A Regional Health Information Exchange System for Stroke Care (Nagoya-RHIE)

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***Abstract*-In this paper, the overview of Nagoya-RHIE system and technical key points on the implementation are described. For stroke care, collaborative use of clinical information is important and secure IT infrastructure for sharing documents is required. Also, standards are needed for interoperability such as common collaborative pathway for stroke care, common clinical documents for the pathway, common framework for sharing documents and transformation between legacy HIS data and common clinical documents. The Nagoya-RHIE project has tackled those technical challenges of building an EHR system. The system has been developed based on HL7 standards and IHE profiles. However, some of IHE profiles have been enhanced for applying them in the real field. Also, a new approach and tool for creating CDA document from specification and instance value set has been developed. A specification template has about 300 elements and 6 type CDA documents have been automatically generated using the specification template. Their framework and many profiles will be useful for the other EHR projects.**

I. Introduction

The Nagoya-RHIE project is an initiative to develop regional health information exchange (RHIE) system based on the global standard, in Japan. The NPO, named Tokai Medinet Forum, is an organization for promoting the project sponsored by METI (Ministry of Economy, Trade and Industry) to implement a RHIE system for stroke care in the Nagoya area using global standards including HL7[9] and IHE (Integrating the Healthcare Enterprise), and to evaluate their efficacy through trial experiment.

A. Approved by Relevant Societies

This project is supported by the following involved organizations;

-Japan Stroke Society,

-Japan Society of Neurosurgery,

-Japan Association of Rehabilitation Hospital and Institution,

-Japanese Association of Emergency Medicine,

-Medical Information System Development Center (MEDIS-DC),

-Japanese Association of Healthcare Information Systems Industry (JAHIS) ,

etc.

B. Background of healthcare policy in Japan

In Japan, every 47 prefecture should decide measures of the regional medical scheme concerning 4 major illnesses including stroke and 5 healthcare policies such as emergency medicine. The collaborative healthcare services will become indispensable from 2008 fiscal year.

Stroke is the third commonest cause of death and the commonest cause of adult disability in Japan. Each year, there will be approximately 8,000 new stroke events around Nagoya University Hospital.

To achieve the secure system for collaborative medicine, basic framework such as EHR is needed.

C. Adopted Standards and Technologies

The project participant companies in JAHIS have made an effort to develop the Japan realm profile and implementation guide for HL7 standard and IHE profile for such as CDA R2, HL7 V2.5, XDS (Cross-Enterprise Document Sharing) with PIX (Patient Identifier Cross-Referencing), PDQ (Patient Demographics Query) and ATNA (Audit Trail and Node Authentication) [1][2].

Also, the security guideline for healthcare network has been continually revised by MHLW (Ministry of Health, Labor and Welfare) in Japan. This project emphasizes a following of the compliance matter according to the revised new guideline. From a technical view point, the facilities such as user authentication, access control, audit trail and digital signature etc. are supported.

D. Progress Status

In August, 2006, the project was initiated, and the system was developed through out 2006 and 2007. Trial use began from 4Q of 2007. Now in 2008, the evaluation works is in progress.

II. Overview of Implementation

This system has been developed based on IHE IT Infrastructure Technical Framework [1][2] and OASIS (Organization for the Advancement of Structured Information Standards) ebXML registry repository standards [3][4].

The joint venture organized under the NPO has been developing the system. In this project, some of IHE profile has

been enhanced. For example, XUA (Cross-Enterprise User Authentication), NAV (Notification of Document Availability) profile has been extended by coupling them with access control mechanism based on XACML (eXtensible Access Control Markup Language) [10].

It is implemented using ebXML ebRIM3.0/ebRS3.0 [3][4], while XDS.a was specified on ebXML2.1. However, it is not conforming to XDS.b profile, because it was implemented ahead of the publishing of XDS.b profile.

Also, the tools for excerpting XDS metadata from CDA header part and generating easily CDA instance based on specification are provided.

It consists of one medical center and many gateways of participant healthcare providers such as acute hospital,

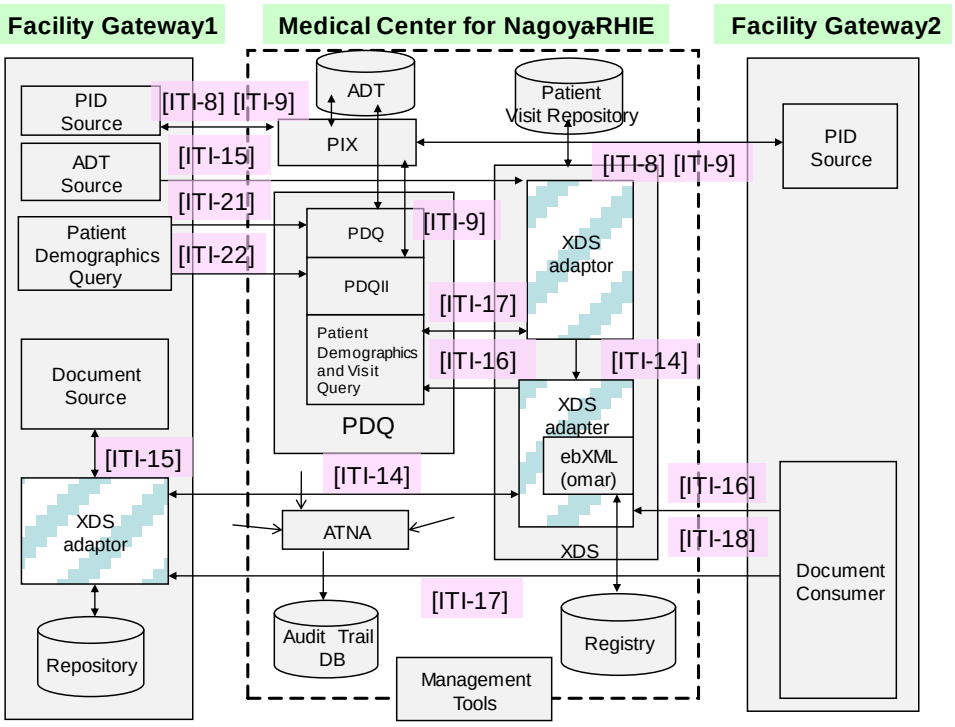

Figure 1. Overview of Nagoya-RHIE system

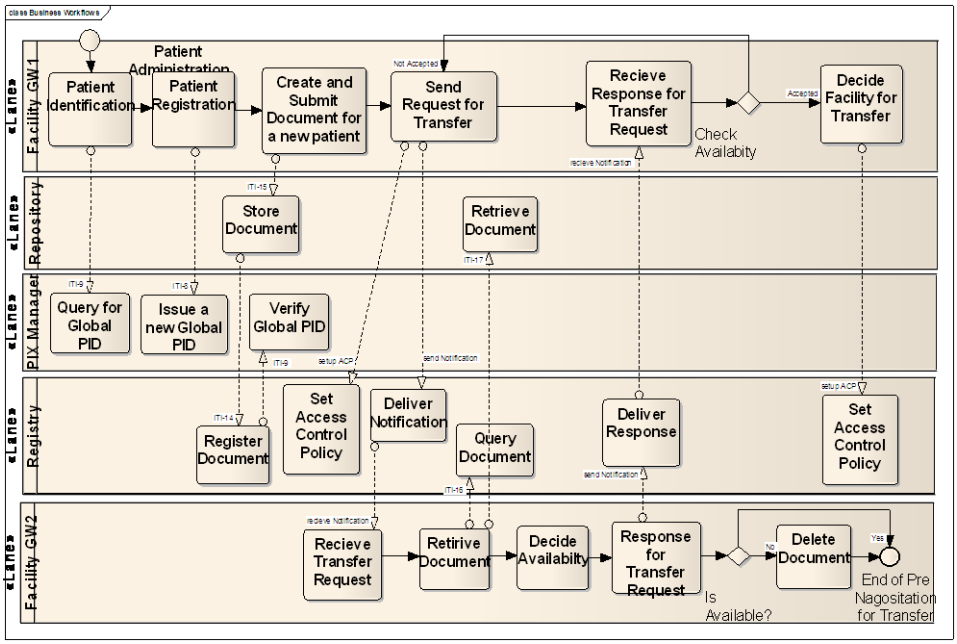

Figure 2. Example: Process Model of First Notification (Referral) for Pre-discharge

rehabilitation facility and clinic. They are connected with the secure VPN (Virtual Private Network).

A. *Adopted IHE ITI Profiles and Transactions*

The Figure 1 shows the overview of Nagoya RHIE System including the following IHE ITI Transactions;

[ITI-14] Register Document Set,

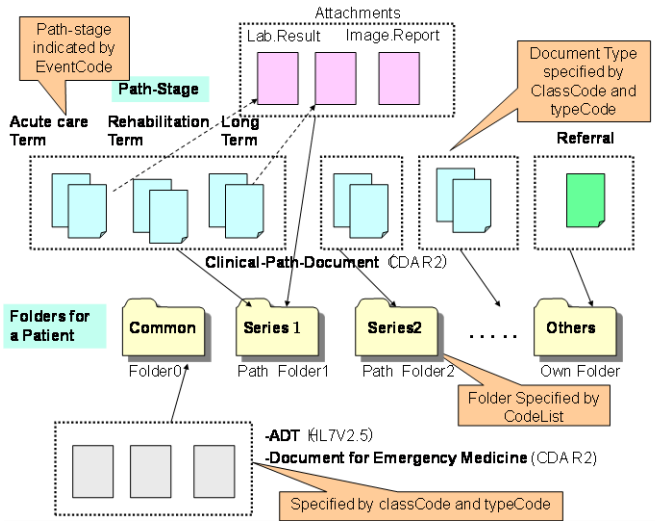

Figure 3. Folder Configuration for Stroke Care.

[ITI-15] Provide and Register Document Set,
[ITI-16] Query Registry,
[ITI-17] Retrieve Document,
[ITI-18] Registry Stored Query,
[ITI-9] PIX Query,
[ITI-8] Patient Identity Feed,
[ITI-21] Patient Demographics Query,
[ITI-22] Patient Demographics and Visit Query.

B. *Used other Related Standards and Technology*

The system has been enhanced by the following functions and tools including open source programs [8][12].

-Master data of User, Facility, Group, and Node (ebXML)
-Access Control and Notification using Folder (ebXML)
-Single Sign On (using openSSO)
-Life Cycle Management for XDS metadata
-Digital Signature (HPKI)
-Import/Export HIS data into/from CDA document

C. *Shared clinical information through XDS*

The system was implemented to exchange 6 type CDA documents for collaborative stroke care.

-First notification (referral) for pre-discharge (see Figure 2)
-Discharge summary for transfer from acute hospital
-Evaluation report after 3 months rehabilitation
-Discharge summary for transfer from rehabilitation hospital
-Report of post-discharge care at home
-Current medication and allergy for emergency medicine

III. Content Management

In the Nagoya RHIE System, the folder framework shown in the figure 3 has been proposed for stroke care. However it could be used for other types of disease. A patient will own several series of folders with appropriate access control.

For stroke care, 6 types of CDA documents can be generated based on Map/Template specification and Instance Value set

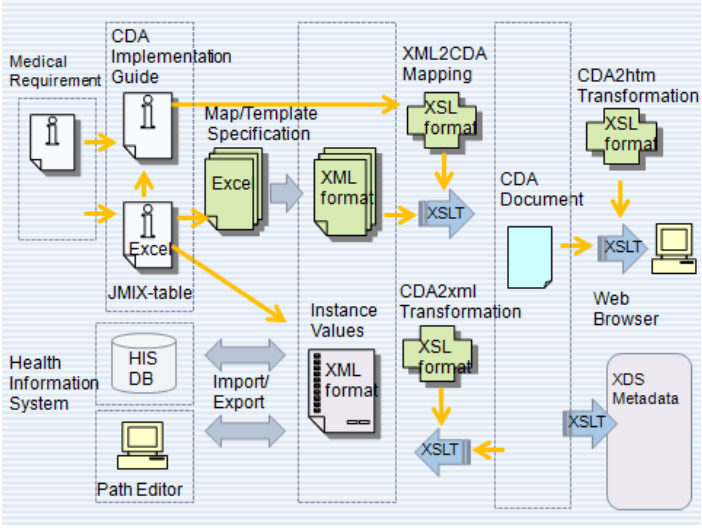

Figure 4. Framework for Managing CDA Artifact

shown in Figure 4. Table 1 shows the volume of the specification for collaborative stroke care document.

A. *Map/template specification*

Specification can be provided using Excel sheets as follows:

1. header-codetable: define code system and value set
2. header-template: define element type of header
3. header-instance: define element value and mapping
4. body-codetable: define code system and value set
5. body-template: define element type of body
6. body-instance: define element value and mapping

B. *Instance Values*

Instance values can be provided as simple XML format from HIS DB or Path Editor.

C. *Automatic generation of CDA document*

XSLT Transformation from Map/Template specification and Instance values into CDA document can be performed. (see

Table 1. Specification and Volume

	Sheet name	Sheet	Number of element
1	header-codetable	1	10
2	header-template	1	11
3	header-instance	6	11,11,16,16,16,16
4	body-codetable	1	96
5	body-template	1	331
6	body-instance	6	4,28,239,34,331,241

Figure5) Automatic generation of CDA document

D. Extracting XDS metadata from CDA header part

When a CDA document is registered in XDS, metadata such as Document Entry, Folder and Submission Set are needed. Table 2 shows the metadata mapping between XDS Document Entry and corresponding CDA header part. Shaded lines are mandate metadata. Only metadata, which XPath of CDA document is not specified, should be added at submission time.

For now, our aimed collaborative care system could be achieved by XDS and CDA. Also, specifying the standard for Japan realm could be done smoothly in JAHIS (effort and cost reduced). It has become clear that XDS with CDA is a good framework for PHR and EHR.

A. Open Issues

There are several differences in detail between Japanese specifications and original IHE profiles. For instance,

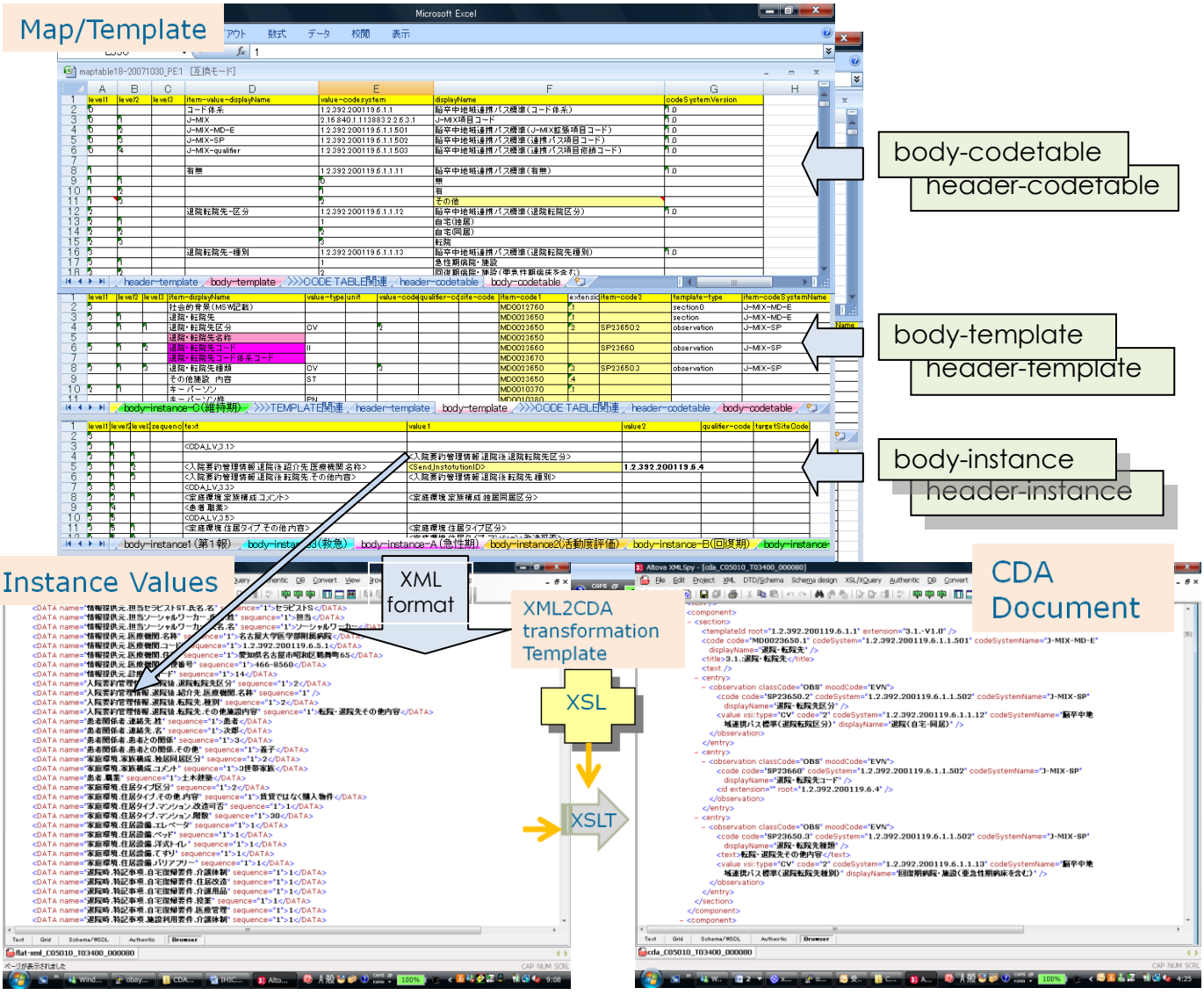

Figure 5. Example of Automatic Generation of CDA Document

IV. LESSONS LEARNED

The new approach and tool for creating CDA document from specification and instance value set is useful to reduce the cost of developing RHIE system.

PIX/PDQ is implemented by SOAP binding and HL7V2.5 message. XDS is implemented by ebXML ebRIM3.0/ebRS3.0.

It is important to have communication in order to support collaborative stroke care. Human communication such as e-mail, and machine communication for various software services should work together effectively. The integration profiles combining XUA and NAV should be provided.

Table 2. Metadata Mapping between XDS Document Entry and CDA Header

	XDS metadata	type	XPath in CDA document	Code
1	availabilityStatus			
	entryUUID	UUID		
	mimeType			JAHIS-mimeCode
	title		ClinicalDocument/title	
2	uniqueId	OID	ClinicalDocument/id/@extension, @root	(Facility ID)
3	patientId	CX	ClinicalDocument/recordTarget/pathientRole/id	
4	sourcePatientId	CX	ClinicalDocument/recordTarget/pathientRole/id	
5	sourcePatientInfo	PID		
6	classCode		ClinicalDocument/code	JAHIS-classCode
7	typeCode		ClinicalDocument/code	NPO-typeCode
8	eventCodeList			NPO-eventCode
9	confidentialityCode		ClinicalDocument/confidentialityCode	JAHIS-confidentialityCode
10	creationTime	DTM		
11	serviceStartTime	DTM	ClinicalDocument/DocumentationOf/ServiceEvent/effectiveTime/low	
12	serviceStopTime	DTM	ClinicalDocument/DocumentationOf/ServiceEvent/effectiveTime/high	
13	size			
14	* authorInstitution	XON	ClinicalDocument/author/assignedAuthor/representedOrganization/name	
15	* authorPerson	XCN	ClinicalDocument/author/assignedAuthor/assignedPerson/name	
16	* authorRole		ClinicalDocument/author/assignedAuthor/code	JAHIS-roleCodes
17	* authorSpecialty		ClinicalDocument/author/assignedAuthor/representedOrganization/asOrganizationPartOf/code/	JAHIS-practiceSettingCodes
18	comment			
19	legalAuthenticator	XCN	ClinicalDocument/legalAuthenticator/assignedEntity/assignedPerson/name	
20	healthcareFacilityTypeCode			JAHIShealthcareFacilityTypeCode
21	practiceSettgCode		ClinicalDocument/component/encompassingEncounter/location/healthCareFacility/code	JAHIS-practiceSettingCode
22	languageCode		ClinicalDocument/langauteCode	
23	formatCode			JAHIS-formatCode
24	hash	SHA1		
25	*URI			
26	parentDocumentId	UUID		
27	parentDocument Relationship		ClinicalDocument/relatedDocument/typeCode	

V. Future Plan

In the current implementation, the pathway editor needs high cost to maintain the program according to change of specification. More flexible tool is expected as a pathway editor. Archetype of openEHR [5] is similar concept of specification in our approach. It must be useful to handle the archetype and template of openEHR within our approach.

Developing specification and archetype driven path editor will be planned.As a next step, the Nagoya-RHIE project will begin to apply the system to other collaborative pathways such as orthopedic surgery, especially femoral [femur] neck fracture.

Acknowledgment

This paper could not have been written without the forward thinking of the Working Group members in Tokai Medinet Forum-NPO and the Standard Committee members in JAHIS.

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