. To get formalized change and release management in place, HIN organizations focused on leadership and vision. The study further suggests that to meet the high levels of service and value, HINs must build robust release management integration between development and production, with IT leadership making equivalent investments at strategic stages within change and release management.
Key Evidence

The following observations and descriptions from the study interviews provide examples of how many of the facets of the leading practice described above have been put into successful use by the HIN planners and operators:

- Alberta Netcare has developed and evolved its change and release management process continuously for a number of years, and now looks at its operational processes as a bright spot in delivery of clinical information exchange services. Major releases happen twice per year, and Netcare takes pride in its rigorous testing processes. The key challenge that Netcare has had to overcome is the required coordination with numerous data sharing organizations. With the formal change and release management process, Netcare has significantly reduced the typical issues and defects that are a result of deploying new functionality into production.

- Estonia and Israel cited the criticality of consistent and available services as a key contributor in achieving success. Formalizing IT operations processes is a foundational requirement.

- British Columbia’s Ministry of Health has formalized IT support operational processes in a number of domains including change and release management.
Leading Practice 10: Leverage existing technical and organizational infrastructure capabilities to achieve more rapid clinical adoption and faster return on investment

**Summary**

**Leading Practice Overview:**

- Take advantage of existing digital infrastructure and e-services that are operated by other parts of the regional public sector within which HINs operate to decrease deployment times, and to leverage stakeholders’ trust in existing common and proven infrastructure.
- Identify and deploy shared infrastructure where they exist (or can be created).
- Manage expectations where there is no pre-existing infrastructure (be prepared for significant investment and slow pay back).

**Opportunities:**

- Leveraging existing infrastructure can result in a significant reduction in initial investment required, as well as reduction in typical risks inherent in deploying new technologies, thereby driving down the total cost of ownership over the lifetime of HIN implementation and operations.
- Support for strategic drivers such as increasing data access, enabling advanced clinical uses, accelerating systems integration, reducing effort for compliance, supporting the rapid development of solution interoperability, and using national testing and certification.

**Challenges:**

- Should existing infrastructure be useable for the exchange of health information, HINs may need to share the cost for use of this common infrastructure, as well as identify and mitigate risks associated with additional substantial load and volumes resulting from HIN users (this assumes that there is regional infrastructure in place).
- By and large, Canadian provinces do not have existing government e-service infrastructure for domains other than health care that can be leveraged to further accelerate the deployment of the required infrastructure for the exchange of health information.
- Technical infrastructure cost allocation among a wide variety of regions’ health care and non-health care related services.

**Leading Practice Observations**

The ability to leverage existing digital infrastructures and e-services that are owned by the region’s public sector has the potential to significantly decrease deployment timelines, and can leverage stakeholders’ trust in the common, proven infrastructure to help accelerate the adoption by the clinical community. Organizations that took advantage of existing efforts at the local level to implement relevant information exchange use cases expedited their efforts and had a significant reduction in the time it took to develop services and a boost in confidence in use of the exchange infrastructure.

Some of the technical and organizational infrastructure practices that HIE organizations have leveraged to drive higher levels of success include:

- Region-wide technical infrastructure that can support the exchange of health information.

![Gartner](image)
• Unique individual identification/Master Person Indexes
• Identification and authentication infrastructure
• Security and privacy infrastructure
• Standards and specifications developed and shared services selected
• Project management and processes for onboarding of new data exchange partners
• Methodologies, agreements and processes for managing data quality
• Notification services.

Manage expectations where there is not pre-existing infrastructure (be prepared for significant investment and slow pay back).

At this time there is little shareable infrastructure in evidence in Canadian jurisdictions. This could be seen as an opportunity to create shared infrastructure or to leverage federal initiatives such as universal identification.

**Key Evidence**

The following observations and descriptions from the study interviews provide examples of how many facets of the leading practices described above have been put into successful use by HIN planners and operators:

• Estonia was able to quickly and cost effectively deploy its centralized data exchange infrastructure by leveraging the existing national identification infrastructure as well as the e-services security services deployed for other governmental services with the result that the entire, highly sophisticated and fully functional exchange of health information utilized by 100% of providers and patients was implemented for approximately 10 million Euros.

• Estonia’s HIN engaged its clinical governance group to effectively identify a limited set of data that was relevant to the clinical workflows the group felt were the most valuable for the community.

• Israel deployed an infrastructure and set of services nationally that had been deployed by one of the health plans.

• The Swedish system leverages a number of technologies and platforms (including authentication and authorization) and the network developed for the entire public sector.

• All HINs have highlighted the critical need for a robust security infrastructure that can be trusted by all key stakeholders.

• Alberta Netcare experienced stability and operational challenges with changes to its data exchange infrastructure due to the volume of required maintenance and enhancement changes, until it instituted a set of formal and enforced processes for change and release management, reducing the number of major releases to two per year, and requiring extensive and thorough testing.

• Israel utilized and extended the infrastructure created for one of the largest health maintenance organizations (HMOs), which pioneered the exchange platform and process.

• Both authorities in the United Kingdom and regions in Ontario appear to be building localized (or sub-regional) solutions by leveraging the jurisdiction/regional infrastructure.
Leading Practice 11: Obtain vendor compliance through making a market

Summary

Leading Practice Overview:

- Influence vendors to adopt and adhere to local and national standards by:
  - Setting up independent, fee-based, certification entities that can use the national and local jurisdiction’s rules and requirements to validate EMR/EHR/HIN vendor compliance with interoperability standards, and related information exchange and care coordination functionality
  - Providing additional incremental funding to providers who use certified/compliant solutions, thereby encouraging them to work with their point-of-service solution vendor to comply with the jurisdictional standards and specifications, and achieve two-way clinical information exchange
  - Identifying sponsors who are willing to fund specific data exchange scenarios or use cases, and using the funds for incentive payments to enable the information exchange use case
  - Considering national mandates with reasonable deadlines, supported by incentive payments for the provider community to motivate the relevant EMR and EHR vendor adoption of standards
- Encourage creative technology approaches by vendors to productively engage in two-way data sharing with the local HINs, including use of integration and transformation technologies by the vendor that allows non-invasive and more rapid compliance with standards

Opportunities:

- Overcome vendor reticence and indirectly encourage vendor implementation of established national and local standards
- Address the vendor compliance needs of Canadian regions and jurisdictions based on the current challenges experienced with the numerous local EMR vendors
- Support for strategic drivers such as accelerating integration of systems, reducing effort for vendor compliance, and supporting the rapid development of interoperability across the region

Challenges:

- Many EMR vendors are challenged with legacy technologies that are difficult to change to achieve compliance with the local standards
- Providing enough of a financial incentive or moral suasion to create momentum in the market place:
  - Creating a viable marketplace to provide the business case for investment
  - Translating financial, policy and marketing levers into customer interest which drives vendor action
- All provinces and territories in Canada have implemented a number of strategies to achieve vendor compliance, however, vendor certification and onboarding continues to be a challenge in certain jurisdictions
Leading Practice Observations

One of the key challenges facing health care with respect to clinical systems’ interoperability is the diversity of underlying technologies, models of practice, data syntax and terminology that permeate the industry. Lack of universally adopted standards and multi-generational commercial-off-the-shelf (COTS) electronic medical record (EMR)/electronic health record (EHR) systems from dozens of local and international system providers that have been built over the last 20-25 years further perpetuate the problem. COTS EMR/EHR vendors in each country respond to the local market drivers and opportunities while attempting to stay ahead of competition typically focused on the needs of the largest delivery systems or niche market opportunities.

Motivating the EMR/EHR system providers to adopt standards and to open up their systems to send and receive clinical data typically falls to public sector health policy makers in each country. The leading practices study identified a number of strategies that are effectively employed by the more successful jurisdictions or regions to engage vendors in making systems changes which increase meaningful clinical data sharing. One of the prominent strategies related to EMR/EHR system vendors is the alignment of market incentives through creation of positive market drivers and influencers.

This effort starts with the local or national government’s definition and adoption of the required interoperability standards. This leverages local and internationally accepted syntactic and semantic standards based on priorities set by the representative clinician stakeholder group(s). Next, empowered bodies create implementation specifications which delineate how these standards are to be instantiated and implemented. Subsequently, adoption and use is promoted through incentives or mandated through regulations. Since any change in vendor behaviour requires the existence of an economic opportunity (or avoidance of losses in revenue or profit) that justifies the required investment of resources, it is important for planners to carefully craft those incentives and/or mandates.

The study suggests that effective promotion of natural market forces, followed by regulatory mandates once a critical mass is reached, is the least disruptive and most practical approach to incrementally moving the entire health care sector in a country or regulatory jurisdiction toward a fully interoperable health care IT ecosystem. The more successful jurisdictions or regions have certain common characteristics:

- Incentive monies to affect the desired changes in the EMR/EHR vendors’ systems are funneled through the payer to the provider to drive the change
- The available funds are tracked and managed separately from normal fee-for-service reimbursements
- Incentive money distribution to the providers (and through them, to the vendors) is tied to verifiable implementation and use of the system interoperability functionality
- Verification and/or certification services are made available as fee-for-service offerings through organizations that have been sanctioned by the local or national government
- Incentives are tied to implementation and use of specific data sharing use cases or clinical scenarios that have been proven to have a demonstrable positive impact on health care delivery
- They ensure that there are sufficient authorized certification bodies with consistent and streamlined frameworks and processes to meet the demands of in-scope jurisdictions
- They encourage creative and innovative application of technology to enable the variety of data sharing opportunities within the security and privacy rules of the jurisdiction.
**Key Evidence**

The following observations and descriptions from the study interviews provide examples of how the leading practices described above have been put into successful use by the HIN planners and operators:

- Estonia has established effective collaboration between the national government and local health care delivery providers to provide a line item incentive on top of each service fee reimbursement (eHealth Monies) to fund the system vendor’s efforts around achieving effective clinical data sharing through the shared national data exchange infrastructure.

- MiHIN, State of Michigan’s HIE entity, uses an internally developed clinical data sharing use case based methodology called “Use Case Factory,” to identify all valuable opportunities for data sharing. Every use case has a sponsor and standalone business case. Any health care stakeholder (public or private) can sponsor and incentivize a data sharing use case (e.g., Blue Shield/Blue Cross has sponsored an ADT sharing use case with a $50M investment and the State of Michigan is sponsoring 40 unique data sharing use cases).
Anticipated Leading Practices Not Found in Evidence

The HIN Planning and Operations Best Practices Discovery Framework projected a number of important areas where we would expect to observe leading practices. There are a number of areas in which there was a notable lack of observable or reported leading practices.

There were no reports of structured methodologies for managing, measuring and reporting on benefits realization. All organizations interviewed agreed that it would be an admirable goal to manage and report on compliance with jurisdictional policy, system-wide benefits, and stakeholder benefits. But none had any structure tools or processes in place to do so.

There was an expectation that HIE organizations would have robust business intelligence and shared analytics services and architectures. While a significant number of interviewees discussed a desire to offer predictive modeling and health care analytics services, none of the study participants had yet developed any viable services or capabilities that were in production use by its stakeholders.

While governance was acknowledged to be fundamentally important, and each organization had structures and processes for effective control and decision-making, there was not any consistent set of principles or structures in evidence.

All HIE organizations agreed that robust trust relationships beyond the policy framework and data sharing agreements were an important cornerstone of their success, however there were no evident consistent principles or practices to develop, manage and maintain these.

Finally, while many stakeholders identified the emerging importance of patient engagement and consumer-driven care, few health information organizations cited structures or processes to ensure that consumer-oriented products, services or capabilities are included in their solutions.
Leading Practices Implications for Infoway and the Broader Canadian Health Care System

Key Themes
A number of key themes were identified from the input provided by the HIE organizations, and from the literature.

First, clinical interoperability should be a means to an end, not an end in itself. That is, the focus should be on narrow and specific outcomes or use cases enabled by interoperability, rather than on achieving interoperability for interoperability’s sake. An example of focusing on a specific outcome through clinical interoperability could be reducing hospital readmission rates by alerting primary care physicians of discharges, and any required follow-up and timing.

Second, health care tends to be local and most provisioning of care and high clinical value sharing of information, from an accountability and execution standpoint, falls upon the shoulders of regional and community level organizations. HIE organizations need to provide services and capabilities targeted at local providers and local processes.

Third, stakeholders all agree that the sharing of patient clinical data and care coordination among hospitals, physicians and other care team members can have an observable positive impact on quality and cost of care. This manifests itself in the form of improved population health, disease prevention, error reduction, reduction in redundant diagnostic procedures, and use of clinical best practices and evidence-based treatment protocols. However, it is clear that the choice to subscribe to and use the services provided by a HIE organization, or even a HIN, is not a natural one for most members of the health care ecosystem. Initial, and sometimes ongoing, participation requires an ongoing effort in terms of communicating and demonstrating the value of participation, and sometimes it may require financial support and the need for regulatory compliance.

Implications for Infoway and the Broader Canadian Health Care System
Infoway has identified a number of strategic drivers and clinical priority domains for its Clinical Interoperability Program as outlined in its Clinical Interoperability Action Plan\(^3\).

The strategic drivers are:

- Increase data access and enable advanced clinical uses
- Transition HINs to a service model to maximize utility and benefits to clinicians and consumers
- Accelerate systems integration and reduce effort for compliance.

Of a wide range of clinical interoperability priorities identified in three key domains, Infoway’s immediate focus will be around e-prescribing, medication reconciliation, immunization and consult management.
Figure 6. Infoway Clinical Interoperability Priorities

Analysis shows that the leading practices provide strong support and foundational capabilities for each of the Infoway strategic drivers and the clinical priorities.

All 11 leading practices are relevant when it comes to standing up and operating HIN services to support the four clinical interoperability priorities. In addition, achieving each the strategic drivers requires implementation of between seven and nine of the 11 leading practices.

Table 1. Leading Practices Related to Infoway Strategic Drivers and Clinical Interoperability Priorities

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<th>Strategic Drivers</th>
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<tr>
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- e-Prescribing
- Medication Reconciliation
- Immunization
At a high level, the leading practices indicate five key actions that are relevant to Infoway and Canadian health care information network organizations:

1. Align interests across all stakeholder organizations and individuals
2. Strengthen and operationalize governance and stakeholder engagement
3. Focus interoperability efforts on clinical scenarios or use cases, and outcomes-based plans
4. Operate the HIN using a business services model
5. Widely publish process, outcome and benefits metrics.

**Align Interests Across all Stakeholder Organizations and Individuals**

Canadian health care stakeholders are broad, as indicated by an approximately 77,000 physicians, 360,000 nurses, 38,000 pharmacists and 1,000,000 allied health professionals, across a variety of public and private delivery organizations supported by systems vendors serving 35,000,000 citizens. Add to that the country’s federated, mostly distributed, health care governance structure, one of the key challenges that arises for Canada is to mobilize stakeholders in unison to accelerate the interoperability of health information technology systems to achieve specific benefits (e.g., improved care quality, safety and outcomes, reduced costs, increased delivery capacity). The overriding lesson from the leading practices study is that it is critical to align stakeholder interests through market incentives or regulatory mandates, and to create urgency and a burning platform for the required transformation.

The following leading practices support achieving higher levels of alignment in interest among key Canadian stakeholders:

- **Leading Practice 1:** Engage entrepreneurial executive leadership to drive implementations and operations
- **Leading Practice 3:** Focus stakeholders on practical and meaningful outcomes
- **Leading Practice 4:** Employ a clinical scenario (use case) based approach to determining development and deployment plans
- **Leading Practice 5:** Define and regulate/mandate/incentivize data ownership and data sharing, and establish data ownership and stewardship roles throughout the entire system
- **Leading Practice 11:** Obtain vendor compliance through making a market.

**Strengthen and Operationalize Governance and Stakeholder Engagement**

The study suggests that to be successful, a HIN must operate as an independent organization with entrepreneurial and risk-taking leadership to achieve optimal results, faster. Further, the HIN leadership needs to productively engage all stakeholders intensively and regularly to drive the HIN’s relevant agenda and priorities through consensus building and continuous alignment of interests. This approach will help accelerate the achievement of key benefits from HIN related investments.

The following leading practices support the definition of the appropriate governance and business models and effective approach for engaging the Canadian stakeholders:

- **Leading Practice 1:** Engage entrepreneurial executive leadership to drive implementations and operations
- **Leading Practice 2:** Plan for project AND operational sustainability upfront
• Leading Practice 3: Focus stakeholders on practical and meaningful outcomes
• Leading Practice 9: Implement rigorous change management protocols and tools
• Leading Practice 11: Obtain vendor compliance through making a market.

Effective governance and leadership will help drive increased data access, enable advanced clinical uses, accelerate integration of systems, and reduce efforts related to vendor compliance. And proper stakeholder engagement is critical to the success of the clinical interoperability priorities such as medication management, communicable diseases and care coordination.

Focus Interoperability Efforts on Clinical Scenarios or Use Cases, and Outcomes-based Plans

Any-to-any, standards-based interoperability between all systems within the Canadian health care ecosystem is next to impossible to achieve due to the diverse set of players, legacy systems, lack of funds for modernization, and market incentives or lack thereof. The Canadian provinces and territories should focus on defining the specific clinical data sets that need to be shared to enable a specific workflow related to the required care coordination during transitions of care, and invest in the variety of technical solutions needed to meet the specific data sharing requirements.

The following leading practices support the implementation and utilization of high value interoperability services through focusing the jurisdiction’s interoperability and standards activities to deliver clinical scenarios or use cases:

• Leading Practice 3: Focus stakeholders on practical and meaningful outcomes
• Leading Practice 4: Employ a clinical scenario (use case) based approach to determining development and deployment plans
• Leading Practice 7: Interoperability through setting, and adoption of standards and implementation specifications is a means to an end, not an end in itself
• Leading Practice 8: Technical architectures and approaches must be adaptable, and must be responsive to the data sharing use cases established by the key stakeholders
• Leading Practice 10: Leverage existing technical and organizational infrastructure capabilities to achieve more rapid clinical adoption and faster return on investment.

This is a foundational element that will enable all priority use cases to be addressed by the provinces and territories.

Operate the HIN using a Business Services Model

Transitioning the HIN to run as an independent, ongoing concern with appropriate funding for operations and reinvestment will allow the HIN to develop the required behaviours and characteristics that enable a jurisdiction to quickly adjust to the changes in stakeholder demands, and become an invaluable part of the health care delivery value chain.

Canadian provinces and territories must determine the best way to achieve this transition, and develop detailed action plans to define the services and funding structures.

The following leading practices highlight the key requirements and operational capabilities needed to transition to a services model organization:

• Leading Practice 2: Plan for project AND operational sustainability upfront
• Leading Practice 5: Define and regulate/mandate/incentivize data ownership and data sharing, and establish data ownership and stewardship roles throughout the entire system
• Leading Practice 9: Implement rigorous change management protocols and tools
• **Leading Practice 10**: Leverage existing technical and organizational infrastructure capabilities to achieve more rapid clinical adoption and faster return on investment.

**Widely Publish Process, Outcome and Benefit Metrics**

“You can’t manage what you can’t measure” and “what gets measured, improves” are two old adages that certainly apply to health care just as well as other industries. Even though the study found that most HINs were funded, deployed and operated without careful attention to capturing and monitoring information related to achievement of specific benefits, all study participants acknowledged plans to publish key metrics about their accomplishments and the benefits achieved from the investment. Publishing a series of carefully crafted metrics about each of the HIN’s operations, its customers and its stakeholders can provide significant positive momentum and competition among stakeholders to accelerate their participation, and to demonstrate the results achieved in comparison to their peers.

Even though the concept of managing and operating the HIN using key performance metrics was not mentioned as a leading practice by any of the interview candidates, the Gartner team has seen the application of this practice to have a significant positive impact on helping organizations accelerate the achievement of key initiative objectives.

The following leading practices support the practice of publishing process, outcome and benefit metrics to Canadian stakeholders:

• **Leading Practice 1**: Engage entrepreneurial executive leadership to drive implementations and operations
• **Leading Practice 2**: Plan for project AND operational sustainability upfront
• **Leading Practice 3**: Focus stakeholders on practical and meaningful outcomes
• **Leading Practice 8**: Technical architectures and approaches must be adaptable, and must be responsive to the data sharing use cases established by the key stakeholders
• **Leading Practice 9**: Implement rigorous change management protocols and tools
• **Leading Practice 10**: Leverage existing technical and organizational infrastructure capabilities to achieve more rapid clinical adoption and faster return on investment.
7. **Best Practices Identified in Other Industries**

There is little consensus in the literature as to what a best practice is. As mentioned previously, Gartner defines a best practice as “a group of tasks that optimizes the efficiency (cost and risk) or effectiveness (service level) of the business discipline or process to which it contributes. It must be implementable, replicable, transferable and adaptable across industries.”

Some writers look to a more rigorous definition which includes such concepts as proven, measurable, certification-based practices which deliver optimal outcomes through the application of repeatable procedures.

The Hackett Group, an organization that hosts best practices conferences, and offers to its clients a database of “certified best practices,” defines best practices as “proven, repeatable, documented techniques that deliver measurable business performance management improvements.”

This study has cast a wide net to identify such measurable and “certifiable” best practices which are relevant to HINs and which have been identified in general, or in other industry settings. The literature provides few concrete examples of techniques, methods or processes that are proven to be measurably more effective at delivering a particular outcome than any other technique, method, process, activity, incentive or reward.

We provide here a set of best practices from other industries that have been excerpted from Gartner Research and from broader industry research.

These best and leading practices provide strong support and foundational capabilities for each of the Infoway strategic drivers and the priority clinical priorities as shown below.

The findings are summarized here and more detail for each follows:

<table>
<thead>
<tr>
<th>Best Practices from Gartner Research</th>
<th>Make Interoperability a Priority</th>
<th>Deploy New Initiatives in Small, Iterative Steps</th>
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**Strategic Drivers**

**Clinical Priorities**

| e-Prescribing                     | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Medication Reconciliation         | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
### Health Information Network (HIN) Leading / Best Practices

#### Immunization

- ✓
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#### Consult Management

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### Best Practices from Broader Research

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Best Practices from Gartner Research

Best Practice #1 from Gartner Research: Make Interoperability a Priority

Best practices organizations in the financial services sector “promote efficient connectivity by making integration and accessibility across internal and external systems a priority.” They also “promote effective communication by supporting industry messaging standards, while prioritizing investments in transformation capabilities and reference data, metadata, and preference information that is shareable within and beyond” their immediate organization.7

The relevance of this best practice to HIN planners and operators is that ensuring interoperability beyond the immediate HIN will be more easily accomplished proactively than reactively. It is important to keep this in mind as HINs grow in size and complexity.

Best Practice #2 from Gartner Research: Deploy New Initiatives in Small, Iterative Steps

Collaborative best practice organizations in the broader public sector understand that “optimizing a peer-to-peer partnership is complex and iterative, involving multiple steps that require investments in process, people and tools.” When evolving these partnerships, these organizations “implement new iterations as pilots, and make adjustments as necessary. [They] deploy previously piloted changes transparently using audits and analysis to understand the cost and service impact of changes.”8

The relevance of this best practice to HIN planners and operators is that HINs will increasingly make contact with each other across jurisdictional boundaries at local and regional levels. This will, in turn, necessitate partnerships between a growing number of organizations that will have to be carefully developed and enacted. These partnerships will need to grow beyond standard contractual agreements. That growth should be agile and iterative, potentially with the use of pilots, to demonstrate value early and frequently.

Best Practice #3 from Gartner Research: Effective Organizational Change Management Drives Implementation Success

Organizations that launch enterprise resource planning (ERP) implementations across a number of industries encounter the reality that “only a small percentage of an ERP deployment's pre-go-live training sticks. The result is poor user adoption, decreased productivity and longer time-to-benefit realization.” To mitigate this loss of knowledge and interest, organizations can:

- “Improve training effectiveness by conducting reinforcement training three to four weeks after go-live
- Deploy a roving support team during the first few weeks after go-live to provide immediate, one-on-one assistance with adoption of new functionality and processes
- Foster organizational change by making sure everyone understands “What's in It for Me,” and recognize and reward successful early adopters
- Demonstrate progress by including an "improvement over time" element in communications so users can see that issues are being resolved.”9

The relevance of this best practice to HIN planners and operators is that ERP deployments are to broad enterprise-wide administration and operations what HIN deployments can be to system-wide health care delivery and coordination. There is much to learn from ERP change management best practices that can be leveraged in a HIN context to reduce user resistance and increase adoption.
Best Practice #4 from Gartner Research: Build Business Cases that are Linked to Measurable Outcomes

Manufacturing organizations have experience with the fact that “IT managers and product life cycle management (PLM) champions often struggle to get executive support for a PLM initiative” which can result in “IT organizations [that] often deliver PLM software implementations late, at higher-than-expected costs, and they deliver lower-than-expected return on investment.” To overcome this, best practice organizations can “build ROI business cases related to key performance indicators (KPIs) associated with improved new product design and delivery at lower cost.” Additionally, they can “work with stakeholders in new product development, manufacturing operations, sourcing, and marketing to identify data and process needs and prioritize those needs for implementation planning.”

The relevance of this best practice to HIN planners and operators is that HINs often encounter difficulties with receiving the required executive support, in tangible form, to achieve a successful rollout, and in demonstrating value for money. There is a lesson learned from manufacturing related to deriving priorities directly from stakeholders and using KPIs to gauge outcomes to overcome limitations in executive support, and to deliver widely agreed upon benefits and outcomes.

Best Practice #5 from Gartner Research: Embody Successful SOA Characteristics to Improve Implementation Results

Successful service-oriented architecture (SOA) implementers in the financial services industry “recognize the impact of architectural decisions on business performance and focus on their goals” and “they don't just build and walk away.” As such, they “clearly identify the technical and business drivers for SOA adoption in [their] firm, [and] use these requirements to prioritize investments.” They also “ensure operational performance meets business requirements through proactive monitoring and response.”

At a more granular level, successful SOA implementers embody the following characteristics:

- They recognize the business and technical significance of architectural decisions
- They clearly define and focus on their goals
- They are purposeful in their development of SOA services
- They directly impact the front office
- They have clearly defined financial responsibility for the development of shared services
- They apply SOA-friendly criteria to application design and evaluation
- They are vigilant in monitoring operational performance.

The relevance of this best practice to HIN planners and operators is that the SOA implementation criteria mentioned are not unique to the financial industry. These characteristics of successful SOA implementers are also applicable in a HIN setting.

Best Practice #6 from Gartner Research: Emphasize the Importance of Good Enterprise Architecture Governance

Organizations from a number of industries that exhibit effective enterprise architecture (EA) governance realize that at their core, effective “EA governance processes should have strong senior management backing and participation from a range of key players, including ‘naysayers’.”

To fully realize the benefits of good EA, the following best practices are recommended:
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- “Define and document EA governance authorities and processes in a formal charter, and ensure that they are well-communicated
- Give EA governance teeth by ensuring it has a strong leader driving it, buy-in from senior management, and appropriate flexibility
- Ensure that EA content is well-documented, freely available and well-communicated
- Involve SMEs and strong influencers – including detractors – in the EA content creation process
- Use [EA] waiver [or exception] request trends to trigger EA content updates”

The relevance of this best practice to HIN planners and operators is that HINs have a significant EA requirement, with a large number of diverse stakeholders from clinical, legislative, business and technical areas. These aforementioned EA best practices are, therefore, very much relevant to a HIN setting.

Best Practice #7 from Gartner Research: Adapt Your Technology Roadmap Using Effective Stakeholder Engagement

Looking at mobile technology implementations from a number of industries (including pharmaceuticals, marketing, financial services, manufacturing, media, retail, government, transportation, and IT products and services), it’s easy to see that mobility has had a significant impact on the way enterprises interact with their employees and customers, particularly as the pace of change has accelerated over recent years.

To keep up with rapidly changing consumer and employee needs resulting from mobile technologies, a number of best practices have been identified:

- “Encourage employee and stakeholder involvement by creating a rapid feedback loop
- When engaging stakeholders, come prepared about what their requirements may be to encourage healthy conversation (i.e., “Don’t go to the business units with a blank piece of paper”)
- Tailor your messaging to each stakeholder group as different stakeholders have differing business requirements
- Communicate often, and be transparent
- Ensure you create standards that cover “data classification and protection application architectures and development methods; [and] endpoint controls.”
- Look ahead to changes that may be on the horizon
- Establish data protection mechanisms based on how you classify your data rather than role-based security
- Allow the business time to adapt by taking smaller steps; this will account for the fact that technology adoption doesn’t occur at the same pace for everyone.”

The relevance of this best practice to HIN planners and operators is that, while the technology being implemented in enterprise mobility is different than that used in a HIN setting, a number of these practices are still relevant. They include:

- Ensuring that stakeholders have an opportunity to provide timely feedback on an as-needed basis
- Being proactive in understanding stakeholder needs even before you’ve made formal contact
- Being open and transparent throughout the process
- Effecting good data classification and standards to future proof your technology.
- Taking smaller steps throughout the implementation.
More directly, however, it is likely that HIN organizations worldwide will increasingly turn toward mobile technologies to derive value which, in turn, makes the practices mentioned here even more relevant.

**Best Practices from Broader Research**

**Best Practice #1 from Broader Research: Data Should be used to Inform Critical Business Decisions Rather than as a Rudimentary Measure of Progress**

Real-time data analysis enabled by digital and mobile technologies allows insights into not just usage behaviours, but also processes that drive critical business decisions.

For example, when looking at ride sharing start-ups, Uber’s success can be partly attributed to resource allocation and pricing decisions made using real-time data. Whether that means ensuring vehicles are available in higher demand areas based on city population flows, or dynamically adjusting prices to ensure supply and demand remains in check, Uber is an example of a company that converts data into actionable findings. Similarly, the airline industry has been commonly known to use flight network data to not just measure baseline information such as aircraft utilization and miles flown, but to also translate that information into reduced fuel consumption, thereby improving operational efficiency.

IBM outlines a number of findings and recommendations on this front derived from its research on the financial services sector. A number of key ones, however, imply that data strategies should be rooted in customer-centric outcomes – beginning with existing data – and linked to measurable business outcomes. This is meant to ensure that data exists for more than just data’s sake, but rather for the purpose of being linked to tangible outcomes.

The relevance of this best practice to HIN planners and operators is that HIN data analysis, as previously addressed, will play an increasingly important role down the road. The extent of data analysis within the context of HINs currently, however, is largely restricted to usage. That is, who is using the HIN, what are they accessing, and how often are they accessing it. If the HIN determinant of success is usage, this data is sufficient. However, to fully realize the benefits of data, HINs need to link usage to everyday business decisions, rather than using data as a periodic measure of progress.

Data capabilities will also play an important role in focusing the outcomes of HIN related efforts. HIN planners and operators can use clinical and financial data in health care that traverses the information exchange infrastructure to identify cost and quality drivers, and, in turn, focus on specialized care management and care coordination across health and social services for the biggest utilizer of the services.

**Best Practice #2 from Broader Research: Enabling Access to Data can Drive Usage and Inter-Organizational Collaboration, but only if Steps are taken to Ensure Organizations are Internally Ready to Share the Data**

Simply making information available does not mean organizations will necessarily be able to use it. Data sharing can improve collaboration between organizations, but only if organizations prepare their internal resources to take advantage of it.

Looking at the context of manufacturing, INSEAD outlines a number of examples where mutual data access and transparency between suppliers and customers enhances the relationship between the two. On the one hand, suppliers are able to enhance just-in-time service delivery through up-to-date customer information. On the other hand, customers are able to better manage contingencies and service disruptions through a better understanding of their external...
environment. This type of mutual data exchange has shown to improve customer-supplier trust and loyalty.\textsuperscript{16}

However, this type of mutually beneficial relationship is not an effort-free endeavour. In outlining best practices for big data, TDWI indicates that any data endeavour, internally or externally, should begin with a business justification, an understanding of which form of data analysis will meet that business need, and, once selected, procedures for enacting that form of data analysis need to be formulated on a proof-of-concept basis. Translated, initiatives should start out small and with a clear understanding of the outcomes they are trying to achieve.\textsuperscript{17}

The relevance of this best practice to HIN planners and operators is that HIN data capabilities are still emerging, and there is plenty of opportunity to work with internal resources to ensure they are leveraging those capabilities to the greatest extent. While legislators, payers and providers all play varying roles depending on the region and circumstance, the customer-supplier relationship in health care isn’t always as clearly defined as in manufacturing. However, that notion that data sharing can, in the long run, be of immense benefit to all parties holds true in this area as well. One common challenge to HIN adoption – the reasons for which can vary by jurisdiction – is reluctance by stakeholders to share data across the continuum of care.

It may be beneficial for HINs, thus, to encourage their members to begin looking at developing their own business cases for data sharing, and leveraging existing applications even before data analysis and sharing capabilities go live HIN-wide. This can help in developing the internal skills and resources required to take advantage of data, while encouraging the organizational appetite for sharing information.

**Best Practice #3 from Broader Research: Interoperability is Not a Snapshot-in-Time Activity, but One that should have Consideration for Future/Desired States, as Supported by Technical Quality of Current Standards**

Sustaining interoperability at the technical and business level means thinking about future internal and external interoperability requirements, rather than the just near-term ones. This is particularly true of contexts involving large, complex data exchange, as legacy standards and processes can be a more significant drain in such contexts.

The Metro Vancouver Radio Frequency Identification (RFID) working group, a group consisting of 11 organizational stakeholders and, thus, one such complex data exchange environment, provides a number of forward looking recommendations on interoperability. These include factoring in systems that will currently – and in the future – be interoperable with any proposed solution, and ensuring that participating organizations review desired and current policy states to ensure interoperability is achieved and sustained.\textsuperscript{18}

The European Telecommunications Standards Institute (ETSI) echoes this sentiment in indicating that standards often outgrow the purview of a single standards-setting organization, and that standards and specifications are more and more likely to be used in ways in which they were never originally intended. To mitigate the interoperability challenges inherent in uncertain future states, ETSI outlines a few steps organizations can take now to increase the likelihood that current standards and specifications can remain viable in the future. The most important of these, of course, is that “good technical quality is essential in any standard. Ambiguities, errors, unclear requirements, conflicting options and other factors that could lead to non-interoperability must be reduced to a minimum.”\textsuperscript{19}

The relevance of this best practice to HIN planners and operators is that, while stakeholders and requirements can vary wildly across industries and sectors, at its core, interoperability is predicated on a number of shared principles. As with transportation and telecommunications,
the complexity and connectedness of HINs is increasing, including the use of multiple standards. This also brings increased challenges in interfacing across platforms and vendors.

HINs must place a priority on frontloading the work to ensure that their data, processes and policies are sufficiently considerate of any desired future state, so as to improve outcomes later on. Sustaining HIN interoperability, thus, is highly reliant on improved technical quality of standards and specifications.

**Best Practice #4 from Broader Research: Novel Process and Workflow Changes are More Effective when Implemented Gradually and In Conjunction with Concerted Stakeholder Engagement Initiatives**

With many technical implementations that introduce significant work flow and process changes, organizations must ultimately decide whether to pursue a longer, lower risk phased implementation, or whether to pursue a higher risk, higher reward “big bang” approach. While the answer is highly contingent on the circumstances in which the question is being asked, generally speaking, the more novel or radical the change, the more likely a phased approach will improve success during go-live.

In this same vein, the Business Process Management Institute, an organization which provides business process management certifications to the professional community, favours a more systematic approach to business process changes. In outlining business process management best practices, the institute implies that pursuing a systematic rollout, beginning with a strategically beneficial pilot group, will reduce resistance to change. That is of course, as long as you communicate with and involve all affected stakeholder groups throughout the rollout.20

Enterprise resource planning (ERP) implementations show greater tendency toward similarly strategic phased approaches. That is largely due to the scope and complexity of, as well as resources available to support, ERP implementations. While reducing time-to-implement is often a high priority, organizations are beginning to realize that if it comes at the expense of organizational readiness for – and willingness to accept – change, then ERP implementations will be more likely to fail.21

The relevance of this best practice to HIN planners and operators is that HINs require substantial changes to clinical and business processes to maximize value. This not only requires significant stakeholder buy-in to achieve, but it also requires significant resources.

Whether it is by selecting specific use cases, stakeholder groups, organizations within the provider network, or otherwise, HINs are more likely to have success by pursuing staged changes rather than big wins. That means maintaining a longer term vision for HIN implementation, while having the patience and focus to make small, iterative progress along the way.

**Best Practice #5 from Broader Research: Network Segmentation is an Effective Way to Mitigate many of the Security and Access Risks Inherent in Large-Scale Connected Environments**

Security is a prominent concern in any networked environment. This is especially true when the consequences for security breaches are elevated resulting from significant punitive, regulatory or other tangible consequences. These failures are often attributed to network architects and administrators for failing to ensure that only those with authorization to access specific data are able to do so. One important method for mitigating this risk is network segmentation.
At a high level, Industry Canada recommends, as a best practice, that Canadian telecommunications services providers ensure a logical, and preferably physical, separation of various network components as a means of managing security. At the very least – and most importantly – this segmentation should be enforced at the network management level where traffic provisioning and interfaces take place. Specifically, Industry Canada recommends “isolate[ing] management functions; restrict[ing] access, allowing access to only known and approved hosts and services; filter[ing] management access to devices; us[ing] secure management protocols whenever possible; log[ging] critical events for network elements; and identify[ing] the sources of malicious events.”

The Australian Department of Defense corroborates this by outlining a number of best practices related to network segmentation and segregation. At a higher level, it is recommended that networks employ the principles of least privilege and need-to-know, meaning network entities should be able to communicate only with each other at the lowest level required to achieve their intended purpose. At a more granular level, this means using appropriate measures to logically restrict network traffic. This can be through: network layer filtering; state-based filtering; port or protocol level filtering; authentication filtering; and application filtering.

The relevance of this best practice to HIN planners and operators is that, not unlike the telecommunications industry where customer demographic and billing information must be adequately managed, or at the Department of Defense where data and information can represent matters of national security, network security in a connected HIN is integral to ensuring patient information is used only for the purpose of administering care and nothing else. In other words, best practice network security and access protocols, such as the ones recommended above, are often data agnostic and should be taken into strict consideration in network architecture design. For HINs, in particular, these measures are especially important in appeasing many of the privacy concerns that are often associated with the ultimate aim of a 360 longitudinal patient record view.
Appendix A – HIN Planning and Operations Best Practices

Discovery Framework Detailed Activity Group Explanations

Regional Strategy and Incentives

Figure 7. Discovery Framework: Regional Strategy and Incentives Summary

The Regional Strategy and Incentives components enhance the likelihood of success through appropriate consideration by executives and strategists of the unique operating constraints and circumstances of their respective jurisdictions, while being forward-looking and cognizant of adoption barriers. The key factors and activities involved in HIN regional strategies and incentives include:

- **Strategic Plan Development**: The HIN develops an overall strategic plan that includes specified vision, goals, objectives and a roadmap for the future state.

- **Short and Long-term Strategy**: The HIN creates a short and long-term strategy for implementation, whether that means new large-scale initiatives or smaller projects within existing operations. The short-term objectives include immediate priorities, and next steps for project planning and initiation. Long-term objectives include a two-five year outlook on the future of the HIN, including health system priorities and objectives, and clinical priorities.

- **Financial and Other Incentives**: The HIN establishes timelines and incentives to increase adoption, including financial incentives. Additionally, the HIN defines the financial support required to achieve its goals.

- **Legislation/Regulations**: The HIN has an understanding of current and future state legal frameworks, legislation, partnership agreements, use of data, data protection, and government regulation.

- **Privacy and Security**: The HIN has a strategy for dealing with the privacy and security requirements of a country, province, state or other geographic/jurisdictional area.
Planning and Scope

Figure 8. Discovery Framework: Planning and Scope Summary

The Planning and Scope components enhance the likelihood of ongoing success through ensuring the correct business processes, agreements and financial resources are in place for a HIN implementation, or for initiatives within an existing HIN. The key factors and activities involved in HIN planning and scope include:

- **Implementation Strategy**: The HIN establishes a clear scope for the implementation (i.e., centralized versus decentralized or hybrid).
- **Operational Plan Development**: The HIN creates tactical goals and objectives that are clearly linked to strategic planning. The operational plan helps to shape the operating budget for HIN implementation.
- **Funding**: The HIN secures sufficient financial resources to meet initial objectives. There is at least a high level plan for funding ongoing operations. Sources include participants’ internal funding, government agency funds, non-profit organizations, local grants, private health care vendors/providers, foundations, private donors, and, if applicable, operational revenue such as that received for transaction fees.
- **Memoranda of Understanding (MOU) and Agreements**: The HIN has a policy framework in which to operate. Defined agreements between parties including: data privacy; data security; commercialization (or not) of de-identified population health information (PHI) and other potential sources of value; data use; data sharing; and business associate agreements.
- **Use Case**: The HIN identifies use case(s) for implementation. In this context, a use case refers to specific clinical or administrative scenarios or processes that a HIN would support through the systems and services it operates. Some of the high-level use cases that HINs usually focus on are:
  - Sharing patient transactional data – Transmitting the results of a single event, such as a lab test or encounter, as well as referrals.
  - Patient summary – Sharing a compiled summary of information from single events.
  - Extended electronic health record (EHR) – Achieving the functions of a full EHR across entities within an organization or across organizations with no EHRs (an additional potential vendor offering provided by some HIN vendors).
- Personal health record (PHR) – Providing a patient-facing portal for access to patient-entered or amended clinical data.
- More focused processes such as all or part of the medication management cycle and the referral cycle.

**Standards Definitions and Promotion:** The HIN identifies a set of clear, locally relevant standards and implementation specifications for messaging, data structures, nomenclatures, health care services, clinical processes, etc.

**Methodologies and Toolsets:** The HIN creates materials that establish clear step-by-step processes and procedures, as well as a framework for change management, to assist users in the initial implementation and ongoing use of the HIN.

**Ease of Use and Interface:** The HIN has plans and approaches to ensure that user interfaces are designed with input from the key stakeholders and deliver access to information largely in context, so that users can access information as part of their existing systems and devices.

**Workflow Design:** The HIN evaluates processes and recommends how to integrate services into the overall day-to-day clinical workflow, which makes it easier to use and increases adoption by physicians and clinicians.

**Procurement:** The HIN creates an effective sourcing model that enables the acquisition of technologies and services cost-efficiently.

**Timing/Prioritization:** The HIN creates an implementation timeline/roadmap with clearly defined deliverables based on agreed upon priorities.

**Infostructure:** The HIN defines and develops an agreed-upon structure for the definition, management and stewardship of health and other information. The infostructure aids with data visibility and data quality to build confidence in the quality and completeness of information, and any analytics developed from that analysis.

**Patient Encounter Flow Use Cases:** The HIN considers the clinical and other workflows that make up the various use cases and encounters. This includes the tracking of the timeliness of data and information as it moves through the HIN’s technology infrastructure.

**Architecture Strategy:** The HIN has a clearly defined architecture strategy that enables and supports interoperability and exchange through loosely-coupled, service-based interfaces to enable callable services and process management.

**New Clinical Content Creation:** The HIN develops a plan for ownership of clinical and other content that is created by the HIN itself, or through the use of HIN services.

**Continuum of Care:** The HIN selects and pilots a specific care setting within which to prove success, and then implements it on a broader scale. Care settings include: primary care; acute/hospital care; community/social care; and long-term care.

**Clinical Services:** The HIN determines which clinical services to implement, and determines a roadmap for how these would be extended, expanded and integrated in a “cradle-to-grave” approach. In other words, the HIN enables clinical services beyond the capturing and sharing of clinical information electronically, to also include clinical process orchestration. Examples of clinical services include: oncology, radiology and cardiology.

**Analytics:** The HIN establishes rules and processes about how it will support analytics and reporting. Emphasis is placed on how the HIN can help to:
- Deliver better care by providing relevant information for improved assessment and care decisions during an encounter, or for longer term planning and preventive care.
- Deliver care better by providing relevant information for improved management, policy and investment decisions in support of protection, diagnosis and care.
Implementation Framework

The Implementation Framework components enhance likelihood of success by ensuring the appropriate technical components of a HIN are in place for effective operations. Implementation activities will be ongoing and iterative as the HIN develops new use cases, and matures its capabilities and services. The key factors and activities involved in the HIN implementation framework include:

- **Adherence to Interoperability Standards**: The HIN adopts locally relevant, industry-based, nationally recognized or proprietary interoperability standards. The HIN develops and supports implementation specifications for each of the standards.

- **Approach to Security**: The HIN extracts value from international standards to determine which security policies make the most sense to the organization. This includes ensuring the security of patient information and its authorized use, as well as adherence to documented guidelines in compliance with data protection standards and regulations that are relevant to the jurisdiction in question.

- **Privacy and Consent Management**: The HIN has regulation, policies, buy-in and enabling technology to allow confidence in compliance with cultural norms and jurisdictional laws, and to allow consumers and patients to determine what health information they are willing to permit their care providers to access and share.

- **Certification/Testing**: The HIN develops processes and standards and implementation specifications for testing and certifying system, individuals and organizational participant compliance with a range of key items including, but not limited to: privacy and security requirements; edge-system connectivity and ability to interoperate; and data quality.

- **Infrastructure Readiness**: The HIN implements and maintains an infrastructure which effectively meets network, computational, desktop, storage and application requirements.

- **Information Exchange and Interoperability**: The HIN facilitates and coordinates clinical information to various stakeholders in a private and secure way. This involves:
  - The transmission of information, and the management of exchange among health care stakeholders using standardized mechanisms.
  - Information that can be understood and used by the other systems or individuals in the HIN, using common information models to support syntactic and semantic interoperability.

- **Health Information Services**: The HIN has the ability to provide information technology services as common, callable services that can be utilized by authorized users and
systems (e.g., access to a shared health record of lab information, or clinical decision support such as drug utilization review).

- **Clinical and Business Process Management**: The HIN supports the end-to-end coordination of data-driven and event-driven processes among stakeholders. Examples include: referral management, care guidelines and regulatory constraints.

- **Analytics and Reporting**: The HIN enables the aggregation, analysis and use of the process and clinical data to support retrospective (what happened in the past), real-time (what is happening now), predictive (what could happen in the future), and prescriptive (what HINs can proactively do) analytics.

### Operations

**Figure 10. Discovery Framework: Operations Summary**

The Operations components act as a driver for success through creation of a sustainable HIN from a financial and a functional standpoint. The key factors and activities involved in HIN operations include:

- **Business and Technical Operating Model**: Technical and business operations are provided by an autonomous organization with a clear mandate, governance structure and business model (including service delivery, marketing and sales, resources, financial models).

- **Reinvestment Model**: The HIN has a clear revenue and funding model which will sustain operations in the long run.

- **Sustained and Evolution**: The HIN’s sustainment activities include a functional and technical evolution that supports product innovation and maintenance of an enhancement pipeline for the near and long term.

- **Outreach and Onboarding**: The HIN establishes technical and operational mechanisms to acquire more partners/users over time, and to encourage end-user adoption through: marketing/collateral related to showcasing the benefits of the HIN to a broader audience; and training and education related to getting users up and running on the HIN.

- **Ongoing Validation**: The HIN employs continual monitoring and management of benefits and return on investment, so as to ensure alignment with clinical needs and processes.

- **Technical Change Management**: The HIN defines and implements standard change management methods for efficient handling of all changes related to the IT infrastructure and applications.
• **Data Integrity:** The HIN creates an oversight mechanism that helps ensure the accuracy and consistency of data over its lifecycle.

**Governance**

Figure 11. Discovery Framework: Governance Summary

The Governance components drive success through ensuring the right oversight structures are in place to drive and adapt, as necessary, the optimal HIN implementation and operational strategies. The key factors and activities involved in HIN governance include:

- **Program and Project Management & Governance:** Decision-making authorities and processes for overall program requirements, as well as the day-to-day project governance processes.
- **Overall Funding Strategy:** Necessary funding (e.g., grants, committed budget, or the approvals to levy fees) to design, build and launch a sustainable operation.
- **Resource Allocation:** The HIN has access to, and assigns, sufficient and appropriately skilled and knowledgeable resources to implementation and operations activities.
- **Implementation Projects Sequencing:** The HIN puts in place processes and procedures that address how to determine scope, funding and change for the immediate project implementation, and also long-term program operational and sustainment activities.
- **Clinical Content Governance:** The HIN develops a process for managing decisions about the use, liability and ownership of clinical and other content that is created by the HIN, or through the use of HIN services.
Benefits Realization components enable success through establishment of a clear linkage between HIN implementation and operations, and associated outcomes. The key factors involved in HIN benefits realization include:

- **Business Case**: The HIN creates a business case that identifies quantitative and qualitative drivers for success, and the ongoing measurement of those benefits.
- **Formal Benefits Identification and Framework**: The HIN identifies specific operating benefits for implementation during the planning process, and then measures and reports the benefits periodically.
- **Value-focused (Clinical Adoption, Quality Implementation, etc.)**: The HIN focuses on defining, tracking and reporting on specific outcomes, including clinical adoption and the quality of implementation.
- **Key Performance Indicators**: The HIN establishes a set of key performance indicators (KPIs) that seek to quantify and measure its success, and gauge performance.
Skills and Resources components drive success through ensuring that all necessary roles are filled by individuals with the necessary capability, experience and attitude. The key factors involved in HIN skills and resources include:

- **Internal Skills and Resourcing:** The HIN has internal skills, or hires resources, with practical expertise and knowledge in HIN design and implementation.
- **Training:** The HIN trains the people who run and use the technology, including internal and external stakeholders (e.g., HIN staff and the staff of HIN partners and “customers”).
- **Third-party Services:** The HIN has access to resources from professional services organizations to provide complete deliverables, or to fill expertise gaps as necessary during the design/strategy phase and the implementation phase. Expedited, cost effective and well-managed supply is made available through strategic sourcing engagements.
- **Maintenance and Support:** The HIN establishes a plan for ongoing maintenance and support. Maintenance includes preventive maintenance, diagnostic maintenance, as well as updates to and replacement/repair of technologies, systems and tools. Support refers to ongoing HIN user help and assistance.
Stakeholder Engagement

Figure 14. Discovery Framework: Stakeholder Engagement Summary

The components of Stakeholder Engagement enable success through ensuring that all potential relevant stakeholders are appropriately involved so as to achieve broad buy-in, achieve approvals for ongoing funding, facilitate onboarding of new partners and users, and encourage utilization of the services provided. The key factors and activities involved in HIN stakeholder engagement include:

- **Multi-Stakeholder Engagement**: The HIN involves key stakeholders including clinicians, physicians, patients and vendors in planning, design and rollout. These stakeholders serve as champions in the adoption process.

- **Change Management (including Communication Strategy)**: The HIN employs an ongoing change management strategy that engages and educates all major stakeholder groups involved in or affected by the HIN implementation.

- **Executive Sponsor and Leader**: The HIN selects an executive sponsor who has the right role, character and an appropriate level of risk tolerance, is entrepreneurial, and understands the organizational and technical change requirements of HIN implementation and operation.

- **Government and Government Agencies**: The HIN actively works with government leadership, agencies and other government entities to ensure that the HIN is not only meeting national and regional requirements, but can also help shape the regulatory, planning and funding environment.
Appendix B – Interviewee Origin Country Profiles from Commonwealth Fund Study

The Commonwealth Fund – a private foundation that promotes improved access, quality and efficiency of health care services around the world – published profiles of a number of international health care systems. Many of the countries within which the organizations that were interviewed for this study operate, with the exception of Estonia and Israel, were presented in the Commonwealth Fund study.

While we recommend reading the full study (a link to which can be found in endnote 24), to help situate the contexts within which interviewee organizations operate, we present a summary of relevant findings from that Commonwealth Fund study here.

Table 2. Healthcare System Financing and Coverage

<table>
<thead>
<tr>
<th>Country</th>
<th>Health System and Public/Private Insurance Role</th>
</tr>
</thead>
</table>
| Australia   | **Government Role:** Regionally administered, joint (national & state) public hospital funding; universal public medical insurance program (Medicare)  
**Public System Financing:** General tax revenue; earmarked income tax  
**Private Insurance Role:** Approx. 50% buy complementary (e.g., private hospital and dental care, optometry) and supplementary coverage (increased choice) |
| Canada      | **Government Role:** Regionally administered universal public insurance program that plans and funds (mainly private) provision  
**Public System Financing:** Provincial/federal general tax revenue  
**Private Insurance Role:** Approx. 67% buy complementary coverage for non-covered benefits (e.g., private rooms in hospitals, drugs, dental care, optometry) |
| Denmark     | **Government Role:** National health care system. Regulation, central planning and funding by national government; provision by regional and municipal authorities  
**Public System Financing:** Earmarked income tax  
**Private Insurance Role:** Approx. ~40% buy complementary coverage (cost-sharing, non-covered benefits such as physiotherapy), some supplementary coverage (access to private providers) |
<table>
<thead>
<tr>
<th>Country</th>
<th>Health System and Public/Private Insurance Role</th>
</tr>
</thead>
</table>
| New Zealand | **Government Role:** National health care system. Responsibility for planning, purchasing and provision devolved to geographically defined District Health Boards  
**Public System Financing:** General tax revenue  
**Private Insurance Role:** Approx. 33% buy complementary coverage (for cost-sharing, specialist fees, and elective surgery in private hospitals) and supplementary coverage for faster access to non-urgent treatment |
| Singapore   | **Government Role:** Government subsidies at public health care institutions and some providers; Medisave: mandatory medical savings program for routine expenses; MediShield: catastrophic health insurance; Medifund: government endowment fund to subsidize health care for low-income and those with large bills. Government regulation of private insurance, central planning and financing of infrastructure and some direct provision through public hospitals and clinics  
**Public System Financing:** General tax revenue  
**Private Insurance Role:** Medisave-approved Integrated Shield Plans (private insurance plans) supplement MediShield coverage to provide catastrophic health coverage for additional ward classes. Other types of private insurance are also available, including private insurance provided by employers |
| Sweden      | **Government Role:** National health care system. Regulation, supervision and some funding by national government; responsibility for most financing and purchasing/provision devolved to county councils  
**Public System Financing:** Mainly general tax revenue raised by county councils, some national tax revenue  
**Private Insurance Role:** Approx. 5% get supplementary coverage from employers for quicker access to a specialists and elective treatment |
United States

**Government Role:**
Medicare: age 65+, some disabled; Medicaid: some low-income; for those without employer coverage, state-level insurance exchanges with income-based subsidies; insurance coverage mandated, with some exemptions (13.4% of adults uninsured)

**Public System Financing:**
Medicare: payroll tax, premiums, federal tax revenue; Medicaid: federal, state tax revenue

**Private Insurance Role:**
Primary private insurance covers ~56% of population (employer-based and individual); supplementary for Medicare

---

### Table 3. Selected Health Care System Indicators from Commonwealth Fund Study

<table>
<thead>
<tr>
<th>Country</th>
<th>AUS</th>
<th>CAN</th>
<th>DEN</th>
<th>NZ</th>
<th>SIN</th>
<th>SWE</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population, 2012 unless otherwise noted</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total population (millions of people)</td>
<td>22.724</td>
<td>34.881</td>
<td>5.592</td>
<td>4.433</td>
<td>5.312&lt;sup&gt;g&lt;/sup&gt;</td>
<td>9.519</td>
<td>313.914</td>
</tr>
<tr>
<td>Percentage of population over age 65</td>
<td>14.20%</td>
<td>14.90%</td>
<td>17.30%</td>
<td>13.80%</td>
<td>10.0%&lt;sup&gt;g&lt;/sup&gt;</td>
<td>18.70%</td>
<td>13.70%</td>
</tr>
<tr>
<td><strong>Spending, 2012 unless otherwise noted</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of GDP spent on health care</td>
<td>9.1%&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10.90%</td>
<td>11.00%</td>
<td>10.0%&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.7%&lt;sup&gt;g&lt;/sup&gt;</td>
<td>9.60%</td>
<td>16.90%</td>
</tr>
<tr>
<td>Health care spending per capita&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$3,997&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$4,602</td>
<td>$4,698</td>
<td>$3,172&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$2,881&lt;sup&gt;h&lt;/sup&gt;</td>
<td>$4,106</td>
<td>$8,745</td>
</tr>
<tr>
<td>Average annual growth rate of real health care spending per capita, 2002–2012</td>
<td>2.4%&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.40%</td>
<td>1.80%</td>
<td>3.5%&lt;sup&gt;c&lt;/sup&gt;</td>
<td>n/a</td>
<td>1.90%</td>
<td>2.40%</td>
</tr>
<tr>
<td>Out-of-pocket health care spending per capita&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$731&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$690</td>
<td>$584</td>
<td>$347&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n/a</td>
<td>$678</td>
<td>$1,045</td>
</tr>
<tr>
<td>Hospital spending per capita&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$1,614&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$1,310&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$2,075</td>
<td>$1,239&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n/a</td>
<td>$1,804</td>
<td>$2,811</td>
</tr>
<tr>
<td>Spending on pharmaceuticals per capita&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$588&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$771&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$295</td>
<td>$297&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n/a</td>
<td>$478</td>
<td>$1,010</td>
</tr>
<tr>
<td><strong>Physicians, 2012 unless otherwise noted</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of practising physicians per 1,000 population unless otherwise noted</td>
<td>3.31</td>
<td>2.48</td>
<td>n/a</td>
<td>2.7</td>
<td>1.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.46&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
### Hospital spending, utilization and capacity, 2012 unless otherwise noted

<table>
<thead>
<tr>
<th></th>
<th>AUS</th>
<th>CAN</th>
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<th>NZ</th>
<th>SIN</th>
<th>SWE</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of acute care hospital beds per 1,000 population</td>
<td>3.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.53&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.61</td>
<td>2.0&lt;sup&gt;i&lt;/sup&gt;&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.95</td>
<td>2.56&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hospital spending per discharge&lt;sup&gt;d&lt;/sup&gt;</td>
<td>$9,346&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$15,754&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$11,472&lt;sup&gt;b&lt;/sup&gt;</td>
<td>$8,434&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n/a</td>
<td>$9,975&lt;sup&gt;b&lt;/sup&gt;</td>
<td>$20,932&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hospital discharges per 1,000 population</td>
<td>173&lt;sup&gt;a&lt;/sup&gt;</td>
<td>83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>172&lt;sup&gt;b&lt;/sup&gt;</td>
<td>148</td>
<td>n/a</td>
<td>163&lt;sup&gt;b&lt;/sup&gt;</td>
<td>125&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Average length of stay for acute care (days)</td>
<td>4.9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>n/a</td>
<td>5.6</td>
<td>n/a</td>
<td>5.6</td>
<td>5.4&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

### Medical Technology Information, 2012 unless otherwise noted

<table>
<thead>
<tr>
<th></th>
<th>AUS</th>
<th>CAN</th>
<th>DEN</th>
<th>NZ</th>
<th>SIN</th>
<th>SWE</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetic resonance imaging (MRI) machines per million population</td>
<td>15</td>
<td>8.8</td>
<td>n/a</td>
<td>11.1</td>
<td>8.3&lt;sup&gt;j&lt;/sup&gt;&lt;sup,b&lt;/sup&gt;</td>
<td>n/a</td>
<td>34.5</td>
</tr>
<tr>
<td>MRI exams per 1,000 population</td>
<td>26</td>
<td>53.7</td>
<td>67</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>104.8</td>
</tr>
<tr>
<td>Physicians’ use of EMRs (% of primary care technology, 2012 physicians)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>92%</td>
<td>56%</td>
<td>n/a</td>
<td>97%</td>
<td>n/a</td>
<td>88%</td>
<td>69%</td>
</tr>
</tbody>
</table>

### Health Risk Factors, 2012 unless otherwise noted

<table>
<thead>
<tr>
<th></th>
<th>AUS</th>
<th>CAN</th>
<th>DEN</th>
<th>NZ</th>
<th>SIN</th>
<th>SWE</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of adults who report being daily smokers</td>
<td>15.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>16.10%</td>
<td>20.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>16.50%</td>
<td>13.3&lt;sup&gt;k&lt;/sup&gt;&lt;sup,l&lt;/sup&gt;</td>
<td>13.10%</td>
<td>14.20%</td>
</tr>
<tr>
<td>Obesity (BMI &gt;30) prevalence</td>
<td>28.3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>13.4&lt;sup&gt;b&lt;/sup&gt;&lt;sup,e&lt;/sup&gt;</td>
<td>28.40%</td>
<td>10.8&lt;sup&gt;k&lt;/sup&gt;&lt;sup,b&lt;/sup&gt;</td>
<td>11.8&lt;sup&gt;e&lt;/sup&gt;</td>
<td>35.30%</td>
</tr>
</tbody>
</table>

Source: OECD Health Data 2014 (June) unless otherwise noted.

<sup>a</sup> 2011.

<sup>b</sup> 2010.

<sup>c</sup> 2002–2011.

<sup>d</sup> Adjusted for differences in the cost of living (PPP; purchasing power parity adjustment).

<sup>e</sup> Self-reported as opposed to measured data.

<sup>f</sup> Source: 2012 Commonwealth Fund International Health Policy Survey of Primary Care Physicians.

<sup>g</sup> Source: World Bank, 2014.

<sup>h</sup> Source: World Bank, 2014; 2005 purchasing power parity (PPP) adjustment.

<sup>i</sup> Source: World Bank, 2014; may include chronic care beds as well as acute care beds.


<sup>k</sup> Source: Singapore Health Promotion Board, 2014.

<sup>l</sup> 2013.
Appendix C – Profiles of Organizations Interviewed

In support of the primary research for this white paper, Gartner interviewed 34 individuals (through 23 interviews) with 15 organizations in nine countries. The organizations interviewed (by country), and subsequent high-level organizational profiles are as follows:

**Figure 15. Summary of Organizations Interviewed by Country**

<table>
<thead>
<tr>
<th>Country</th>
<th>Organization Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>easternhealth GREAT HEALTH AND WELLBEING</td>
</tr>
<tr>
<td></td>
<td>UnitingCare Health</td>
</tr>
<tr>
<td>Estonia</td>
<td>E-TERVIS Eesti tervise ombudsusu</td>
</tr>
<tr>
<td>Sweden</td>
<td>inera</td>
</tr>
<tr>
<td>Israel</td>
<td>State of Israel Ministry of Health</td>
</tr>
<tr>
<td>USA</td>
<td>CORHIO™ Colorado Regional Health Information Organization</td>
</tr>
<tr>
<td></td>
<td>Inland Empire HIE</td>
</tr>
<tr>
<td></td>
<td>MiHIN Shared Services</td>
</tr>
<tr>
<td>Canada</td>
<td>Alberta Health Services</td>
</tr>
<tr>
<td></td>
<td>eHealth Ontario</td>
</tr>
<tr>
<td></td>
<td>Interior Health</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Health Link</td>
</tr>
<tr>
<td>Singapore</td>
<td>IHiS Because IT’s in Healthcare</td>
</tr>
<tr>
<td>Denmark</td>
<td>medcom Det danske Sundhedsdistanet</td>
</tr>
</tbody>
</table>

Gartner
### Table 4. Profiles of Organizations Interviewed

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description: “The Alberta Electronic Health Record (Alberta EHR) is the integrated provincial electronic health information network that provides shared access to prescribed health information, by authorized custodians, in a secure environment. The scope of the Alberta EHR is limited to networked health information systems for which Alberta Health is either the Information Manager or custodian.”[^25]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website:</td>
<td><a href="http://www.albertahealthservices.ca">www.albertahealthservices.ca</a></td>
</tr>
<tr>
<td>Business Structure:</td>
<td>Provincial government agency</td>
</tr>
<tr>
<td>Primary Geographical Scope of Operations:</td>
<td>Alberta, Canada</td>
</tr>
<tr>
<td>Population in Primary Geographical Scope:</td>
<td>Approx. 4M+</td>
</tr>
<tr>
<td>Number of Participating Health Professionals:</td>
<td>47,000+</td>
</tr>
<tr>
<td>Description: “CORHIO is a non-profit, public-private partnership that is improving health care for all Coloradans through the adoption of Health Information Technology (HIT) and the implementation of secure, electronic health information exchange (HIE).”[^26]</td>
<td></td>
</tr>
<tr>
<td>Website:</td>
<td><a href="http://www.corhio.org">www.corhio.org</a></td>
</tr>
<tr>
<td>Business Structure:</td>
<td>Non-profit, public HIE</td>
</tr>
<tr>
<td>Primary Geographical Scope of Operations:</td>
<td>Colorado, USA</td>
</tr>
<tr>
<td>Population in Primary Geographical Scope:</td>
<td>Approx. 5M+</td>
</tr>
<tr>
<td>Number of Participating Hospitals:</td>
<td>47</td>
</tr>
<tr>
<td>Number of Participating Health Professionals:</td>
<td>2,000+</td>
</tr>
<tr>
<td>Number of Labs:</td>
<td>4 non-hospital labs</td>
</tr>
<tr>
<td>Number of Other Participating Facilities:</td>
<td>140+ long-term and post-acute care facilities, 24 behavioral health centers, State Public Health Department</td>
</tr>
<tr>
<td>Initial Launch Funding Source:</td>
<td>State and federal grants</td>
</tr>
<tr>
<td>Ongoing Maintenance and Operations Funding Source:</td>
<td>Participant subscription fees[^27][^28]</td>
</tr>
<tr>
<td>Organization</td>
<td>Overview</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Eastern Health</strong></td>
<td><strong>Description:</strong> “Eastern Health provides a comprehensive range of high quality acute, sub-acute, palliative care, mental health, drug and alcohol, residential care and community health services to people and communities that are diverse in culture, age, socio-economic status, population and healthcare needs.”</td>
</tr>
<tr>
<td><strong>Website:</strong></td>
<td><a href="http://www.easternhealth.org.au">www.easternhealth.org.au</a></td>
</tr>
<tr>
<td><strong>Business structure:</strong></td>
<td>Community care network</td>
</tr>
<tr>
<td><strong>Primary Geographical Scope of Operations:</strong></td>
<td>Boroondara (Camberwell), Knox (North East and North West), Manningham, Maroondah, Whitehorse (Box Hill and Nunawading), Yarra Ranges (including Dandenongs, Lilydale and Seville) shires near Victoria, Australia</td>
</tr>
<tr>
<td><strong>Population in Primary Geographical Scope:</strong></td>
<td>Approx. 750,000</td>
</tr>
<tr>
<td><strong>Number of participating hospitals:</strong></td>
<td>7</td>
</tr>
</tbody>
</table>

| **eHealth Ontario**   | **Description:** “eHealth Ontario was established by the provincial government in September 2008 as an independent agency of the Ontario Ministry of Health and Long-Term Care. eHealth Ontario is enabling physicians and health care providers establish and maintain electronic health records (EHRs) for all of Ontario’s 13 million residents.” |
| **Website:**          | [www.ehealthontario.on.ca](http://www.ehealthontario.on.ca)             |
| **Business structure:** | Provincial government agency                                              |
| **Primary Geographical Scope of Operations:** | Ontario, Canada |
| **Population in Primary Geographical Scope:** | Approx. 13M+ |

| **E-tervis**           | **Description:** “The Estonian eHealth Foundation promotes and develops national e-solutions within the health care system – we create solutions and offer services with the goal to assist in providing high-quality and accessible health care services. Our broader goal is to promote the development of a patient-centered health care system that has well-informed patients.” |
| **Website:**           | [http://www.e-tervis.ee](http://www.e-tervis.ee)                        |
| **Business structure:** | Non-profit founded by the Ministry of Social Affairs, and division of responsibilities for administration shared between other government entities |
| **Primary Geographical Scope of Operations:** | Estonia |
| **Population in Primary Geographical Scope:** | Approx. 1.3M+ |
| Organization | Description: “HealthLink provides a computer communications system that links the information technology systems of more than 10,000 medical organizations across Australia, New Zealand, the Pacific Island nations and Canada. Each year more than 70 million pieces of clinical information are exchanged using the HealthLink system. HealthLink provides nearly all of the clinical communications used in New Zealand and is the largest provider of clinical messaging services in Australia.”

Website: [www.healthlink.net](http://www.healthlink.net)

Business structure: Commercial for-profit HIE infrastructure provider

Primary Geographical Scope of Operations: Global, but most prominently New Zealand and Australia

Population in Primary Geographical Scope: Approx. 4.4M+ in New Zealand, and Approx. 23M+ in Australia

Number of Participating Hospitals: 70

Number of Participating Health Professionals: 70,000 (estimate of the number of clinicians at 11,000 user organizations)

Number of Labs: 130

Number of Other Participating Facilities: 11,000 healthcare provider organizations, mostly general practices

Number of Unique Users: As above

Initial Launch Funding Source: Seed funding

Ongoing Maintenance and Operations Funding Source: Revenue generated through implementation services and messaging charges

Sample of Current Clinical Data Exchange Use Cases: Referrals, radiology, care management, pathology, prescriptions, claims

Planned Clinical Data Exchange Use Cases: Further extension of existing use cases |

| Organization | Description: “IEHIE represents a large group of hospitals and medical centers, medical groups, IPAs and physician practices.” Its goal is to “achieve continuity of care in the Inland Empire community by allowing providers and patients trusted, timely and secure access to patient health information.”

Website: [www.iehie.org](http://www.iehie.org)

Business structure: Private HIE formed through a collaborative of regional health care entities

Primary Geographical Scope of Operations: San Bernardino, Riverside and other California Counties, USA

Population in Primary Geographical Scope: Approx. 5M+ |
<table>
<thead>
<tr>
<th>Organization</th>
<th>Overview</th>
</tr>
</thead>
</table>
| IHiS         | **Description:** “IHiS is a healthcare-IT leader, transforming patient care through excellence in technology. Managing highly integrated systems across Singapore’s public healthcare sector, our IT professionals support more than 40,000 healthcare staff at all public hospitals, national specialty centres and polyclinics.

IHiS architects and oversees the performance of the institutions’ clinical, business and healthcare analytics systems. We played a key role in six Singapore hospitals becoming among the first public institutions in the Asia Pacific region to achieve HIMSS EMRAM Stage 6, an international benchmark for advanced technology used in patient care.”

**Website:** [http://www.IHiS.com.sg](http://www.IHiS.com.sg)

**Business structure:** Wholly-owned subsidiary of Ministry of Health Holdings (MOHH) subsidiary, which is the holding company responsible for Singapore’s public healthcare assets

**Primary Geographical Scope of Operations:** Singapore

**Population in Primary Geographical Scope:** Approx. 5.4M+

**Number of Participating Health care Institutions:** 9 regional hospitals, 6 specialist centres, and 18 polyclinics

**Number of Labs:** No private labs at this time, as most lab work performed in hospitals

**Number of Participating Health care Professionals:** 20,000

**Initial Launch Funding Source:** Ministry of Health via MOHH

**Number of Unique Users:** 40,000

**Ongoing Maintenance and Operations Funding:** Long-standing government commitment

**Sample of Current Clinical Data Exchange Use Cases:** Discharge summary, medication records, lab results, radiology reports

**Planned Clinical Data Exchange Use Cases:** Ambulatory-specialist referrals, continuation of care records, private GPs and private labs
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<tr>
<th>Organization</th>
<th>Overview</th>
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| Inera | **Description:** “Inera coordinates the county council and regional common e-health and development services for the benefit of citizens, patients, healthcare professionals and decision makers. The goal is to support care, strengthen the patient's position and create good access to health care.”

**Website:** [www.inera.se](http://www.inera.se) (Swedish only)

**Business structure:** Owned jointly by nine Swedish healthcare regions to coordinate joint eHealth strategies

**Primary Geographical Scope of Operations:** Sweden

**Population in Primary Geographical Scope:** Approx. 9.6M+ |

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<th>Interior Health</th>
<th>Overview</th>
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| **Description:** “Interior Health is mandated by the Health Authorities Act to plan, deliver, monitor and report on publicly funded health services for people who live within the Southern Interior of British Columbia. Its vision is ‘to set new standards of excellence in the delivery of health care.’”

**Website:** [www.interiorhealth.ca](http://www.interiorhealth.ca)

**Business structure:** Publicly funded health care provider

**Primary Geographical Scope of Operations:** Southern interior of British Columbia, Canada

**Population in Primary Geographical Scope:** Approx. 742K

**Number of Participating Hospitals:** 24

**Number of Participating Health Professionals:** 1,500

**Number of Labs:** 1 regionalized service (8 performing labs)

**Number of Other Participating Facilities:** 487 physician clinics

**Number of Unique Users:** 22,000

**Initial Launch Funding Source:** Digital health capabilities funded via Interior Health capital and operational funding

**Ongoing Maintenance and Operations Funding Source:** Ongoing operational funding model and sustainability are planned, and currently in progress

**Sample of Current Clinical Data Exchange Use Cases:** Lab results, radiology reports and transcribed reports

**Planned Clinical Data Exchange Use Cases:** Referrals and consults
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| **State of Israel Ministry of Health** | Health Information Network (HIN) Leading / Best Practices  
**Description:** “The Ministry of Health bears national responsibility for ensuring the health of the population of Israel. The ministry determines the policy on matters of health and medical services, and is in charge of planning, supervision and control, licensing and coordination of the health system’s services.”  
**Website:** [www.health.gov.il](http://www.health.gov.il)  
**Business structure:** Government ministry  
**Primary Geographical Scope of Operations:** Israel  
**Population in Primary Geographical Scope:** Approx. 8M+  
**Number of Participating Hospitals:** 50  
**Number of Participating Health Professionals:** 26,000  
**Number of Labs:** Contained within hospitals and HMOs  
**Number of Other Participating Facilities:** 5 HMOs covering 100% of the population’s community primary care  
**Initial Launch Funding Source:** Ministry of Health funded HIE implementation  
**Ongoing Maintenance and Operations Funding Source:** Regional health organizations responsible for ongoing operational and maintenance costs  
**Sample of Current Clinical Data Exchange Use Cases:** Clinical encounters, diagnosis, hospital visits, operations, medical procedures, allergies, labs, imaging (documents), pathology, prescriptions and discharge summaries  
**Planned Clinical Data Exchange Use Cases:** Imaging (original images) and nursing documents |
**Organization** | **Overview**
--- | ---
**MedCom** | **Description:** “MedCom was established in 1994 as a publicly funded, non-profit cooperation. MedCom facilitates the cooperation between authorities, organizations and private firms linked to the Danish healthcare sector. In the 1999 financial agreement between the counties and central government, it was decided that MedCom would be made permanent, with the following objective:

‘MedCom will contribute to the development, testing, dissemination and quality assurance of electronic communication and information in the healthcare sector with a view to supporting good patient progression.’”

**Website:** [http://www.MedCom.dk](http://www.MedCom.dk)

**Business structure:** Publicly funded non-profit organization

**Primary Geographical Scope of Operations:** Denmark

**Population in Primary Geographical Scope:** Approx. 5.6M+

**Number of Participating Hospitals:** 89

**Number of Participating Health Professionals:** 20,000

**Number of Labs:** 65

**Number of Other Participating Facilities:** 10,000 (including hospital wards, GP clinics, dental clinics, x-ray facilities, etc.)

**Number of Unique Users:** Approx. 40,000

**Initial Launch Funding Source:** Jointly owned and funded by the Ministry of Health, Danish Regions and Local Danish Governments

**Ongoing Maintenance and Operations Funding Source:** Long-standing funding by the aforementioned parties

**Sample of Current Clinical Data Exchange Use Cases:** Discharge summaries, lab reports, prescriptions

**Planned Clinical Data Exchange Use Cases:** Telemedicine enhancements and shared medication record
| Organization | Description: “The Michigan Health Information Network Shared Services (MiHIN) is Michigan’s initiative to continuously improve health care quality, efficiency and patient safety by promoting secure, electronic exchange of health information through the MiHIN Health Information Services Cloud™ (HISC). MiHIN represents a growing network of public and private organizations working to overcome data sharing barriers, reduce costs, and ultimately advance the health of Michigan’s population.”

Website: [http://www.mihin.org](http://www.mihin.org)
Business structure: Public and private non-profit collaboration
Primary Geographical Scope of Operations: Michigan, US
Population in Primary Geographical Scope: Approx. 9.9M+
Number of Participating Hospitals: State and federal grants
Sample of Current Clinical Data Exchange Use Cases: Sample use cases include, but are not limited to: Admission, discharge, and transfer summary (ADT), syndromic submission, immunization submission, active care relationships, and lab report submission
Planned Clinical Data Exchange Use Cases: Planned use cases include, but are not limited to: immunization forecasts, birth defect notifications, medication reconciliation and birth and death registries |

| NYeC | Description: “The New York eHealth Collaborative (NYeC, pronounced ‘Nice’) is a not-for-profit organization, working to improve healthcare for all New Yorkers through innovative health information technology (health IT). Founded in 2006 by healthcare leaders, in partnership with the New York State Department of Health, the New York eHealth Collaborative receives funding from state and federal grants to serve as the focal point for health IT in the State of New York. NYeC’s mission is to develop policies and standards, assist healthcare providers in making the shift to electronic health records, and coordinate the creation of a network to connect healthcare providers statewide.”

Website: [www.nyehealth.org](http://www.nyehealth.org)
Business structure: Not-for-profit organization
Primary Geographical Scope of Operations: New York, USA
Population in Primary Geographical Scope: 8.4M+
Initial Launch Funding Source: State and federal grants
Ongoing Maintenance and Operations Funding Source: Longstanding public funding |
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<tr>
<td>UnitingCare Health</td>
<td>Please note that the individual interviewed for this study from UnitingCare Health was also substantially involved in other initiatives or organizations, such as the Australian Private Hospital Association and the Australian Government initiated review of the country’s Personally Controlled Electronic Health Record. As such, background information for UnitingCare Health is provided for reference only, and it should be noted that the scope of the conversation was broader than a single entity.</td>
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**Description:** “UnitingCare Health is one of the largest not-for-profit private hospital groups in Queensland and is a service group of UnitingCare Queensland, along with UnitingCare Community, Blue Care and Australian Regional and Remote Community Services (ARRCS), which manages aged care and community services in the Northern Territory.

The hospital group is a major provider of health care services in Queensland which operates almost 1,000 licensed hospital beds and employs over 4,100 people.”


**Business Structure:** Not for profit community health provider

**Geographical Scope of Operations:** Brisbane, Buderim, and Hervey Bay in Queensland, Australia

**Population in Primary Geographical Scope:** Approx. 2M+, with approx. 100,000 annual admissions
Bibliography


Any questions regarding this White Paper should be addressed to:

Martin Geffen  
Vice President, Consulting  
Gartner Canada Co.  
1 Dundas Street W  
Suite 2500  
Toronto, ON  
M5G 1Z3  
Telephone: +1 416-228-7667  
Email: martin.geffen@gartner.com

Dennis Giokas  
Chief Technology Officer  
Canada Health Infoway  
150 King Street West  
Suite 1300  
Toronto, ON  
M5H 1J9  
Telephone: +1 416-979-4606  
Email: dgiokas@infoway-inforoute.ca