healthAlliance

Health Information Exchange

Trial Implementation Options

26 July 2013

Our partners

Auckland District Health Board Te Toka Tumai

Counties Manukau District Health Board A Community Partnership

Northland District Health Board Te Poari Hauora A Rohe O Te Tai Tokerau

Waitemata District Health Board Te Wai Awhina

HBL HealthBenefitsLimited Te Ara Maia

Version History

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2.0	2 November 2012	Revised version incorporating healthAlliance feedback.	Stuart MacKinnon, Michael Tapp, Aseem Agarwal
3.0	26 July 2013	Revised for publication on Health IT Board website	Stuart MacKinnon

Related Documents

Document	File Name/URL	Description
HIE Overview and Glossary (HISO 10040.0)	http://tinyurl.com/HISO10040-0	Overview of the HISO 10040 standards.
HIE CDR Utility Services (HISO 10040.1)	http://tinyurl.com/HISO10040-1	Specifies transport and identity services for information exchange
HIE Content Model (HISO 10040.2)	http://tinyurl.com/HISO10040-2	A framework for the creation of a common set of logical data definitions
HIE Structured Documents (HISO 10040.3)	http://tinyurl.com/HISO10040-3	A framework for structured documents as the currency of the HIE
Ministerial Review Group Report "Meeting the Challenge"	http://www.beehive.govt.nz/release/ministerial-review-group-report-released	The 2009 review chaired by Murray Horn, recommending new models of care, and the formation of the National Health IT Board
National Health IT Strategy	http://www.ithealthboard.health.nz/content/national-health-it-plan	The 2010 Strategy by the National Health IT Board.
Regional Information Strategy 2010-2020 (RIS10-20)	http://www.healthpoint.co.nz/download,224361.do	Authored by the Northern Region CIOs, Dec 2009

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Executive Summary

In April 2012 the Health Information Standards Organisation (HISO) published the 10040 'Health Information Exchange' Interoperability Standards. In mid-2012 the Ministry of Health engaged healthAlliance to propose a trial implementation of these standards, in a project that supports both regional and national healthcare information management goals.

This work has its origins in the call for new, patient-centric models of care recommended by the 2009 Ministerial Review Group. Following on from that review, the Northern Region Information Strategy focused on 'Person Centred Health Information' and the need for 'shared and trusted electronic health records and care plans'. The National Health IT Plan of 2010 then put forward the 'eHealth' vision that:

> *To achieve high-quality healthcare and improve patient safety, by 2014 New Zealanders will have a core set of personal health information available electronically to them and their treatment providers regardless of the setting as they access health services.* (p.5)

A Health Information Exchange (HIE) based on the HISO 10040 standards can provide a standard method for sharing health information. This information will take the form of 'documents' that can contain both traditional human-readable content, as well as computer-readable content, that can be imported and used by clinical and other systems.

The HISO 10040 Interoperability Standards define the following:

- *'CDR Utility Services'* (how 'documents' are published to and 'consumed' or viewed from the HIE)
- *'Structured Documents'* (how 'documents' are represented and organised internally), and
- *'Content Model'* (how data is represented inside a document's structure)

When implemented, the HISO 10040 standards will provide technical benefits that in turn, support clinical projects and their benefits. Technical benefits include:

- Reduction in the number of interfaces between systems and simplification of interfaces through standardisation.
- The ability to incorporate multiple data sources in the HIE as well as leveraging the current investment in large Clinical Data Repositories.
- Providing a platform for sharing of information across regional boundaries.

Clinical and financial benefits will be accrued from workstreams that are able to use the HIE infrastructure to share healthcare information such as; shared care initiatives, medicine safety

projects, electronic referral and discharges, after hours care, and supporting Integrated Family Health Centres and locality partnerships.

While a establishing a health information exchange, to be successful it needs to be developed in conjunction with clinical projects. The recommended approach is to demonstrate a trial implementation of an HIE infrastructure in association with at least one clinical project.

Three possible options for a trial HIE implementation were identified which would involve using the HISO 10040 standards to improve sharing of:

- InterRAI Assessments,
- Electronic Discharge Summaries, or
- Primary Care Summary Information

Ideally one of the three options would be found to offer higher relative value, and lower relative difficulty than the other options but this was not the case.

Sharing InterRAI assessments via the HIE would likely offer the least difficulty, as the national InterRAI project is already funded to deliver structured report documents via a HISO 10040 standard interface. At the same time, the proposed use of InterRAI assessments by community pharmacists in the Northern Region may be limited, so the project is expected to provide lower potential value compared with the other two options under consideration.

Using the HISO standards to share Electronic Discharge Summaries (eDSs) would provide greater value by addressing the non-delivery issues that occur using current point-to-point messaging for these documents. At the same time, eDSs could be made available to after hours and emergency health services. Modifying GP systems to receive eDSs via the Health Information Exchange would open the way for them to receive other documents this way as well, further reducing the need for point-to-point messaging. Introducing new structured eDSs at the same time would make this a significantly more challenging project than sharing InterRAI assessments.

Finally, using an HIE to store and share primary care summary information was argued to provide the greatest value by supporting after hours and emergency care, and forming a sound basis for the 2014 goal of making a core set of personal health information available for New Zealanders. This project would also offer the greatest implementation challenges, as it would involve a large number of GP practices and new types of documents.

To progress a trial HIE implementation based on the HISO 10040 standards in the Northern Region, two streams of work are recommended:

- First, is to initiate a process to establish the trial implementation infrastructure including registry and middleware, and other components that are not dependant on specific clinical applications of the infrastructure (such as initial governance processes).
- Second, is the selection of a suitable clinical project or projects to make use of the HIE infrastructure and standards.

Introduction

In April 2012 the Health Information Standards Organisation (HISO) published the 10040 'Health Information Exchange' Interoperability Standards. In mid-2012 the Ministry of Health engaged healthAlliance to propose a trial implementation of these standards, in a project that supports both regional and national healthcare information management goals.

This document begins by providing background to the demand for shared electronic healthcare records expressed in regional and national health IT plans, and provides a high-level explanation of the major components of the HISO 10040 standards for those who are not familiar with them.

The document then briefly overviews the advantages of interoperability and Health Information Exchanges (HIE) and then provides a high-level explanation of the major components of the HISO 10040 Interoperability Standards for those who are not familiar with them.

The technical benefits of an HIE are then explored, along with the ways that the infrastructure can be used to support clinical projects which come with their own clinical and financial benefits.

Next, an overview of trial implementation project options, conceptual designs, and advantages and disadvantages of each option are provided, along with a vision for how an HIE can contribute to sharing of clinical information in New Zealand following on from an initial trial.

The document then describes solution architecture required for a trial implementation and privacy and security considerations. Finally costs of implementing a trial Health Information Exchange project are estimated and recommended next steps are presented.

Strategic Context

2009 Ministerial Review Group: A More Affordable and Sustainable Health Service

The current direction of health service delivery and supporting information technology can be traced to the 2009 Ministerial Review Group report "Meeting the Challenge"[1]. Meeting the Challenge recommendations focused on developing a more affordable and sustainable health service and included:

- Closer to home 'New Models of Care' which are
  - Patient-centric,
  - Integrate primary, secondary and community services,
  - Are cost-effective, and
  - Reduce avoidable hospital admissions and unplanned readmissions.
- Improve patient safety and quality of care.
- Reconfigure services to ensure the right services are available in the right place including shifting some secondary services to primary care settings.

To support this new vision, the Review Group also recommended the formation of the National Health IT Board, to provide strategic leadership for national health IT strategy, planning, and governance over national systems. While the board was forming and writing the National Health IT Plan, the Northern Region Information Strategy was also being written.

Northern Region Information Strategy 2010-2020: Person-Centred Health Information

In 2009, the Northern Region DHB CIOs authored the Northern Region Information Strategy 2010-2020[2]. This strategy document reinforced many of the recommendations of the Ministerial Review Group and linked them to issues in the Northern Region.

"Person Centred Health Information" was a key focus area in the document. The authors acknowledged the complex, costly and fragmented current system architecture.

> *Our vision is improved health outcomes through empowering people, general practice teams and the wider clinical team to effectively manage care through appropriate access to and use of shared and trusted electronic health records and care plans.*
>
> (p.23)

[1] http://www.beehive.govt.nz/release/ministerial-review-group-report-released
[2] http://www.healthpoint.co.nz/download,224361.do

The authors proposed that to be able to support 'New Models of Care' and support 'Better, Sooner More Convenient' initiatives such as 'Integrated Family Health Centres', patient information would need to be shared via a 'Electronic Health Record' that various Point of Care and national systems could connect to. See Figure 1 below from the original document.

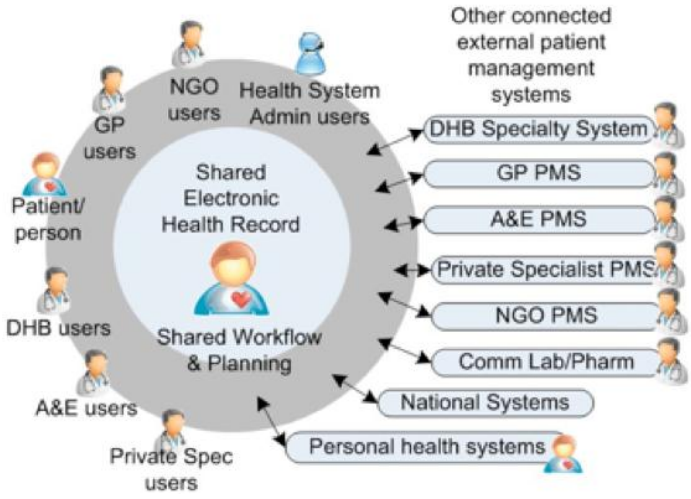


Figure 1 - "Future Shared System" - 2009 "Northern Region Information Strategy 2010-2020"

2010 National Health IT Plan: A Core Set of Personal Health Information

In the meantime, to support the recommendations of the Ministerial Review Group, the National Health IT Board developed its Plan[3] which included the 'eHealth' vision that:

> *To achieve high-quality healthcare and improve patient safety, by 2014 New Zealanders will have a core set of personal health information available electronically to them and their treatment providers regardless of the setting as they access health services.* (p.5)

And:

> *…each patient will have a virtual health record, with information stored electronically and accessible regardless of location by linking to existing systems run by healthcare organisations" (eg, general practice, hospital-based systems), a regional clinical results repository and a shared care record*. (p. 7)

The now well-known graphic from the plan identifies the key components required to support this vision (see Figure 2 below). Note the concept of the Clinical Data Repository at the centre

[3] http://www.ithealthboard.health.nz/content/national-health-it-plan

of the diagram is the basis for the Health Information Exchange being proposed in the present document.

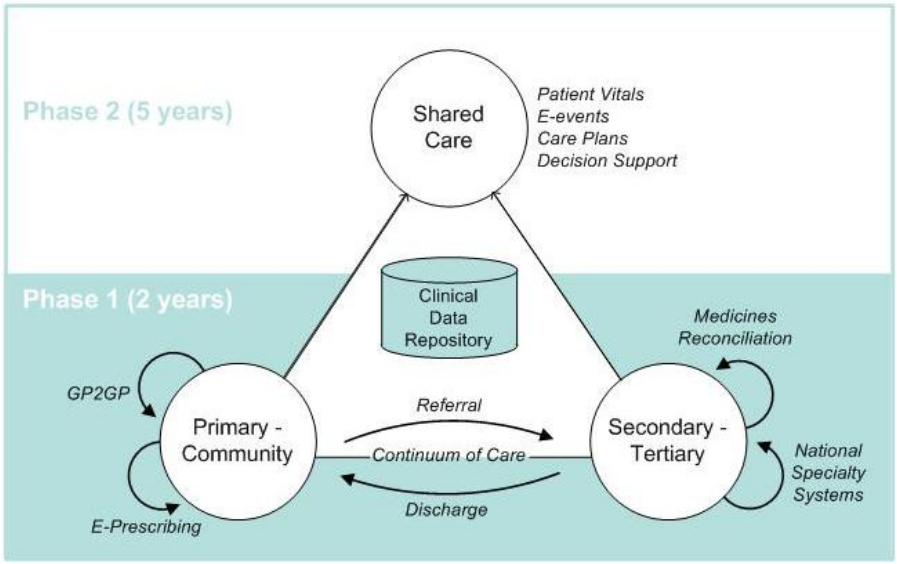


Figure 2 - Enabling an Integrated Healthcare Model (National Health IT Plan, Sept. 2010)

The National Health IT Plan identified workstreams under two phases. Workstreams where an HIE approach would be directly beneficial are marked with an asterisk. Workstreams are as follows:

Phase 1 - Consolidation

- Quality Information for Primary Health Care
- Continuum of Care*
- Safe Medications Management*
- Clinical Support*
- Patient Administration
- Population Health
- Business Support
- Safe Sharing Foundations*

Phase 2 – Shared Care

1. Maternity / well child / paediatrics*
2. Long-term conditions*

* Workstreams where an HIE approach would be directly beneficial.

What Is an HIE and How Can It Help?

A Health Information Exchange based on the HISO 10040 Interoperability standards will provide a standard method for sharing health information. This information will take the form of 'documents'. In health information exchanges, 'documents' can contain both traditional human-readable content, as well as computer-readable content that can be imported and used by clinical and other systems.

Why is Interoperability Important?

Interoperability refers to the ability of health information systems to work together within and across organisational boundaries in order to advance the effective delivery of healthcare for individuals and communities[4].

To achieve integrated healthcare, various repositories, point of care and portal systems need to exchange information with other health information systems in the health IT 'ecosystem'. Without standards, integration between systems is ad hoc, and in extreme cases can take the form seen on the left of Figure 3 below, where every system requires an individual interface to every other system. In contrast, an HIE based on interoperability standards can provide each health information system with a single interface to the information stored by all of the other collaborating systems, as shown conceptually on the right of Figure 3 below.

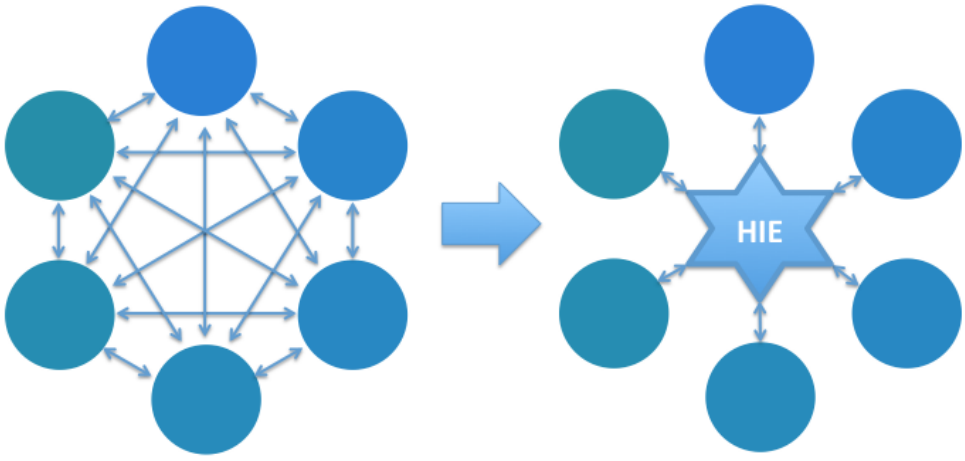


Figure 3 - Individual interfaces between health systems compared with a Health Information Exchange [5].

[4] http://www.himss.org/content/files/interoperability_definition_background_060905.pdf

[5] Adapted from Benson , T. (2010) *Principles of Health Interoperability, HL7 and SNOMED*. Springer.

Overview of the HISO HIE Interoperability Model

The HISO HIE Interoperability Standards define three major components of a successful Health Information Exchange:

- *'CDR Utility Services'* (how 'documents' are published to and 'consumed' or viewed from the HIE)
- *'Structured Documents'* (how 'documents' are represented and organised internally) and,
- *'Content Model'* (how data is represented inside a document's structure).

Readers who are familiar with these concepts are referred to the standards themselves for detail (links provided under 'Related Documents' on the first page of this document). The purpose of this section is to describe these components at a high level only.

Health Information Exchange CDR Utility Services

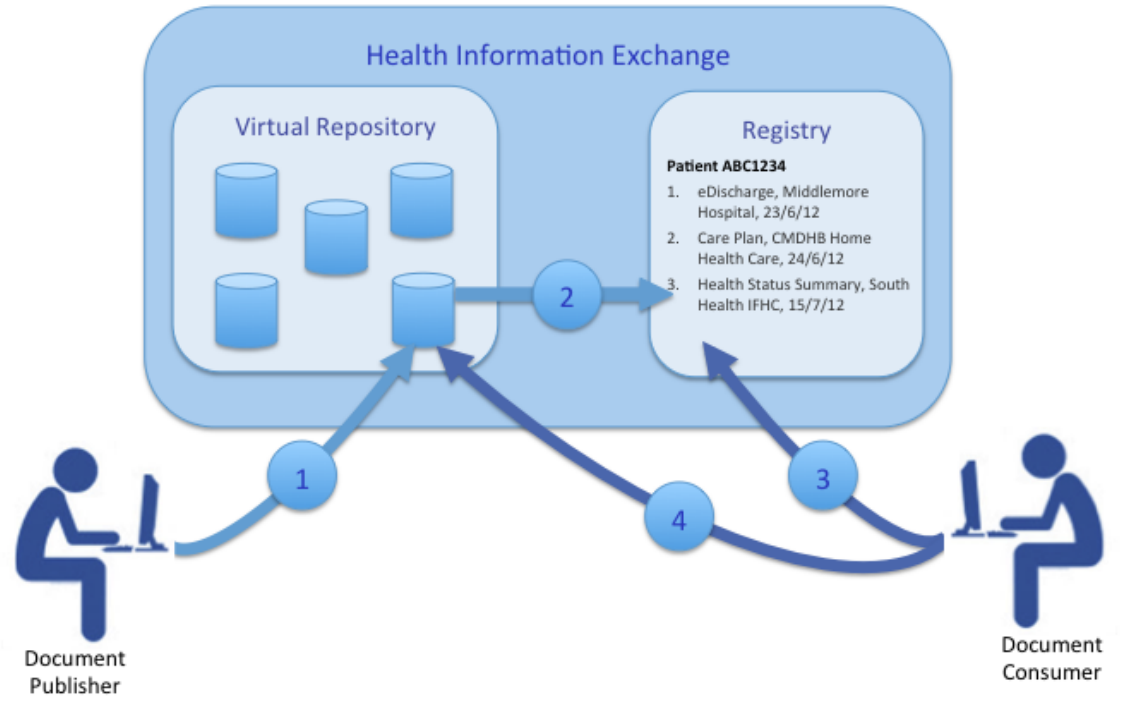
The HISO standards for publishing and consuming documents from the Health Information Exchange are based on the international 'IHE XDS' (Cross Enterprise Document Sharing) standards. IHE summarise XDS in this way:

> *Cross-Enterprise Document Sharing (XDS) is focused on providing a standards-based specification for managing the sharing of documents between any healthcare enterprise, ranging from a private physician office to a clinic to an acute care in-patient facility and personal health record systems. This is managed through federated document repositories and a document registry to create a longitudinal record of information about a patient within a given clinical affinity domain. These are distinct entities with separate responsibilities:*

- *A **Document Repository** is responsible for storing documents in a transparent, secure, reliable and persistent manner and responding to document retrieval requests.*
- *A **Document Registry** is responsible for storing information about those documents so that the documents of interest for the care of a patient may be easily found, selected and retrieved irrespective of the repository where they are actually stored.*
- *Documents are provided by one or more **Document Sources***
- *They are then accessed by one or more **Document Consumers***

(From http://wiki.ihe.net/index.php?title=Cross-Enterprise_Document_Sharing)

Figure 4 below, provides a simplified overview of how documents are stored and accessed from an XDS-based health information exchange.



1. Document publisher creates a document and a copy is stored in an HIE repository.
2. At the same time, information about the document and where it is stored in the HIE, is automatically entered into the registry.
3. An authorised healthcare provider, providing care to the patient, requests a list of documents available in the HIE.
4. If the healthcare provider wishes to view a document, it can be automatically retrieved from wherever it is stored in the repository.

Figure 4 - How Documents Are Shared In An XDS-based Health Information Exchange

Note that the 'Virtual Repository' can be made up of a number of data sources. The document 'consumer' does not need to know what or where these sources are. It is the Registry's role to keep track of what is available within the various data sources within the virtual repository.

Health Information Exchange Structured Documents

The HISO standard for Structured Documents adopts HL7 CDA (Clinical Document Architecture) as its foundation. The HL7 organisation describes CDA as a '*standard for the representation and machine processing of clinical documents in a way, which makes the documents both human readable and machine processable and guarantees preservation of the content*'[6]. A representation of the Generic CDA structure is presented in Figure 5 below.

[6] http://www.hl7.org.au/CDA.htm

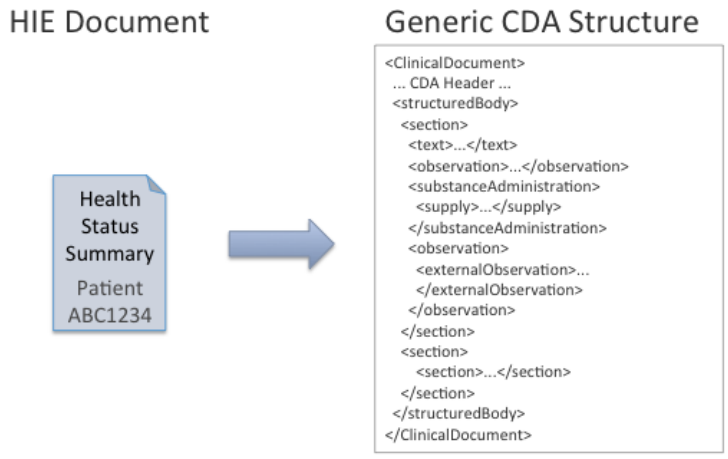


Figure 5 - HIE Documents are structured using HL7 CDA

Health Information Exchange Content Model

The HISO 10040 standards also define the standards for the content of structured documents. The principle method for standardising content is to use 'OpenEHR Archetypes' alongside industry standard 'terminology' or coding systems including SNOMED CT, LOINC and ICD-10. An example blood pressure archetype is depicted in Figure 6 below. The archetype defines all of the potential information that may be recorded in relation to a blood pressure, as well as data formats and valid value ranges for example.

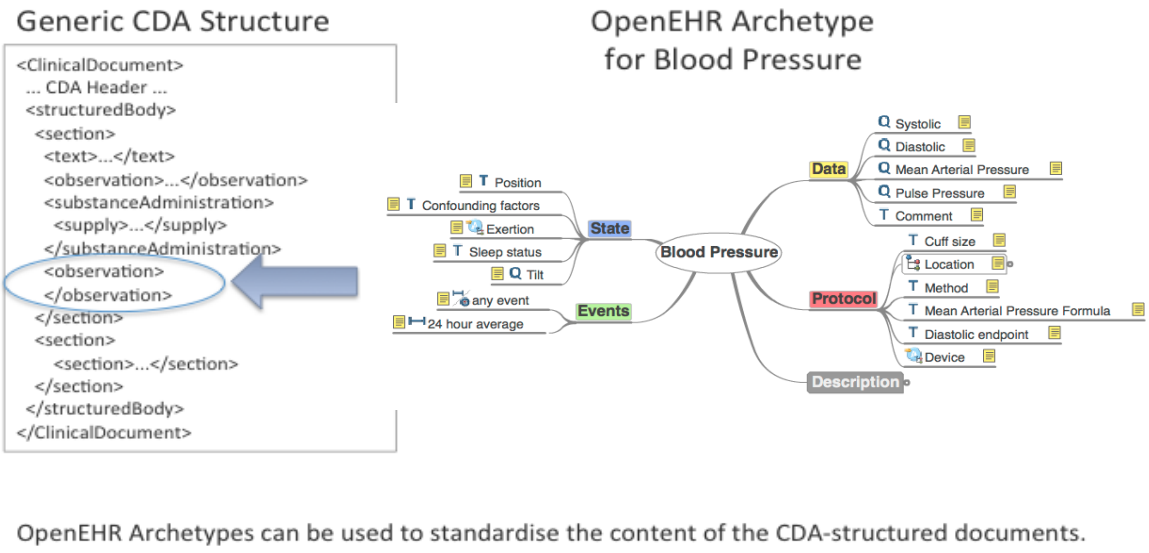


Figure 6 - Representation of an OpenEHR Archetype for Blood Pressure.

How The Pieces Fit Together

The Ministry of Health provided an initial vision for the regional development of Health Information Exchanges, enabling access to a range of local, regional and national information sources, by a range of point of care systems (see Figure 7 below). This was a useful starting point for the scoping team, when considering what items could be included in an HIE project in the region. Figure 7 depicts multiple point-of-care systems consuming documents from multiple regional and national systems. Because there is a single method of integration, new point of care systems and new data sources can be added without needing to create potentially dozens of new point-to-point interfaces.

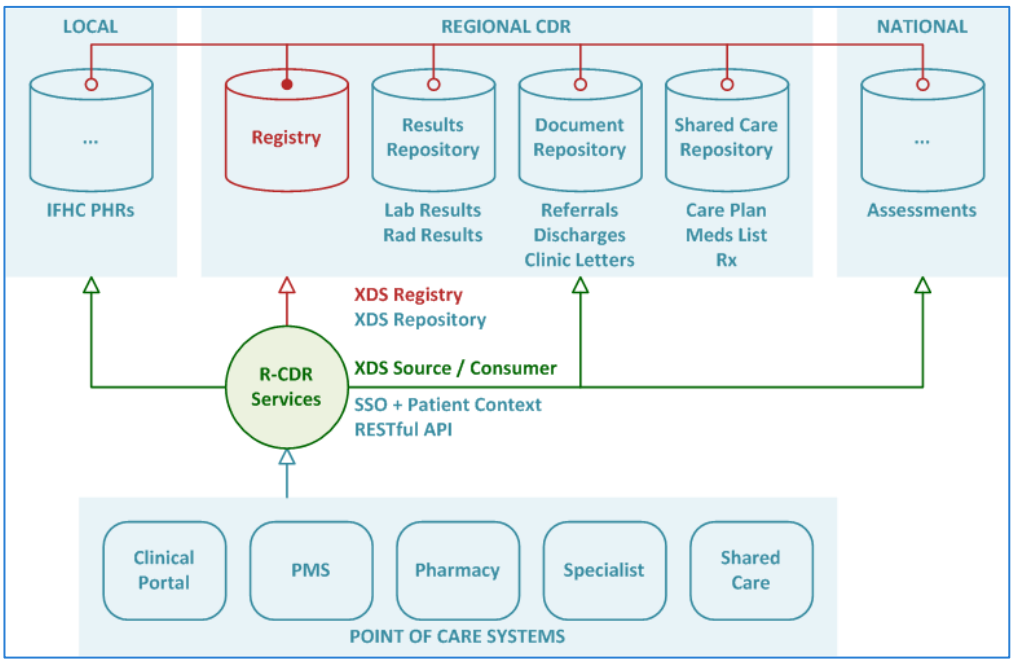


Figure 7 - Initial Ministry of Health Vision for the Exchange of Health Information

In this vision, each point of care system can access any information within the HIE that its users are authorised to access. This will enable a virtual health record to be available for New Zealanders, wherever patients access health services.

Benefits of Implementing an HIE

A Health Information Exchange, implemented using the HISO 10040 standards, is an infrastructural project that will produce technical benefits, which will in turn, support a variety of clinical benefits (see Figure 8 below).

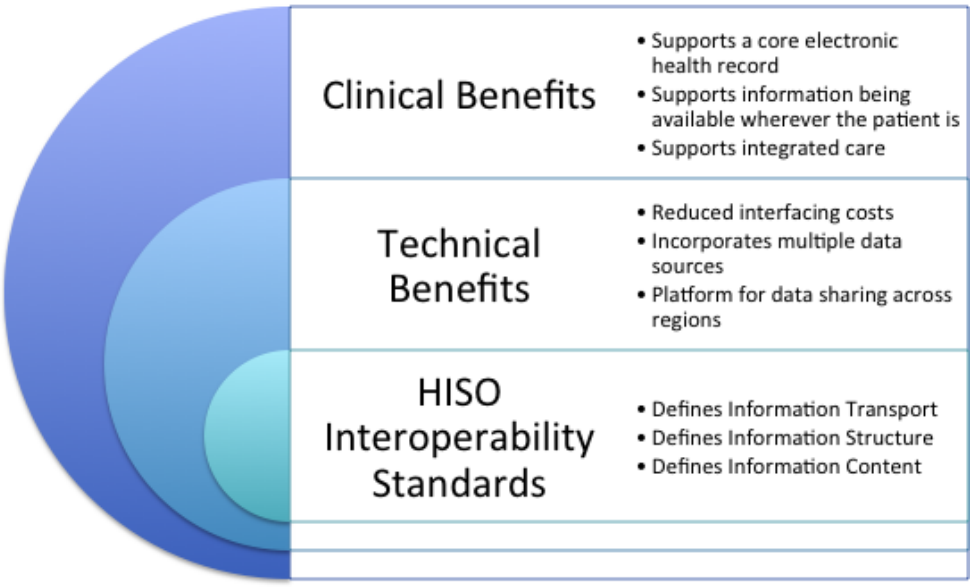


Figure 8 - Relationship Between Interoperability and Clinical Benefits

Direct Technical Benefits

Reduced interfacing costs

By using the HISO Interoperability Standards to publish or view shared documents, each system needs only interface with the HIE itself, rather than having to interface individually with the myriad of systems that produce and consume health care information. This reduces the number of interfaces required between healthcare systems and therefore the cost of interface creation and maintenance. Standardising the interfaces themselves simplifies the task of creating those interfaces that are required as well, which will also reduce IT costs.

These benefits become clearer when considering the problem of introducing new sources of healthcare information, or new consumers of healthcare information. The electronic integration of ambulance services with the rest of the health sector is a case in point. St John is managing a national project that is exploring ways to share patient information they create with hospitals, accident and medical centres and GPs. At the same time, they would like Ambulance Officers to be able to access hospital and GP summary health information, to assist them with assessing the needs of patients during a callout. To share the information they

create, St John will need to integrate with multiple DHB systems and dozens of accident and medical services across the country.

As healthcare information sharing becomes increasingly sophisticated, the same challenges St John have will repeat when integrating other new information sources and consumers, such as private healthcare providers, private hospitals, aged care facilities, community pharmacists, and other allied healthcare providers. The HISO 10040 standards offer an alternative to the cost and technical burden of current system-to-system interfacing.

Incorporate Multiple Data Sources

A major benefit of the XDS registry approach is that it provides architectural options that are not currently feasible.

In the absence of the HISO 10040 standards, the main strategy used to simplify sharing of information is the storage of information in single large regional Clinical Data Repositories (CDRs), such as Éclair in the Northern Region. This has been an effective way to reduce the number of interfaces required to share information. An HIE approach can leverage the current investment in CDRs but it is no longer necessary to store all of a region's shared health information in a single CDR to achieve better sharing of information, as a the use of a registry can allow data to be stored in multiple locations.

healthAlliance currently receives at least one request per month to publish a new type of health information to the regional CDR. Copying data into the CDR is time consuming and expensive. The recent migration of hospital outpatient clinic letters to the CDR cost approximately $500k. Provided healthcare information can be stored securely and with high availability at source, then using an HIE approach, there is no need to migrate or copy information to a CDR.

There are examples where information is best migrated to a CDR. It is arguably better to store summaries of primary care information in a CDR, than it is to expect hundreds of GPs to maintain 24/7 online access to their individual practice systems.

Platform for Sharing Information Across Regions

To date, each region has taken an ad hoc approach to the adoption of health information standards and so the challenges of sharing of health information are magnified many times when considering the challenges of sharing information across regional boundaries. In most parts of New Zealand a short drive is all that is required to take a patient into another region, where any locally shared electronic health information they *do* have is not available.

With suitable governance, the XDS approach incorporated in the HISO Interoperability Standards can provide a platform for cross-regional sharing of healthcare information.

Indirect Clinical Benefits

An HIE can support the National Health IT Plan 'eHealth' vision by making a core set of personal health information available to patients and healthcare providers, wherever the information is needed as they access health services across New Zealand.

The clinical and financial benefits resulting from effective sharing of health information are well understood, and are the basis of business cases for the various regional and national projects that aim to support integrated healthcare. These projects include shared care initiatives, medicine safety projects, electronic referral and discharges, after hours care, and supporting Integrated Family Health Centres and locality partnerships.

Some of the most commonly cited benefits of better sharing of healthcare information include:

- Reducing clinical time required for searching and retrieving health information from multiple sources.
- Decreasing medical (especially medication) errors due to unavailable information.
- Reducing duplicate assessments and tests.
- Supporting integrated, shared care and new healthcare services that reduce the cost of healthcare.

Quantifying Benefits

As infrastructure, an HIE cannot directly claim the clinical and financial benefits of clinical projects, but it can accelerate, enhance and support the work being carried out by clinical projects that directly produce these benefits.

It is difficult to put dollar values on the technical benefits of implementing an HIE. We do know that as infrastructure, an HIE platform will provide better means to achieve a wide range of clinical projects, which will deliver the ultimate value to patients and the health sector.

The St John integration challenge could provide an opportunity to estimate the cost of integrating new data sources and consumers in the sector using the current system-to-system integration approach. Those estimates could then be compared with integration using a national HIE.

Options for Trial HIE Implementation

While a establishing a health information exchange, to be successful it needs to be developed in conjunction with clinical projects. The recommended approach is to demonstrate a trial implementation of an HIE infrastructure in association with at least one clinical project.

A successful trial implementation will:

- Align with one or more DHB-funded projects in the region
- Demonstrate something new and important for the sector
- Demonstrate key features of the HISO interoperability standards
- Have potential to engage successfully with health system vendors
- Provide a model for national HIE adoption

Taking these success factors into account, three possible starting points for HIE implementation have been explored.

Sharing InterRAI Assessments

The new national Community Pharmacists Services Agreement allows for pharmacists to provide services to patients with long-term conditions and complex medication management needs. The Northern Region e-Medicines Forum have requested that community pharmacists have electronic access to national InterRAI assessments, which contain information that can be used by pharmacists to a) assess a patient's eligibility for their Long Term Condition services and b) help determine what types of assistance a patient may need to support their use of medicines.

The northern region community pharmacists have a business requirement that could be well supported with an HIE approach. In addition, there may be demand for structured InterRAI report data from aged care facilities, which could also be met by this work in the future.

The national InterRAI project has already planned to implement structured reports in CDA format by March 2013, and is currently investigating the feasibility of 'XDS enabling' the InterRAI report databases around the same time.

Currently some funding has been set aside by DHBs for webservice connections between hospital instances of Concerto and the InterRAI report database. New funding would be required to make structure reports available using an HIE approach. Until additional funding for this work can be located, InterRAI assessments will need to be made available to

pharmacists by DHBs (fax on request), or electronically via Concerto, through the CareConnect Portal (Regional Clinical Documents Project). A conceptual representation how InterRAI assessments could be shared within an HIE model is provided in Figure 9 below.

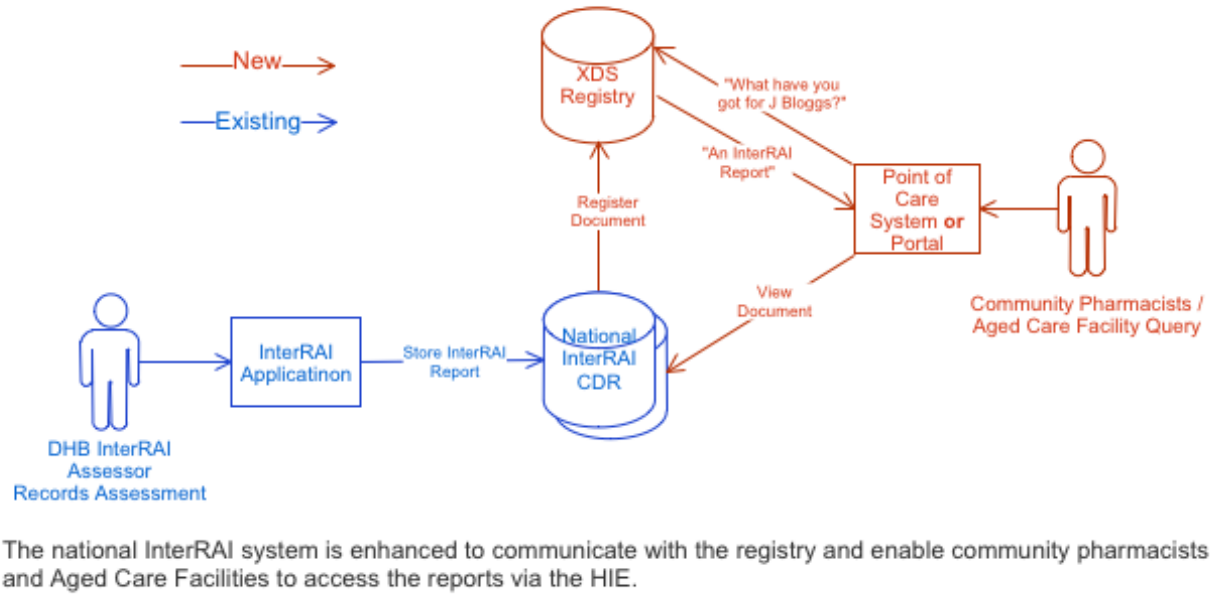


Figure 9 - Sharing National InterRAI Assessments

Table 1 below provides an overview of the option to share national InterRAI assessments along with consideration of key success factors.

Table 1 - Sharing National InterRAI Assessments Overview

Publisher	National InterRAI databases
Repository	National InterRAI databases
Potential Consumers	Community Pharmacists via the CareConnect Portal, or natively within their own point-of-care systems.
Potential to align with one or more DHB-funded projects in the region	Some funding is available for DHBs to establish point-to-point integration between DHB Concerto and the InterRAI databases. New funding would need to be identified to support this work.
Demonstrate something new and important for the sector	Regional access to a national system via an HIE.
Demonstrate key features of the HISO interoperability standards.	• XDS document sharing would be demonstrated. • InterRAI project is already working on producing CDA documents.

Potential to work successfully with health system vendors	The InterRAI project is already planning to XDS-enable their databases and produce HISO standard CDA documents. Pharmacy system vendor appetite for consuming HIE documents natively is yet to be assessed, but this is not essential if documents are provided via the CareConnect portal.
Provide a model for national HIE adoption	Yes

Sharing Hospital Discharge Summaries

The option of sharing hospital discharge summaries (eDSs) via an HIE came about initially from discussions with St John about their information requirements. A large proportion of ambulance call-outs are to people who have recently been discharged from hospital. If an ambulance officer can see a recent discharge summary for a patient, then they are in a far better position to assess a patient's current medical needs. Being able to access these documents would enhance St John's ability to decrease the number of call-outs resulting in hospitalisation, through initiatives such as the GAIHN "Better response to acute events" project[7].

In addition to sharing hospital discharge summaries with St John, these documents could also be made available to other healthcare providers who cannot usually see them at present, including GPs other than the patients usual GP, and After Hours services. If GP Practice Management Systems were modified to retrieve documents from an HIE, then eDSs could also be made available to them, addressing the difficulties DHBs sometime have in getting eDSs to the correct GP.

There is no DHB-allocated funding for integration with St John services at present, however the DHB-funded Regional Clinical Documents project has some funding for regional sharing of discharge summaries. A regional Transfer of Care project (eDS enhancements) project is being discussed, but funding is yet to be identified.

Figure 10 below describes an approach to sharing eDSs using HIE principles. The diagram includes the option of using the existing Soprano Medical Templates (SMT) databases in the region as repositories, or using a separate Clinical Data Repository (CDR). Each approach has advantages - SMT databases already hold eDS data in atomic form, while a CDR configured to store structured documents would have multiple applications in the future.

[7] http://www.gaihn.health.nz/GAIHNProgramme/Betterresponsetoacuteevents/StJohnTransportProject.aspx

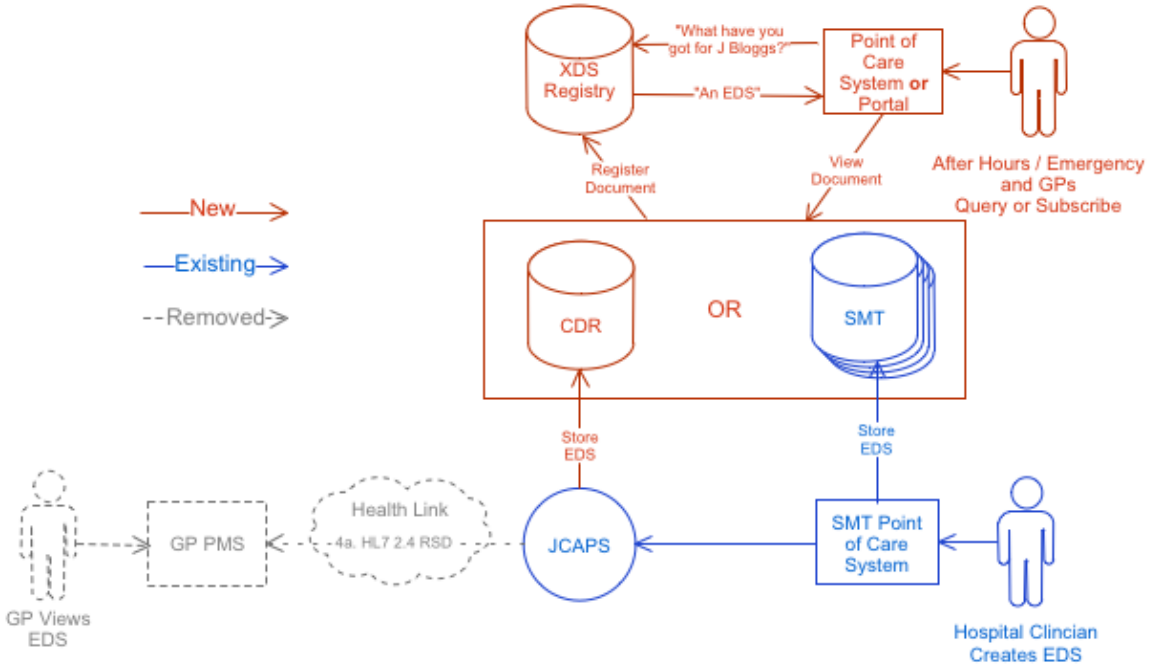


Figure 10 - Sharing Electronic Discharge Summaries

As well as enabling After Hours and emergency health services to access eDSs the approach in Figure 10 above includes the modification of GP PMSs to subscribe to eDSs via the registry. This approach would remove the need to send eDSs (and in the future other documents as well) using point-to-point messaging. This would address the current issues DHBs with electronically 'addressing' eDSs to the correct GP. Any GP who needs to see an eDS could see it, without the DHB needing to know or anticipate who the patient's future GP contacts are going to be.

The current national "Transfer of Care" (eDS enhancements) work intends to replace the use of HL7 2.x messages with the CareConnect CDA standard. While GP PMS vendors are modifying their systems to import these new CDA messages, they could also enable PMSs to subscribe to documents relating to their patients, directly from an HIE.

Table 2 below provides an overview of the option to share Electronic Discharge Summaries along with consideration of key success factors.

Table 2 - Sharing eDSs Overview

Publisher	Secondary SMT x 4
Repository	• Secondary SMT x 4 or Structured Document CDR
Potential Consumers	• GP subscribe to documents and view them natively within their PMS. • After Hours services and St John view via CareConnect Portal. • Hospital emergency departments view via DHB Concerto. • Option for other point-of-care systems (e.g. St John) to view documents natively.
Potential to align with one or more DHB-funded projects in the region	• Regional Clinical Documents, Transfer of Care project
Demonstrate something new and important for the sector	• Provision of documents to GP PMSs via a subscription model. • Provision of eDSs on demand, to After Hours and Emergency healthcare services.
Demonstrate key features of the HISO interoperability standards.	• XDS document sharing would be demonstrated. • Potential to use existing HL7 2.4 messages (with PDF) initially, or demonstrate the new HISO ConnectedCare document standards.
Potential to work successfully with health system vendors	• The vendor for SMT (Orion Health) is willing to discuss a project along these lines. • Modification of existing PMSs to receive content from an HIE adds time and cost but PMSs will need to be modified to receive future HISO ConnectedCare documents in the future anyway.
Provide a model for national HIE adoption	Yes

Sharing Primary Care Summaries

Sharing Primary Care information is especially important for After Hours services, Integrated Family Health Centres (IFHCs), and hospital and ambulance emergency services. Currently, primary care information is effectively locked in GP practice management systems (PMSs). This is major problem for patients and their healthcare providers when patients access services outside their regular GP practice. With few exceptions, the information held by a patient's GP is not available to other healthcare providers. *'Siloed' primary healthcare information is a major barrier to the National Health IT Plan 2014 goal of availability of core patient electronic information, regardless of healthcare setting*.

There are a number of ways primary health care information could be shared. Figure 11 below describes an approach to sharing primary care summaries via an HIE. This approach is similar to the one taken by the Canterbury eSCRV project for sharing of primary care records, but with the addition of an XDS registry.

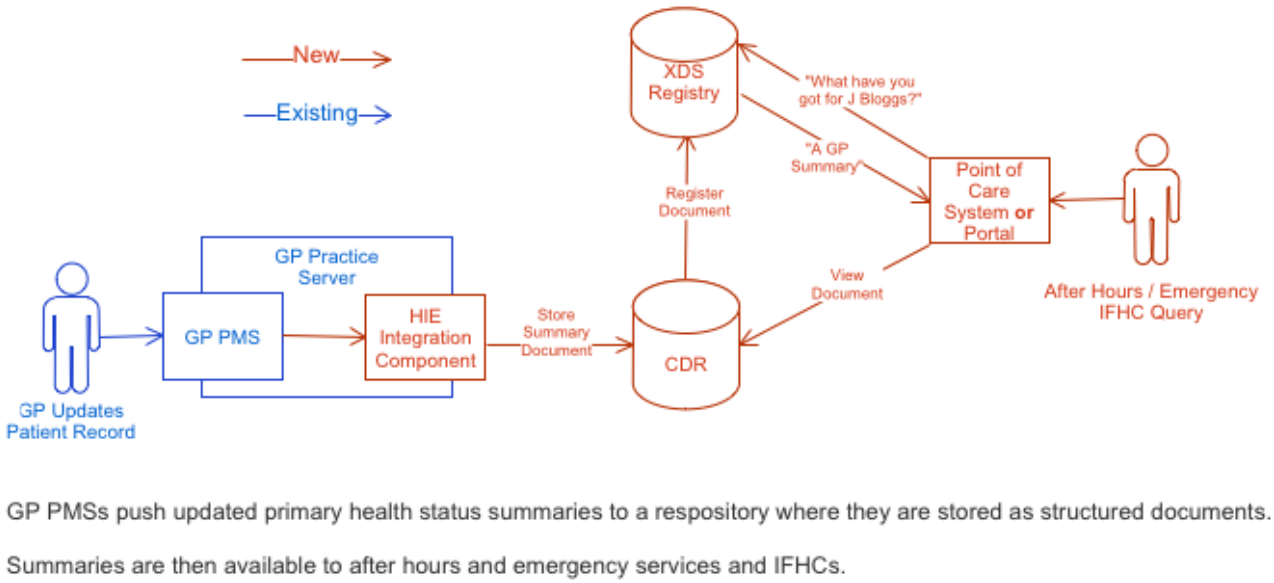


Figure 11 - Sharing Primary Care Summaries

Table 3 below provides an overview of the option to share primary care summaries using the described approach, along with consideration of key success factors.

Table 3 - Sharing Primary Care Summaries Overview

Publisher	GP PMS systems (Push via 'HIE Integration Component')
Repository	Structured Document CDR
Potential Consumers	• After Hours services, IFHCs, St John view via CareConnect Portal. • Hospital emergency departments view via DHB Concerto. • Option for point-of-care systems (e.g. St John) to view documents natively. • Shared Care programmes could use this information to create Hospital-initiated enrolments.
Potential to align with one or more DHB-funded projects in the region	• After Hours project
Demonstrate something new and important for the sector	• Creation of a PMS-independent northern region repository of primary care summaries which is accessible via an HIE.
Demonstrate key features of the HISO interoperability standards.	• XDS document sharing would be demonstrated. • Potential to adapt the existing GP2GP message structure, or demonstrate the new HISO ConnectedCare document standards.

Potential to work successfully with health system vendors	It would be ideal to have PMS vendors collaborate to push summaries to repository in the same way Australian PMSs export a Shared Health Summary to their Personally Controlled Electronic Health Record (PCEHR). It would also be possible to adopt the same approach taken in Canterbury where a third-party component is used to populate the repository from GP systems.
Provide a model for national HIE adoption	Yes

Weighing up the Opportunities

Three opportunities for an initial trail implementation have been identified. All of them have various advantages and disadvantages as a starting point for the implementation of an HIE. The most salient dimensions to consider these options across, are 'potential difficulty' (and probable cost) and 'potential value'. For arguments sake, the three options are presented relative to each other in Figure 12 below.

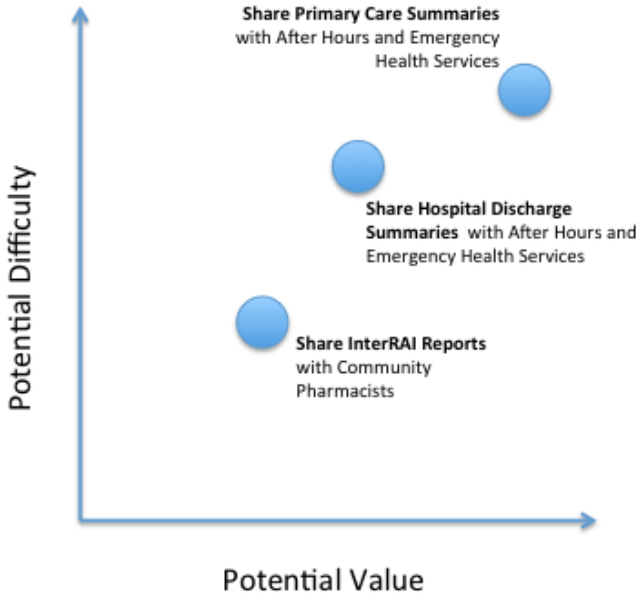


Figure 12 - Opportunities - Difficulty versus Value

Sharing InterRAI Assessments

The primary case for sharing InterRAI assessments in the Northern Region at present is to assist with community pharmacist's selection and assessment of patients with long-term conditions, needing specialised assistance with medications.

The technical foundations for HIE-based sharing of InterRAI assessments are in train. The national InterRAI programme is committed to supplying reports in CDA format, and is also planning to enable its databases to act as XDS repositories in 2013. Having an XDS-enabled source of structured data, funded and implemented by the national programme, lowers the difficulty level relative to other options. Provided delivery of reports via the CareConnect portal is acceptable to pharmacists, this option would present the fewest challenges.

What is currently unknown is the extent to which pharmacists would access these reports. Eligibility for pharmacist Long Term Condition services can be assessed using a variety of criteria. If other sources of information are sufficient to allow patient entry to the programme, there is a chance that InterRAI documents would be referred to less than currently anticipated. For this reason this option is considered to be of potentially lower value than other options.

Sharing Hospital Discharge Summaries

Sharing hospital discharge summaries via an HIE would make them accessible to healthcare providers who cannot currently access them – especially After Hours services, and potentially St John Ambulance services. There are two scope items that would increase value (and difficulty) if included. First, if GP systems were modified to subscribe to HIE documents, this would address the problem of undelivered eDSs and allow sharing of other documents such as clinic letters with GPs via an HIE also. Second, it would ideal for eDS documents to be upgraded to ConnectedCare CDA structured documents at the same time as this would provide for GPs to import data such as problem lists and medications from the documents.

In terms of difficulty, this project would fall between sharing InterRAI assessments and sharing primary care summaries. eDS data is already available within SMT databases but these databases would need to be XDS enabled or they would need to export eDSs to a separate CDR. Enabling GP systems to subscribe to HIE documents would require some method for GPs to be authenticated to receive documents, without needing to enter additional usernames and passwords. Introduction of the new structured ConnectedCare CDA documents would be a challenging piece of work on its own.

Sharing Primary Care Summaries

This option was assessed to have the highest relative potential value because GP PMSs usually contain a patient's most complete health information, but with few exceptions, this information is only available to their GP. If a patient visits an After Hours service, a hospital Emergency Department, another GP (perhaps at an IFHC), or needs ambulance services, this information is not available. Significant clinical value can be achieved by establishing a robust, flexible and vendor-independent way to share primary care summaries.

Compared with the other two options, this project is more challenging because it would involve GP practices as information sources. In addition, sharing primary care summaries would be a new activity and would introduce novel privacy issues to address.

A repository approach similar to the Canterbury Electronic Shared Record View (eSCRV), where GP systems 'push' summary records to a CDR is recommend. This could be done by the GP systems, or by way of a third-party component installed at each practice that extracts data from the GP systems. In Australia, PMS vendors (including MedTech Global[8]) have modified their systems to produce 'Shared Health Summaries' for the Personally Controlled Electronic Health Record (PCEHR). It would be preferable for PMS vendors to build this functionality into their products as they are in Australia, rather than develop, deploy and maintain third-party components at each GP practice.

[8] http://tinyurl.com/MedTech-PCEHR

Post-Trial Implementation - Future Vision

Regardless of which clinical projects a trial HIE implementation supports first, success will lead to wider regional and national implementation. In addition to InterRAI assessments, discharge summaries and primary care summaries, other types of information that could be shared via an HIE include:

- Shared Care Plans and Action Plans
- Electronic referral summaries
- My List of Medicine updates
- Electronic prescriptions
- Pharmacy dispensing information
- Laboratory and Radiology results
- Hospital Outpatient letters
- Ambulance event summaries
- Private healthcare event summaries

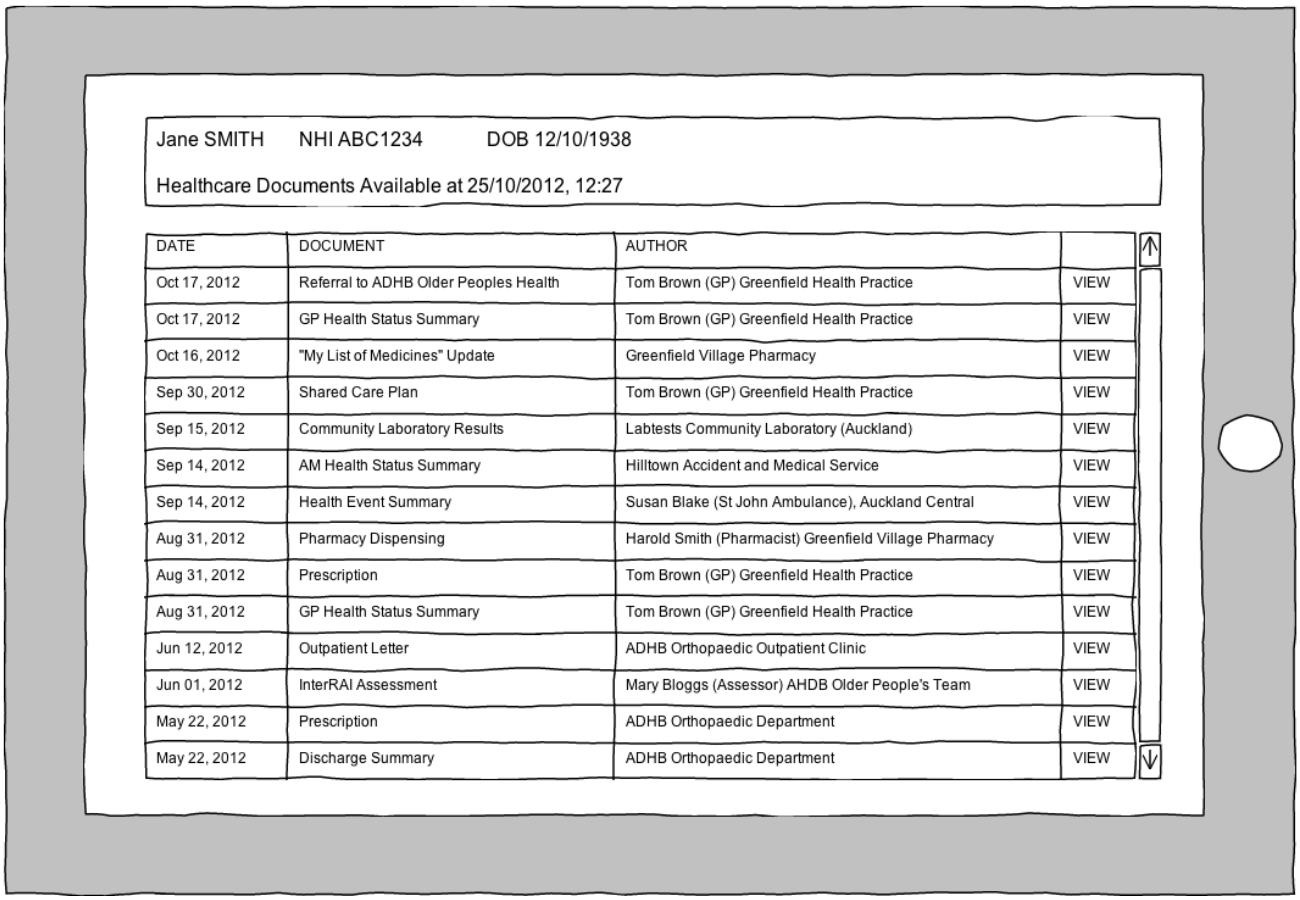


Figure 13 - Mock-up of a Simple Clinical View of an HIE Document List

A mock-up of a clinician's future view of these types of documents is provided in Figure 13 above. This mock-up only conveys the ability to access human-readable documents. It does not convey the potential use of structured data within documents to automatically update and be used by point-of-care systems to support clinical activities such as prescribing, referral and decision support for example.

Solution Architecture

This section describes the technical solution architecture that will support the implementation options described. The different components/elements are described below and views of the solution follow that show how the components are related to one another. An appendix is also provided in the document that traces how the parts of the solution relate to the HISO standard with commentary describing how the different requirements defined in the standard are expected to be addressed by the solution.

Solution Components

XDS.b Registry Product

This component is responsible for acting as the Northern Region affinity domain registry and implements the IHE standards that an XDS.b registry must.

A single logical instance of the registry will be implemented for the region with it's physical deployment reflecting the non-functional requirements defined for it. The expectation is that the registry will be implemented by a product whose specific purpose is to act as a registry in the way described. This may be product already deployed in the Northern Region and enhanced to act as registry or it may be a new implementation. The decision on the specific technology used will need to made prior to any selected option being implemented.

Native XDS.b Repository

Each of the implementation options requires one or more XDS.b repositories. Depending on the option this might be an enhanced version of an already deployed product or it may be a newly deployed product. Either way, the expectation is that a repository acting as a native XDS.b repository is implementing the IHE standards for such a repository.

Such a repository would also hold onto clinical documents in a structured manner consistent with agreed archetype definitions and make that document content available as CDA documents consistent with agreed CDA templates.

Non-native XDS.b Repository & XDS.b Adaptor

Depending on the implementation chosen there may be one or more document repositories that are able to hold onto structured clinical documents in a manner consistent with defined archetypes & CDA templates, but are unable to implement the XDS.b messaging standards that allow them to act as native XDS.b document repositories. Such repositories would be made

XDS.b compliant by use of an adaptor, which translates between the way the clinical documents are provided by the given repository and the XDS.b standard. Such an adaptor may be provided and deployed separately to the given repository but will be transparent to the XDS.b registry and consuming systems so that those systems will not be aware the underlying repository is not natively XDS.b enabled.

OpenEHR Clinical Knowledge Manager

The OpenEHR Clinical Knowledge Manager is the reference implementation of an archetype repository and is currently used and deployed in Australia for this purpose. Regardless of the implementation option chosen, it will need to be implemented in New Zealand so that the archetypes that define the content held in XDS.b repositories can be agreed and maintained. A governance process will need to be defined to allow the content to be managed. Ideally, XDS.b repositories will natively use this registry to validate content, in practice though it is expected that XDS.b repositories will ensure that content is consistent but not use the repository directly.

CDA Template Library

The CDA template library is where CDA templates are defined and maintained. Regardless of the implementation option chosen such a library will need to be implemented on a national basis to complement the archetype repository. The templates defined here reference and act in concert with the archetypes defined in the OpenEHR Clinical Knowledge Manager to define the content provided by XDS.b repositories. Depending on the option(s) chosen, one or more CDA templates will be defined that support the clinical documents to be exchanged for the option(s). As with the archetype repository, governance will need to be established to allow CDA templates to be maintained effectively. The HISO standard allows for the library to provide schemetron rules that XDS.b repositories can implement to create CDA content, it is not expected this will be implemented initially with the most likely option being natural language definitions.

XDS Consumer System

There may be one or more systems that will query and retrieve clinical documents via the HIE depending on the option(s) chosen. These systems will need to be able to act as XDS.b consumers querying the registry and then retrieving documents from one or more repositories as required. These systems may also employ an XDS adaptor in the same manner as non-native repositories so they are able to use the HIE to retrieve the content they require.

HIE Middleware

This component of the HIE solution provides the "glue" for the functional components to communicate effectively. Over time, it allows the components of the HIE solution to be flexible in their implementation of standards by translating as necessary. It also provides the ability to monitor and manage HIE transactions centrally and ensure service issues are visible. It may be implemented as a new product deployment to support the implemented solution(s) or may use existing middleware solutions in place within the Northern Region depending on the suitability of the existing solutions.

HIE Solution Views

The views below use ArchiMate notation to describe the solution, which allows the solution to be accurately described. ArchiMate looks somewhat similar to UML with some of the relationships and components having a similar meaning (such as Composition, Aggregation & Association). The meaning of the relationships & elements used in the views that may be unfamiliar to readers are:

Service: These are shown as rounded elements and represent externally visible functionality. It should be noted that these are more abstract than web services and do not necessarily mean the same as a given web service, but may be implemented as such.

Used By: This relationship indicates that one element is used by another and is read in the direction that the arrow is pointing i.e. The element pointed to by the arrow is being used by the element at the base of the arrow. Some people can find this confusing, as it is the opposite interpretation to that often made when looking at this type of arrow.

Realisation: This relationship shows how more logical & conceptual elements are realised by more concrete elements. The main example in the views is where Services are realised by Application Components.

Function Component Overview

Figure 14 below provides an overview of the main functional components of the HIE solution architecture and the relationships between them regardless of the implementation option selected. The implementation option selected will affect the specific repository(s) and the specific consumer(s) of HIE content, but not the core aspects of the solution that will need to be implemented to meet the HISO standards and this is reflected here.

The diagram shows that central to the communication of clinical information is the XDS interface which is used by the different components of the solution to exchange & query information. Depending on the option selected and implementation choices made there may be

one or more repositories and these repositories may implement the XDS.b standard natively or via an adaptor. Regardless of the specific repository, the content (used by the HIE) held in a given repository will be governed by archetypes held in a nationally central implementation of the OpenEHR Clinical Knowledge Manager. Similarly, when clinical documents are exchanged via XDS, they do so using CDA document templates also held in a centrally implemented template library.

The NHI & HPI are national identify services used by the registry and the repositories as the source of identity information for patients and health care providers.

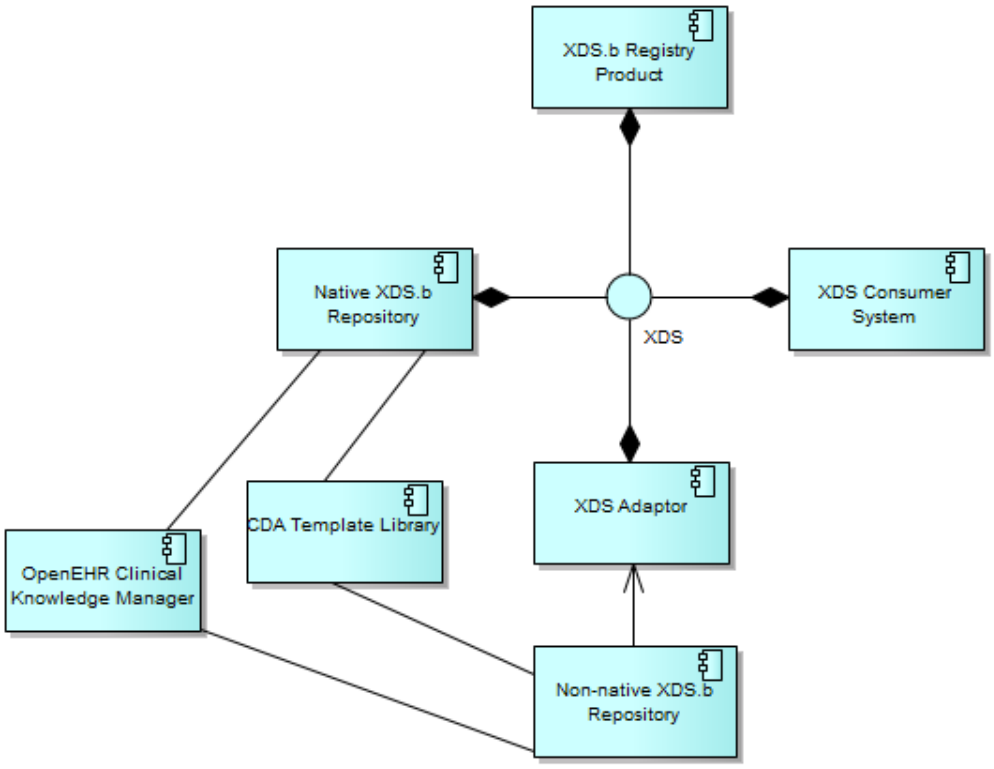


Figure 14 - HIE Function Component Overview

Integration & Service View

Figure 15 below describes the core services and components that will make up the HIE solution, regardless of the implementation option chosen. It shows that middleware provides the central hub for communication between the components of the HIE. The registry and repository (or XDS adaptor) components are responsible for implementing the HIE services and making them available via the middleware.

Consumers of the exposed services then use middleware to access the exposed services according to IHE profile usage. The NHI & HPI are existing services implementing the PDQ & HPD query services defined by IHE and although not shown in the diagram are likely to be accessed directly by HIE components as well as via middleware.

Not shown in the diagram but in scope and described in the traceability appendix is the assumption that authentication & authorisation is taking place as a matter of course to support the transactions shown in the diagram. Patient privacy and consent will also need to be addressed by the solution components and may align with the IHE Basic Patient Privacy Consent profile although his is not mandated by the HISO standard.

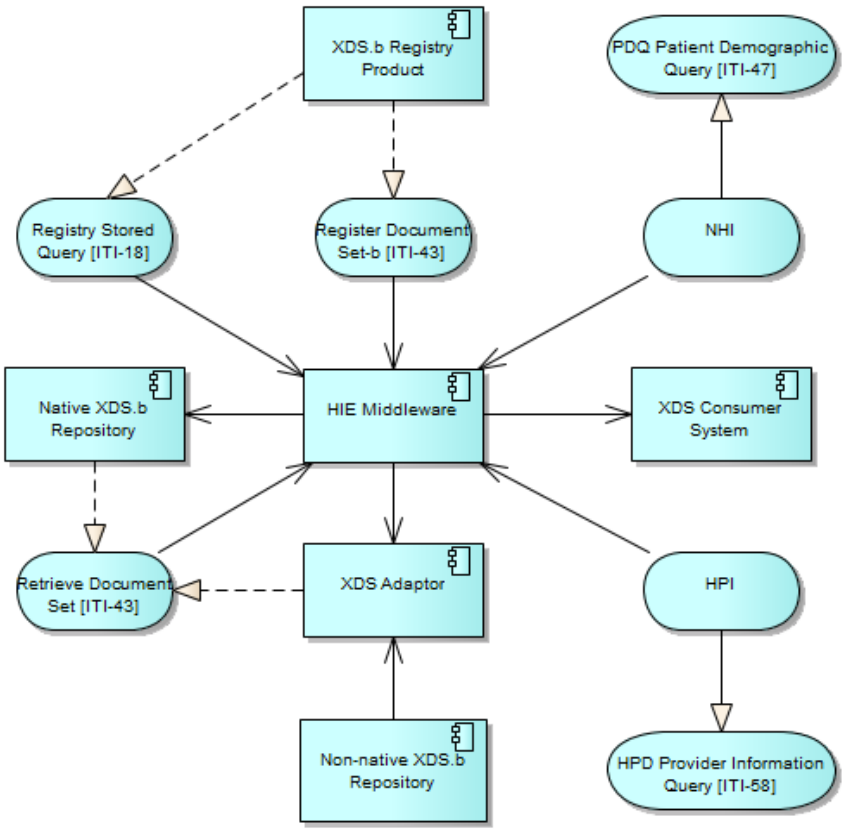


Figure 15 - Integration and Service View

Traceability Matrix

Appendix 3 (p.42) contains a traceability matrix which lists the HISO 10040 standard requirements, whether they would be in or out of scope in a trial implementation, anticipated trail components, and notes on implementation.

Privacy and Security Considerations

The IT Health Board conducted a series of public consultation meetings on sharing health information in 2010[9] and again in 2012[10]. An important finding from the 2010 series was that *healthcare consumers want shared records, sooner rather than later*. In fact it surprised some attendees to learn how little sharing of information occurs. At the same time, health information is deeply personal, and consultation has highlighted the concerns people often have about sharing health information. Recent high-profile breaches of information security in the public sector should further heighten our awareness of the need to be able to meet people's expectations around acceptable sharing of health information.

While seeking the benefits of shared health information, healthcare consumer feedback indicates that assurances including the following will be required:

Knowledge of what information is shared
Knowledge of what information is shared is a cornerstone of patient involvement and control over information sharing. Any projects to extend sharing of patient information need to consider how patients will be informed, as this can be passive, such as notices at healthcare provider sites, through to active informing through a face-to-face discussion with healthcare providers.

Knowledge of how information will be used
Any projects to extend sharing of healthcare information need to consider potential secondary uses of information. An area that is likely to cause grave concern for some is if information is available to individuals or organisations outside of the health sector, such as insurance companies and other government agencies. Structured health documents allow easier analysis of health information across groups, so an area that should be discussed is the potential use of information for anonymised public health research.

Ability to opt-off sharing information
The ability to not share information is important to some people and this must be built in to the design of any Health Information Exchange. The issue for projects will be determining how fine-grained control over sharing should be. For example, should it be possible to prevent sharing of certain types of documents, or certain content within documents? Should the documents be shared with all healthcare organisations, or only certain healthcare

[9] http://www.ithealthboard.health.nz/sites/all/files/consumer-forum/FutureofHealthWorkshopSummary.pdf
[10] http://www.ithealthboard.health.nz/content/nhitb-shared-health-information-public-seminars

organisations? If a point-of-care system is capable of flagging certain information as 'sensitive', then it is technically possible to prevent it from being included in shared documents. The more fine-grained the control over content and sharing, the more technical and administrative costs increase.

Knowledge that there are safeguards to ensure secure and appropriate access

Patients need to know that only authorised individuals will have access to their information, and that when they do access information, it is directly for the purposes of their healthcare. The ConnectedHealth network provides a secure network for exchanging health information. IHE XDS standards are capable of supporting all major, and many minor use cases for access control and audit[11]. A registry-based model simplifies access control by providing a central point of access to documents, rather than needing to manage authentication across multiple source systems.

Next steps in relation to security and privacy

- Assess consent models related to any existing documents to be shared.
- Consult with consumer and privacy advisory bodies on new uses of existing documents or creation and sharing of new documents.
- Review and adapt privacy and security frameworks where applicable (e.g. Northern Region TestSafe, National Shared Care Plan Programme and Canterbury eSCRV).
- Define security and privacy requirements for inclusion in project design documents.
- Consider future regional and national authentication requirements and how the will be addressed in interim and long-term HIE solutions.
- Consider technical issues including automatic HIE authentication from point-of-care systems to avoid multiple logins.
- Establish an HIE privacy governance model to be applied to the HIE infrastructure and any associated clinical projects.

[11] See for example: http://www.ihe.net/Events/upload/ihe_webinar_2008_sesssion_11_Security-for-XDS_2008-07-14_Moehrke.pdf

Recommended Next Steps

To progress a trial HIE implementation based on the HISO 10040 standards in the Northern Region, there are two streams of work that can begin simultaneously to some extent (see Table 4 below).

First, is to initiate a process to establish the trial implementation infrastructure including registry and middleware, and other components that are not dependant on specific clinical applications of the infrastructure (such as initial governance processes).

Table 4 - Concurrent Implementation Processes – Infrastructure and Clinical Project

Implement HIE Infrastructure	Implement Clinical Project
• Select Vendor(s) – Select a vendor or vendors who demonstrate the ability to build a credible HIE registry, understanding of the integration of various repositories, and proven HIE implementation experience. – Develop Implementation Plan. – Conduct initial scoping with the vendor to develop an implementation roadmap and costs estimates. • Negotiate Contract – Negotiate the contract with the vendor based on the developed implementation plan and cost estimates. • Start set up of HIE Infrastructure	• Select Candidate Project for Trial Implementation – Select a pilot project from the options identified. This will involve further discussion with both the Ministry of Health and healthAlliance once the options have been debated. • Agree on Scope – Agree on the inclusion and exclusion of optional scope items. • Define Detailed Requirements – Define the requirements of the pilot based on agreed scope and requirement to integrate with HIE infrastructure. • Engage in any additional procurement exercises as required • Start clinical project

Second, is the selection of a suitable clinical project or projects to make use of the HIE infrastructure and standards.

Ideally one of the three clinical project opportunities identified would offer higher relative value, and lower relative difficulty than the other options. That option would then be recommended as the ideal starting point for HIE implementation. This is not the case. Each of these options has the potential to offer clinical benefit, as well as demonstrating key principles of the HISO 10040 Interoperability Standards.

If we begin with a relatively less difficult option such as sharing InterRAI assessments, we have the ability to establish the technical foundations for an HIE with fewer potential implementation issues. Alternatively, if we begin with a more difficult option such as sharing primary care summaries, we have greater costs and more complex implementation issues, but the relative benefits are greater, including making significant progress toward the National Health IT Plan 2014 goal for availability of core patient electronic information regardless of healthcare setting.

The most likely factor in determining the first clinical project to be implemented is the availability of funding to support the work. This document may be useful in strengthening business cases for DHB contributions to the cost of each of the candidate projects.

Appendix 1 - Glossary

Abbreviation	Term	Description
	After Hours Care	Care provided outside of a provider's usual hours of business. That is when regular or extended care as defined above is not available. After hours services provide care to meet the needs of patients, which cannot be deferred until regular care is next available.
CDA	Clinical Document Architecture	The Clinical Document Architecture is a HL7 standard for the representation and machine processing of clinical documents in a way, which makes the documents both human readable and machine processable and guarantees preservation of the content. See: http://www.hl7.org.au/CDA.htm
CDR	Clinical Data Repository	A database that stores clinical data for the purposes of sharing healthcare information. There can be many CDRs in an HIE virtual repository.
eDS	Electronic Discharge Summary	Sometimes referred to as an eDischarge or Transfer of Care document. A summary of a patients stay in hospital, sent to the patients GP, often with important post-discharge advice.
eSCRV	Electronic Shared Care Record View	A repository-based system for sharing health information developed in Christchurch. See: http://www.ithealthboard.health.nz/content/shared-care-record-view-escrv
HIE	Health Information Exchange	A united collection of a number of individual CDRs within a region. Each CDR is a single database storing some particular kind of health information - e.g. lab results or medications lists or care plans - while the Health Information Exchange is a virtual database, which has the purpose of providing an index to the overall content of its component CDRs, via a registry.
HISO	Health Information Standards Organisation	The Health Information Standards Organisation (2010) is an advisory group to the National Health IT Board, which sits under the National Health Board (NHB).
IFHC	Integrated Family Health Centre	Family health centres that offer a range of integrated primary care diagnostic and community health services.
IHE	Integrating the Healthcare Enterprise	International organisation promoting and providing implementation guidelines for standards-based interoperability. See: http://www.ihe.net/
	Interoperability	Interoperability refers to the ability of health information systems to work together within and across organizational boundaries in order to advance the effective delivery of healthcare for individuals and communities. (From http://www.himss.org/content/files/interoperability_definition_background_060905.pdf)
PMS	Practice Management System	More recently also referred to as EMRs or Electronic Medical Record Systems. These are used by primary health practitioners, usually within a GP practice. MedTech32, MyPractice and Profile are PMS's commonly used in the Auckland area.
POC	Point of Care	Refers to health information systems that are used at the point of care. For example a Practice Management System in a GP Practice or pharmacy system in a community Pharmacy.
SMT	Soprano Medical Templates	An Orion Health application used by hospitals in the region to produce electronic discharges.
XDS (XDS.b)	Cross Enterprise Document Sharing	The IHE integration profile for document-oriented health information exchange, based on ebXML. See:http://wiki.ihe.net/index.php?title=Cross-Enterprise_Document_Sharing

Appendix 2 - Project Cost Components for Each Option

The next three tables list anticipated cost components for each option described in the section 'Options for Trial HIE Implementation' (p.19). Once an option or options have been agreed, these tables can be used to contribute to the cost model.

Table 5 - Cost Components - HIE Publishing and Integration

HIE Publishing and Integration	Sharing InterRAI Assessments	Sharing Discharge Summaries	Sharing Primary Care Summaries
XDS Registry	Yes	Yes	Yes
Repository middleware (Adaptor) to facilitate communication between registry and repositories	Yes	Yes	Yes
Define document structures (use existing documents or new ConnectedCare CDA?)	Yes	Yes	Yes
Configuration of Adaptor to enable SMT as an XDS Source, producing 'eDSs on Demand'		?	
Development of CDR to receive structured documents from SMT, store then and share documents via XDS.		?	Yes
Acquire GP PMS 'HIE Integration Component' (Adapt Canterbury's, or build from scratch, or ask PMS vendors to develop)			Yes
Create CDA InterRAI assessments and XDS Enable databases (National InterRAI Project Expense)	Yes		

Table 6 - Cost Components – HIE Document Viewing

HIE Document Viewing	Sharing InterRAI Assessments	Sharing Discharge Summaries	Sharing Primary Care Summaries
Development of CareConnect Portal to consume HIE documents for Portal users	Yes	Yes	Yes
Development of GP PMSs to natively consume HIE documents (Subscription model with seamless single sign-on authentication)		Yes	
Development of Secondary Care Concerto to consume HIE documents	Yes		Yes
Development of St John system to natively consume HIE documents (Optional, at their expense)	Yes	Yes	Yes

Table 7 - Cost Components – Foundation Items

Foundation Items	Sharing InterRAI Assessments	Sharing Discharge Summaries	Sharing Primary Care Summaries
Clinical Consultation and Advisory Panels	Yes	Yes	Yes
Development of Privacy Models	Yes	Yes	Yes
Establish HIE System Governance (including Affinity Domains)	Yes	Yes	Yes
Change Management (Patient and Clinicians)	Yes	Yes	Yes
End to End Test System to enable vendors to develop for the HIE	Yes	Yes	Yes

Appendix 3 – HISO 10040 Standards Requirement Traceability Matrix

Standard ID/ Requirement	Requirement Description	Trial Scope	Implementing Component(s)	Implementation Commentary
10040.1/2.2.1	HIE transport shall follow the XDS registry-repository model	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	An XDS registry will be implemented to support the solution regardless of the initial option chosen. One or more XDS enabled repositories will be implemented depending on the solution.
10040.1/2.3.1	R-CDRs shall be XDS-enabled	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The implementing components will be XDS enabled.
10040.1/2.3.2	Each R-CDRs shall include a single XDS.b registry	Core	-XDS Registry Product	A single implementation of the XDS Registry Product for the Northern Region will be established by the solution.
10040.1/2.3.3	There shall be one XDS affinity domain per R-CDR	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The affinity domain is represented by the Northern Region DHBs in this solution. That is CMDHB, WDHB, ADHB & NDHB.
10040.1/2.3.4	R-CDRs shall interconnect in accord with IHE XCA	Excluded	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	As the first implementation of the standard, there is currently no other XDS affinity domains to interconnect with.
10040.1/2.3.5	R-CDRs shall operate under a common XDS affinity domain policy	Optional	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The implementation will establish an initial XDS affinity domain policy and governance as part of the scope of the implementation project. This will act as the initial basis a common policy but may not be the final version of this.
10040.1/2.3.6	HIE participant systems may have service adapters	Extension	-XDS Enabled SMT Repositories	SMT is not currently an XDS product and would unlikely to be so in future so would be XDS enabled by an adapter.
10040.1/2.5.1	HIE transport shall be based on web services	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Communication between all components will be via web service communication.

Standard ID/ Requirement	Requirement Description	Trial Scope	Implementing Component(s)	Implementation Commentary
10040.1/2.5.2	Use of HL7 v2 for transport is in containment	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	HL7 v2 will not be used as part of the solution.
10040.1/2.6.1	The authoritative source of patient identity information shall be the NHI	Core	-NHI	All components will use the NHI as the authoritative source of patient identity.
10040.1/2.6.2	R-CDRs shall have patient identity and demographics services conforming to IHE PIXV3 and IHE PDQV3	Core	-NHI	As noted in the standard the NHI implements this requirement.
10040.1/2.6.3	The authoritative source of health provider identity information shall be the HPI	Extension	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Currently no existing repositories use the HPI as the identifier for health providers. However, these repositories do use identifiers that can be traced to HPI identifiers. Part of the scope of XDS enabling existing repositories will be to modify them as necessary hold the HPI reference to the identity currently held. The XDS repository, will natively hold the HPI.
10040.1/2.6.4	Provider identity services should conform to IHE HPD	Core	-HPI -XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The HPI is responsible for implementing the HPD profile as the source. The XDS components implemented will act as consumers of this.
10040.1/2.7.1	Authentication, access control and audit around document sharing shall conform to IHE ATNA	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	All components implemented in the project will conform to this requirement.
10040.1/2.7.2	Digital signatures shall conform to IHE Document Digital Signature (DSG)	Optional	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	When used, digital signatures will conform to this requirement.
10040.1/2.8.1	Medical image management shall conform to IHE XDS-I	Optional		None of the options identified for the implementation will include medical images so this requirement will not be implemented.
10040.1/2.9.1	Telecommunications networks shall adhere to IHE Consistent Time (CT)	Core	-healthAlliance network -ConnectedHealth network	These networks will implement this requirement.

Standard ID/ Requirement	Requirement Description	Trial Scope	Implementing Component(s)	Implementation Commentary
10040.1/2.10.1	Terminology services shall conform to HL7/OMG CTS2	Optional		None of the options identified for the implementation will require the implementation of terminology services so this requirement will not be implemented.
10040.2/2.2.1	The Content Model shall derive from the ASTM Continuity of Care Record (CCR) specification	Extension	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The XDS enabled content held in the relevant XDS enabled repositories will hold onto content in a manner consistent with this requirement.
10040.2/2.2.2	The Content Model shall be extensible	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The XDS enabled components will allow content definitions to be versioned and extended so that content can be added to over time.
10040.2/2.3.1	Content Model data definitions shall be formulated according to the ISO/IEC 11179 metadata standard	Extension	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The scope of the data definitions used will be driven by the implementation option selected and the requirements for that implementation.
10040.2/2.3.2	The data definitions of the Content Model shall be formulated as OpenEHR archetypes	Extension	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	As noted in 10040.2/2.3.1 this will be driven by the requirements of the implementation option chosen, but whichever option is chosen, the content will be expressed as archetypes.
10040.2/2.3.3	Content Model data definitions shall be registered in accord with ISO/IEC 11179 processes and stored in a compliant registry	Extension	-OpenEHR Clinical Knowledge manager	To support content being held as archetypes and for those archetypes to achieve their content interoperability goals, the archetypes need to be defined and governed at a national level. Regardless of the implementation option chosen, the OpenEHR knowledge manager will need to be implemented to act as the metadata repository for the archetypes and governance established to allow the archetypes to be defined and extended over time.
10040.2/2.3.4	Units of measure shall follow the UCUM standard	Extension	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	This will require investigation of how information is currently held in repositories that will be XDS enabled. Where possible it will be implemented according to this requirement.
10040.2/2.4.1	Development of the Content Model shall follow the DCM approach	Extension	-OpenEHR Clinical Knowledge manager	The archetype model addresses this requirement.
10040.2/2.4.2	DCMs may be reused from other national programmes	Extension	-OpenEHR Clinical Knowledge manager	Archetypes may be reused from Australia (for example).

Standard ID/ Requirement	Requirement Description	Trial Scope	Implementing Component(s)	Implementation Commentary
10040.2/2.4.3	DCMs shall define maximal datasets	Extension	-OpenEHR Clinical Knowledge manager	The archetype model addresses this requirement.
10040.2/2.5.1	OpenEHR archetypes may be used to develop and express DCMs	Extension	-OpenEHR Clinical Knowledge manager	As noted in 10040.2/2.3.2, archetypes will be defined dependent on the implementation option chosen.
10040.2/2.5.2	OpenEHR archetypes may be transformed into other information modelling forms	Extension	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Repositories may hold onto structure information in other formats as long as they are consistent with the relevant defining archetype.
10040.2/2.5.3	There shall be a shared archetype library	Core	-OpenEHR Clinical Knowledge manager	This will be established by whatever implementation option is chosen regardless of the option.
10040.2/2.6.1	SNOMED CT Reference Sets shall be used wherever possible	Extension	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	This will be implemented where possible.
10040.2/2.6.2	The Content Model shall have explicit terminology bindings	Extension	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Where SNOMED is implemented, this requirement will be addressed.
10040.3/2.1.1	Structured documents shall be the common currency of information exchange	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Regardless of the implementation option chosen, the XDS enabled repository will provide structured documents.
10040.3/2.1.2	Documents shall conform to the HL7 Version 3 Clinical Document Architecture (CDA), Release 2 (R2)	Extension	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Any and all XDS repositories will implement this requirement
10040.3/2.1.3	Documents shall be persistent	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Any and all XDS repositories will implement this requirement
10040.3/2.1.4	Documents shall have defined custodianship	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Repositories will hold information identifying the custodianship for any given document.
10040.3/2.1.5	Documents shall have the potential for authentication	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Any and all XDS repositories will implement this requirement

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10040.3/2.1.6	Documents shall establish the context for their contents	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	This is primarily the responsibility of the system where the document is created, but each of the implementation options would include this and regardless of the repository this information will be stored in the given repository.
10040.3/2.1.7	Documents shall demonstrate wholeness	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Same as noted in 10040.3/2.1.6.
10040.3/2.1.8	Documents shall be transport independent	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Each XDS enabled repository will be responsible for ensuring this holds true.
10040.3/2.1.9	Documents shall not embody workflow	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Similar to 10040.3/2.1.6, this will largely be the responsibility of the point of service/care system, however XDS repositories will also ensure this holds true when storing documents.
10040.3/2.1.10	Use of HL7 Version 2.x to express content should be contained to solutions where CDA is not a viable alternative	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	All of the implementation options will implement CDA/archetype content as the form for expressing content.
10040.3/2.1.11	HL7 Version 3 messaging use should be contained	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	HL7 v3 messaging is not included in any of the options.
10040.3/2.2.1	Documents shall be human readable	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	All repositories will ensure this is the case.
10040.3/2.2.2	Documents should be at CDA level 3	Optional	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	All repositories should be capable of storing information to this level of detail. However for the implementation options, CDA level 2 is most likely due to the way information is captured in point of service/care systems.
10040.3/2.3.1	Information may be extracted from the document	Extension	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	This is likely to be the case for most of the implementation options.
10040.3/2.4.1	Document type (template) metadata shall be standardised	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The XDS enabled registry will ensure the attributes described in the standard are stored, as will the relevant repositories.

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10040.3/2.4.2	Every document (instance) shall have a unique identifier	Core	-XDS Registry Product -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The registry and repositories will ensure this is the case.
10040.3/2.5.1	Document content shall be secured to ensure confidentiality, integrity, availability, authenticity and non-repudiation to sender and recipient systems	Core	-healthAlliance network - ConnectedHealth network	The networks providing secure SSL/TLS encryption will be responsible for meeting this standard.
10040.3/2.6.1	Documents may have attachments	Core	-XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	Although for the various options information is intended to be provided at CDA level 2, consuming systems may require the document to provided in a human readable form as well meaning that content may provided in PDF as well structured data. This will be clarified by the requirements of the given option(s) chosen.
10040.3/2.7.1	Every approved template shall have an identifier derived from the HL7 New Zealand OID root	Core	-CDA Template Library	This will be established during the given option implementation for the template(s) developed to support the option.
10040.3/2.7.2	Template definitions shall conform to the HIE Content Model	Core	-CDA Template Library -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The registry and repositories will ensure this is the case.
10040.3/2.7.3	Document type (template) shall have a defined set of sections	Core	-CDA Template Library -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The template library will contain the definition while the repositories will be responsible for enforcing it.
10040.3/2.7.4	Templates shall be specified in either of two forms: (a) natural language definitions, within implementation guides, or (b) sets of Schematron rules	Core (a)/Optional (b)	-CDA Template Library	The exact template form(s) will be established as part of the requirements for the implementation option(s) chosen.
10040.3/2.7.5	When any section template is modified the process should be to create a new template identifier	Core	-CDA Template Library -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	The template library will need to support this as will the document repositories implemented.

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10040.3/2.7.6	A section template may be either CDA level 2 or level 3	Extension	-CDA Template Library -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	As described in 10040.3/2.2.2, the option(s) implemented are intended to implement CDA level 2.
10040.3/2.7.7	Data types should follow the ISO 21090 standard	Extension	-CDA Template Library -XDS Enabled Éclair -XDS Enabled SMT Repositories -XDS Repository Product	This is likely to be dependent on the point of service/care systems where the information is being captured and will need to be addressed by the requirements of the implementation option(s) chosen.
10040.3/2.8.1	There shall be a library of standard templates for information exchange	Core	-CDA Template Library	The implementation option(s) chosen will establish this library and start to populate it.
10040.3/2.8.2	There shall be a governance body with responsibility for the template library	Core	-CDA Template Library	The governance process will be established when implementing the chosen option(s). The governance body itself will need to be established in partnership with the MoH.
10040.3/2.8.3	Templates shall be subject to a formal registration process modelled on ISO/IEC 11179 for metadata registration	Core	-CDA Template Library	This will be addressed when establishing the governance process described in 10040.3/2.8.2