Original Article

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Quick Response Code:

Website: www.jehp.net

DOI: 10.4103/jehp.jehp_2_19

Designing a communication protocol for acquired immunodeficiency syndrome information exchange

Mostafa Shanbehzadeh, Jahangir Abdi[1], Maryam Ahmadi[2]

Abstract:

INTRODUCTION: Interoperability will provide similar understanding on the meaning of communicated messages to intelligent systems and their users. This feature is essential for controlling and managing contagious diseases which threaten public health, such as acquired immunodeficiency syndrome (AIDS). The aim of this study was also designing communication protocols for normalizing the content and structure of intelligent messages in order to optimize the interoperability.

MATERIALS AND METHODS: This study used a checklist to extract information content compatible with minimum data set (MDS) of AIDS. After coding information content through selected classification and nomenclature systems, the reliability and validity of codes were evaluated by external agreement method. The MindMaple software was used for mapping the information content to Systematized Nomenclature of Medicine-Clinical Terminology (SNOMED-CT) integrated codes. Finally, the Clinical Document Architecture (CDA) format was used for standard structuring of information content.

RESULTS: The information content standard format, compatible selected classification, or nomenclature system and their codes were determined for all information contents. Their corresponding codes in SNOMED-CT were structured in the form of CDA body and title.

CONCLUSION: The complex and multidimensional nature of AIDS requires the participation of multidisciplinary teams from different organizations, complex analyzes, multidimensional and complex information modeling, and maximum interoperability. In this study, the use of CDA structure along with SNOMED-CT codes is completely compatible with optimal interoperability needs for AIDS control and management.

Keywords:

Acquired immunodeficiency syndrome, communication protocol, human immunodeficiency virus, minimum data set, semantic standardization, structural standardization

Department of Health Information Technology, School of Paramedical, Ilam University of Medical Sciences, Ilam, Iran, [1]Department of Parasitology, School of Medicine, Ilam University of Medical Sciences, Ilam, Iran, [2]Department of Health Information Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran

Address for correspondence:
Dr. Jahangir Abdi, Department of Parasitology, School of Medicine, Ilam University of Medical Sciences, Banganjab, Ilam, Iran.
E-mail: jahangirabdi@yahoo.com

Received: 01-01-2019
Accepted: 15-02-2019

Introduction

Interoperability means the capability of computer systems with heterogeneous platforms in terms of hardware, software, and networking components for effective and integrated operation in different organizations.[1,2] The interoperability is meaningful sharing of information between systems and their users.[3] There are four types of interoperability for information systems: (1) legal interoperability, (2) functional or technical interoperability, (3) structural interoperability, and (4) semantic interoperability.[4] The information systems use four levels of interoperability to communicate. At the highest level (fourth level), the exchanged data are equally understandable by human and machine (information systems).[5] At this level of interoperability, it is very important to create normalized data structures and harmonized content standards in the form of efficient communication protocols.[5]

Information systems interoperability is one of the most important prerequisites

How to cite this article: Shanbehzadeh M, Abdi J, Ahmadi M. Designing a communication protocol for acquired immunodeficiency syndrome information exchange. J Edu Health Promot 2019;8:99.

for having a comprehensive system of monitoring and controlling community health-threatening diseases.[6] The Center for Disease and Control in the United States identified acquired immunodeficiency syndrome (AIDS), tuberculosis, and malaria as major dangers to public health.[7] Using public health information exchange (PHIE) infrastructure for controlling and managing AIDS plays an important role in improving the indicators of this disease at community level and controlling it more efficiently.[8] Adaptation and development of communication protocols for integrated transfer of public health reports at PHIE infrastructure would normalize the content and structure of information messages to improve interoperability between information systems.[9]

The communication protocols are a set of rules and guidelines which reduce the complexity of communication between nodes in a network.[10,11] There are two main components in communication protocols: syntax (determining the structure and ordering of data bits of messages) and semantic (defining the semantic of data bits of messages).[10] Adoption of communication standards for medical documents on the Internet in order to structure information messages and using terminology mapping approach for converting scattered information content into integrated codes will provide similar understanding on exchanged messages to all platforms.[12]

The terminology mapping is a kind of standardization modeling of information messages which uses normalization of data elements in coordinated formats (usually integrated terms and codes).[12] Patra *et al*. aimed to create a normalized protocol for sharing the information of children with AIDS. They conducted the following stages to design a communication protocol: (1) identification of data elements of AIDS reporting (minimum data set [MDS]); (2) normalization of information content through the use of medical nomenclature systems (International Classification of Diseases (ICDs), Logical Observation Identifiers Names and Codes (LOINC); and (3) Using structural Clinical Document Architecture (CDA) standard to integrate the ordering of information content.[13]

However, this study aims to develop a communication protocol by normalize the reporting content and structure of messages to step forward in improving the interoperability between information systems which are involved in care and treatment of AIDS in various beneficiary organizations.

Materials and Methods

This study was conducted in four stages: (1) extracting information content for MDS of AIDS data elements; (2) encoding content and evaluating the reliability and validity of codes; (3) normalizing information content by terminology mapping; and (4) normalizing the structure of messages through using the formats of exchanging medical information on the Internet. The MDS of AIDS data elements are already designed by researcher through using a systematic review approach in the form of three nonclinical, clinical, and supportive information categories.[14]

Collection of information content

The real information of clinical cases of patients in database of the National AIDS Organization of Iran was used to identify the information content for MDS data elements. The information was provided to researcher providing that the privacy principle is observed and the identification information will remain secret. The researcher-made checklist was used for guided extraction of information content from clinical cases of patients with AIDS based on MDS classes and data elements.

Encoding information content

In next stage, the information content was coded using selected classification or nomenclature systems (ICD, LOINC, International Classification of Functioning, Disability and Health [ICF)], Read Code Classification [RCC)], and normalized drug codes [RXNORM]). After coding, the validity and reliability of codes were evaluated through surveying two health information management specialists who had a work experience in hospital encoding unit. In this regard, the external agreement method was used to recodify the information content and compare the primary codes with secondary. The descriptive statistical tests were used to check the validity of codes and evaluate the reliability of coding.

Thesaurus mapping

After evaluating and verifying the contents encoded in selected medical classification or nomenclature systems, all scattered codes were mapped to integrated codes in SNOMED-CT were defined by mapping through Mind Maple software (Java software developer organization).

Determining the medical documents' exchange format

After normalizing information content by mapping, it was necessary to structure integrated content in the form of normal reports. The CDA standard was proposed as an optimal structural standard for transferring information in comprehensive Health Information Exchange infrastructure of Iran.[15] Therefore, all mapping contents (SNOMED-CT codes) were structured in the form of CDA body and title, and the final communication protocol was proposed.

Results

The MDS was already designed by Shanbehzadeh and Ahmadi.[14] The proposed MDS was divided into three data categories includes nonclinical, clinical, and supportive with ten, six, and three data classes and 73, 63, and 24 data elements, respectively.[14] The data extraction checklist was used to collect the contents of clinical cases based on MDS data elements. The MDS-compatible information content was extracted in three nonclinical, clinical, and supportive areas. It should be noted that in order to preserve the security and confidentiality of patient information, the information content of demographic data was defined formally (unrealistically). After extracting the information content, all contents were encoded through their respective classification and nomenclature systems. The ICD10, ICF, RXNORM, LOINC, ICDs, Ninth Revision, Clinical Modification (ICD9CM), the International Classification of Health Interventions, ICD10 Procedure Coding System (ICD10-PCS), and the International Classification of Procedures in Medicine (ICPM), the Diagnostic and Statistical Manual of Mental Disorders (DSMs), and RCC were used to codify diseases and other related disorders, health conditions, drug and prescription, laboratory and evaluation findings, medical and surgical procedures, mental situation, and general and specific situation, respectively.

The evaluation of validity and reliability of codes using external agreement showed that from three information categories, 20 information classes, 68 data elements, 71 preference codes, and 68 reference codes (SNOMED-CT), there were 66 similarities between initial and secondary codes (code matching), 5 significant difference between initial and secondary codes, and 8 minor difference between primary and secondary codes. All differences between codes were ignored at decimal level. Therefore, only significant difference was the basis for evaluating the final reliability between primary and secondary codes. Table 1 shows these differences along with the results of their final reliability assessment.

After finalizing the codes which were assigned to information content, it was necessary to provide preconditions for normalizing content through thesaurus mapping. In Tables 2-4, the structuring of information content is conducted based on information category, information classes, and data elements. The format of information content, type of preferred classification or nomenclature system, and corresponding codes were defined for all information contents in each of three information categories in SNOMED-CT. In addition, the code values were defined for some data elements; this integrated the definition of information content of those data elements.

The SNOMED-CT National Pathology Exchange Online Browser was used to search for concepts and codes in SNOMED-CT. There were 20 conceptual categories of SNOMED-CT in this browser. The MindMaple software was used to link the information content with scattered preferred codes and terms in multiple classifications and nomenclature systems and then mapping them to integrated reference terminology (SNOMED-CT). Due to the high level of information classes in MDS, one class of medical category, one class of supportive category, and two class of clinical category were visualized as mapping paths in MindMaple Software. The name of information class, name of data element, name of information content, preferential codes, and their reference code were specified at mapping paths [Figure 1].

The general areas of mapping in this study include: (1) mapping general and specific situations to RCC codes and SNOMED-CT code; (2) mapping disease and mortality situation to ICD10 codes and SNOMED-CT code; (3) mapping nomenclature of medication to RXNORM codes and SNOMED-CT code; (4) health situation mapping to ICF codes and SNOMED-CT code; (5) mapping medical, surgical, and supportive measures to ICD9CM, ICPM, and ICD10-PCS codes and SNOMED-CT code; (6) mapping laboratory and evaluative measures to LOINC codes and SNOMED-CT code; and (7) mapping mental situation to DSM codes and SNOMED-CT code. As shown in Figure 2, the coded information was placed around the mapping image by selected medical classification

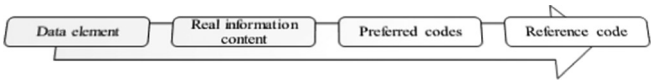

Figure 1: Triple mapping routes

Table 1: Reliability codes assessment

Information category	Information class	Data element	Information (record) content	Coding system	Primary code	Secondary code	Final evaluation
Nonclinical	High-risk group	Occupational hazard	Exposure to occupational risks	ICD10	Z57.8	Z58.5	Z57.8
Clinical	Diagnostic	HIV stage	HIV Stage 2	ICD10	Z21	B24	Z21
Clinical	Laboratory	HIV test name	Elisa test	LOINC	29538-6	29358-0	29538-6
Supportive	Consultation	Marital/sexual	Sexual behavior	ICD9CM	64.41	94.41	94.41

ICD=International Classification of Diseases, LONIC=Logical Observation Identifiers Names and Codes

Table 2: Nonclinical minimum data element description

Information classes	Data elements	Information (record) content	Data element format	Vocab code/ value set	Preferred codes	Reference codes (mapping)
Demographical	Full name	Z.J	Entity Name	RCC	XaLva	371484003
	Age (Y:Year)	53	Numeric	RCC	X24Ai	28288005
	Date of birth	01/10/1964	Integer	-	-	184099003
	Sex	Female	Boolean	RCC	X768C	248152002
	Place of birth	Iran/Tehran	String	RCC	XaG3t	315446000
	Ethnicity	Persian	Coded value	RCC	Xa6g5	297553001
Socioeconomically	Marital status	Married	Coded value	RCC	XE0ob	36629006
	Religion	Islam, Shia	Coded value	RCC	XM1b9	28010004
	Literacy	Diploma	Coded value	RCC	13Z46	342341000000108
	Revenue	10/000/0000 R	Coded value	RCC	ZV4E3	424860001
Contact	Address	-	String	RCC	XaDvP	184097001
	Phone number	+98912********	Numeric	RCC	XaZ4q	824551000000105
	Postal code	***** - *****	Numeric	RCC	9158	184102003
Identification	Patient identifier	011-52148-2	Numeric	RCC	XE2Hj	422549004
	Medical record number	02-29-01	Numeric	RCC	Xn73J	398225001
Financial	Payment method	Private insurance	Coded value	RCC	XaFk3	314847007
	Insurance ID	44785233	numeric	RCC	XE2Hj	456281000000100
Document	Document heading	DOC 01	String	RCC	Xa4H9	716931000000107
	Document goal	HIV HIE	String	RCC	Xa4HA	717721000000109
	Document ID	002240563	Numeric	-	-	-
	Date of creation	03/05/2017	Integer	RCC	XaIhc	716631000000104
Legal	Consent	Therapeutic	Coded value	RCC	XaM87	1064521000000107
	Prescription errors	Wrong dose	Vocab code	ICD10	T50.9	397766003
	Confidential code	a01501	Alpha numeric	RCC	9R12	717391000000106
High risk/at risk group	IV injection	blood transfusion	Vocab code	ICD10	Z51.8	385228000
	Drug addiction	No history of	Vocab code	RCC	Xaa4m	14732006
	Sexual orientation	Sexual deviation	Vocab code	ICD10	Z72.5	102947004
	Occupational	Occupational	Vocab code	ICD10	Z57.8	525831000000103
	Mental status	Anxiety	Vocab code	DSM	309.24	73595000
Contamination	Contamination category	Contact with Razor	Vocab code	ICD10	W27	475171000000100

RCC=Read Code Classification, ICD=International Classification of Diseases, DSM=Diagnostic and Statistical Manual of Mental Disorders

or nomenclature systems, and the integrated content was placed at the center of mapping image through SNOMED-CT.

After mapping and normalizing the information content by integrating all information contents through SNOMED-CT normal names and codes, the information exchange was structured using the most consistent normal exchange format for medical documents CDA and placement of data elements along with integrated codes which described the data elements contents; in this way, the final protocol format for transmission of AIDS information was provided. In CDA structure, the structural division is based on allocation of information content related to the identification of entities involved in care and treatment of diseases in naming of these formats and insertion of information content related to detailed information and process reports in body of documents. Table 5 shows the CDA format for the information content of data elements in MDS.

In structure of CDA, the demographic, socioeconomic, identification, and contact information classes related to identification of entities involved in AIDS care and treatment were placed at heading of documents. The body of documents included detailed information related to information classes of exposed groups, type/category of transmission of disease, pregnancy information, situation of life, information on clinical situation, diagnosis, measures and services provided to patients (surgical, prescriptive, and laboratory), background situation, and support services.

Discussion

To establish an integrated and macroexchange infrastructure for AIDS management, it is necessary to meet some requirements after establishing network and communication platforms in order to make possible the communication among all stakeholders: (1) identification of data elements and designing national MDS for integrated AIDS reporting; (2) coordinate definition of

Table 3: Clinical minimum data element description

Information classes	Data elements	Information (record) content	Data element format	Vocab code/ value set	Preferred codes	Reference codes
Diagnostic/ problems	Primary diagnosis	Respiratory infection	Vocab code	ICD10	J06.9	281794004
	Final diagnosis	Asymptomatic HIV	Vocab code	ICD10	Z21	91947003
	Chief compliant	HIV lymphadenopathy	Vocab code	ICD10	B24	713507008
	Present HIV stage	HIV stage 2	Vocab code	ICD10	Z21	91947003
Diagnostic/ problems	Present disease status	Inactive	Vocab code	ICD10	Z21	91947003
	HIV type	Type 1 HIV	Vocab code	ICD10	B24	932981000000105
Procedure	Medical/operation	Bone biopsy	Vocab code	ICD9CM	41.31	21911005
Laboratory	HIV test name	Elisa and CD4	Vocab code	LOINC	29538-6	406109008
	Routine tests	CBC	Vocab code	LOINC	24317-0	26604007
	Other tests	PDD - Tuberculin	Vocab code	LOINC	38751-4	252352008
	Test result	Positive HIV	Boolean	ICD10	Z21	165816005
Prescription	Prescription name	Efavirenz 100 mg	Vocab code	RXNORM	C0674428	324876006
	Administration route	Oral form	Vocab code	RCC	XaljJ	26643006
	Drug allergy	Skin rash	Vocab code	ICD10	R21	64144002
	Compliance assessment	Noncompliance	Vocab code	ICD10CM	Z91.12	713017009
	Discontinue cause	Feeling frustrated	Vocab code	ICD10CM	Z91.138	224973000
History	Disease	Peptic ulcer	Vocab code	ICD10	Z87.10	266998003
	Operation	Cesarean section	Vocab code	ICD9CM	74.99	41059002
	Prescription	Omeprazole 20mg	Vocab code	RXNORM	C0708503	317306008
	Social	Social exclusion	Vocab code	ICD10CM	Z60.4	105412007
Complication	Comorbidities	HIV pneumocystis	Vocab code	ICD10	B24	88860002
	Complication	Chemotherapy anemia	Vocab code	ICD10	D59.2	81711008
Pregnancy	Current pregnancy	Not pregnant	Vocab code	ICD10	Z32.0	60001007
	Pregnancy planning	Oral contraceptive	Vocab code	ICD10	Z30.4	5935008
Survival status	Current state of life	Patient alive	Boolean	RCC	Xabvw	438949009
	Cause of death	Inconsistent	Vocab code	RCC	X80wq	260380004

RCC=Read Code Classification, ICD=International Classification of Diseases, LONIC=Logical Observation Identifiers Names and Codes, RXNORM=Normalized Drug Codes

Table 4: Support minimum data element description

information classes	Data elements	Information (record) content	Data element format	Vocab code/value set	Preferred codes	Reference codes
Consultation programs	Psychological	Psychological	Vocab code	ICD9CM	94.49	171022008
	Marital	Sexual	Vocab code	ICD9CM	94.41	441901000000108
	Nutrition/diet	Diet therapy	Vocab code	ICPM	9-149	441901000000108
	Occupational	Vocational	Vocab code	ICD10 PCS	HZ45ZZZ	171002009
	Education	Safe sex	Vocab code	RCC	XaKuU	386467004
Support programs	Screening services	HIV screening	Vocab code	ICD10 PCS	HIG VL ZZ	992781000000103
	Advocacy groups	Charitable	Vocab code	ICF	d910	312051009
	Immunization	DTP vaccine	Vocab code	ICD9CM	99.39	463801000000108
Ancillary services	Dental care	Root canal	Vocab code	CDT	D3331	54258006
	Radiography	Plain chest	Vocab code	ICD9CM	87.38	5131003
	Rehabilitation	Respiratory physiotherapy	Vocab code	ICD9CM	93.1	91251008

RCC=Read Code Classification, ICF=International Classification of Functioning, ICD=International Classification of Diseases, PCS=Procedure Coding System, ICPM=International Classification of Procedures in Medicine

information formats through functional data dictionary; (3) normalization of information content through dictionaries and medical classification systems; (4) synchronization of data flow models by mapping; (5) adoption of messenger standards for standard ordering and formatting of data elements; (6) setting reporting deadlines; (7) identifying reporter, place of submitting report, and qualified person to receive the report; and (8) determining the feedback situation of reports.[7]

In the Office of the National Coordinator for Health Information Technology report, the information exchange protocol was designed for public health conditions. The components of this protocol included: (1) designing MDS for public health reporting; (2) definition of terms' formats (code, decimal, strand, dual, textual, and numeric); and (3) predicting classification or nomenclature systems for information content normalization.[16] In this study,

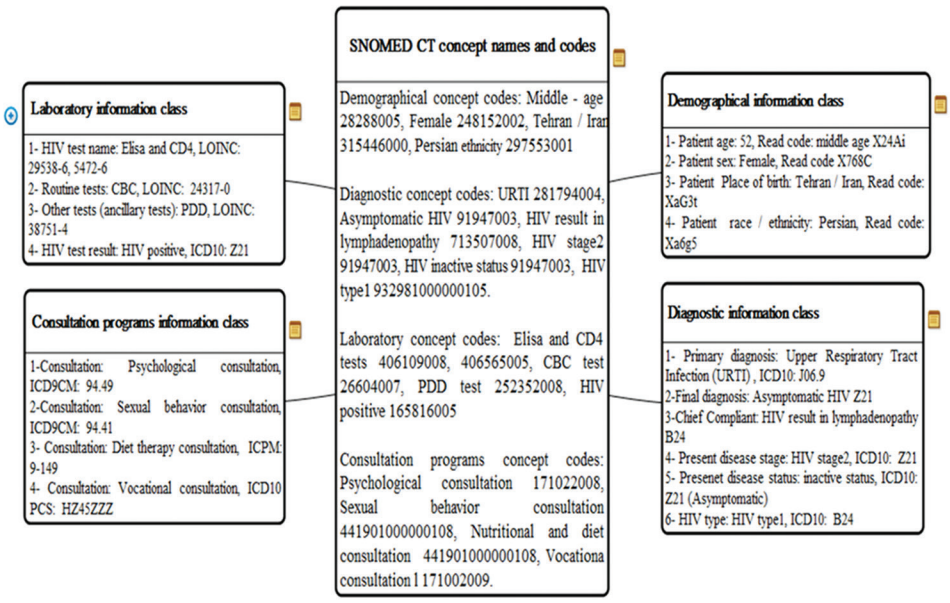

Figure 2: Visualization of thesaurus mapping through MindMaple software

Table 5: Clinical document architecture format for acquired immunodeficiency syndrome information exchange

Document heading
Demographical information: Patient name: Z. J., Sex: F, Age: 53, Nationality/Race: Iranian/Persia, Date of birth: 01/10/1964 , Place of birth: Tehran
Contact information: Address: Iran, Tehran, Vanak Sq. Valli asr St, Phone number: +98 912 111111, Postal code: 57896-23511
Identification information: Patient identifier (National ID): 011-52148-2, Medical record number: 02-29-01, ART ID: 000-223, Confidential code: a01501, Insurance ID: 44785233
Document information: Document heading: DOC 01 HIV INTEROP. , Document goal: HIV Interoperable Information Exchange (HIIE), Document ID: 002240563, Document date of creation: 2017/05/03
Document body
Diagnosis/problem: Primary diagnosis: 281794004, Final diagnosis: 91947003, Chief compliant: 713507008, Present HIV stage: 91947003, Present disease status: 81000119104, HIV type: 932981000000105, Medical procedures/operations: 21911005
High risk/at risk: Intravenous injection/blood transfusion: 385228000, Drug addiction: 14732006, Sexual orientation: 102947004, Occupational hazards: 525831000000103, Mental status: 73595000, Contamination type (category): 475171000000100
Laboratory information: HIV test name: 406109008, 406565005, Routine tests: 26604007, Other tests (ancillary): 252352008, Test result: 165816005
Prescription/pharmaceutical: Prescription name - dose: 324876006, 407791001, Prescription type: 26643006, Drug allergies/adverse effects: 64144002, Disease stage at treatment start: 103415007, Compliance/adherence assessment: 713017009, Discontinue/withdrawal cause: 224973000
History: Disease/problem history: 266998003, Procedure/operation: 423827005, Prescription: 317306008, Social: 105412007, Complication/ Comorbidities: 88860002, 81711008
Pregnancy/delivery: The current pregnancy condition: 60001007, Pregnancy planning: 5935008
Life status: The current state of life: 438949009, Underlying cause of death (if deceased): 260380004
Consultation: Mental: 171022008, Nutrition and diet therapy: 441901000000108 , Occupational: 171002009, Marital/sexual behaviors: 441901000000108
Supportive programs: Education and awareness programs: 386467004, Screening services: 992781000000103, Advocacy groups membership: 312051009
Ancillary services: Radiography services: 5131003, Immunization services: 463801000000108, Dental care: 54258006, Rehabilitation services: 91251008

CDA=Clinical document architecture

data synchronization was considered to be an important prerequisite for designing information exchange characteristics.[16] The author declared in this study MDS of reporting AIDS-related situations was already designed by researcher in three nonclinical, clinical, and supportive information categories in a separate study.[14]

The data elements content was integrated through selected classification or nomenclature systems and mapping into SNOMED-CT content. Finally, the CDA standard was used to structure the information ordering to report AIDS conditions in the aforementioned categories.

Patra *et al*. designed an MDS for conducting teleconsultation with AIDS patients and tried to insert data elements related to identifying information entities (demographic information) in CDA headline and the AIDS care, ART treatment, and referrals data elements in body of CDA to integrate the message structure. Then, the information content was normalized through LOINC and ICD codes.[13] In the present study, all interoperability requirements were met through content (terminology mapping) and structural (data sorting based on CDA structure) normalization. The strength of the current research was to use mapping process to normalize the information content. The thesaurus mapping is a technical function to create information integrity through transformation of multiple terms to unified term.[17,18] Mapping data elements may convert care documents from inactive to an active element to improve continuous and collaborative care.[19] Bouhaddou *et al*. showed that mapping the information content of RXNORM dictionary to SNOMED-CT creates synergy and plays an important role in integrating the concepts to evaluate drug interactions.[20]

Gordon *et al*. identified the information classes and data elements of personal health records of patients with AIDS and used the Continuity of Care Document (CCD) structural standard to structure the information content for transmission on the Internet. The information content was organized in two parts: CCD headline (information of entities involved in care) and CCD body (detailed information on care and clinical processes).[21] Lim *et al*. aimed to create a CDA format for patients with AIDS in Korea. The identification information was placed in CDA headline, and detailed information was inserted in CDA body. The SNOMED-CT and LOINC codes were used to integrate information content into CDA structure.[22] CDA supports complex and multidimensional analyses in health-care system, and CCD supports the most up-to-date and relevant patient care settings for continuing treatment. The CDA focuses on primary and secondary care objectives, and CCD supports initial care programs. The time frame for information content in CDA structure is past and present, but the CCD is related to the current clinical state of patient.[22] The present study, similar to a study of Lim *et al*., defined the information patterns for transmission of patients with AIDS in CDA standard format. Furthermore, the information content was normalized through SNOMED-CT codes.

Nematollahi *et al*. suggested that the design of MDS of AIDS along with providing disease reporting standards is important requirements for establishment of a comprehensive AIDS information management system at the national level for Iran.[23] Safdari *et al*. introduced the SNOMED-CT standard as the most comprehensive and most functional standard for integrating Electronic Health Record (EHR) in Iran.[24] In the present study, the SNOMED-CT standard was proposed to report AIDS-related situations in Iran. The SNOMED-CT thesaurus is recognized as a comprehensive content standard for integration of content format of terms for semantic interoperability.[25]

Tierney *et al*. designed the MDS of reporting AIDS in both clinical and nonclinical areas and used classification and nomenclature systems to normalize the information content of MDS data elements. For example, ICD10 was used for categorizing disease and mortality situations; the LOINC was used for naming information content related to laboratory and evaluative measures; Current Procedural Terminology was used for classifying financial and repayment measures; National Drug Code was used for coding information related to prescribing and drug therapies; and ICD10-PCS was used to normalize therapeutic procedures.[26] In this study, the systematic and structured data exchange of patients with AIDS was conducted through normalization of exchange structures of documents on the Internet using structured reports in CDA body and title.[26] The present study used selected classification and nomenclature systems to normalize the AIDS reporting data elements; finally, all contents were integrated into SNOMED-CT through mapping. Then, the data elements and SNOMED-CT codes were structured through CDA format. In both studies, standard formats were defined for content of data elements as code, free text, string, and number (pure number, decimal, and numerical textual).

Rezaie *et al*. aimed to create interoperability for the transmission of information in EHR in Iran. The proposed MDS was designed in two clinical and administrative information categories, eight information classes, and 85 data elements. In the headline of CDA structure, the document identification information, patient identification information, and referral information were inserted in a structured way, and in CDA's body, the information of problems and diagnosis, records, assessment and laboratory, health-care plans, and care services were provided. This study used LOINC, SNOMED-CT, ICD9, and RCC standard to normalize information content.[15] In the present study, after designing the MDS in three main clinical, nonclinical, and supportive information categories, 20 information classes, and 183 data elements, the information content of each data element was inserted in headline and body of CDA in the form of SNOMED-CT codes. Totally, this study a practical step forward into better interoperability between Public Health Information Systems. But only considered the requirements for standardization of semantic and syntax, and technical aspects for developing of communication protocol (for example: Encryption

and decryption, error detection and control, scheduling, redirection and routing, marking, authentication and message synchronization) are neglected.

Conclusion

The use of integrated and agreed communication protocols for the transmission of AIDS information among health and care organizations, laboratories, health organizations, management and policy-making agencies, insurance companies, and other stakeholder organizations has played a major role in improving the interoperability between information systems and collaboration between them. This requirement is very important because of complexity and multidimensional nature of AIDS.

Acknowledgment

The present article is the outcome of a PhD thesis with number 9221563207 that approved by the Iran University of Medical Sciences. Moreover, it is sponsored by the Research Deputy of the Ilam University of Medical Science.

Financial support and sponsorship

This study is financially supported by Ilam University of Medical Sciences.

Conflicts of interest

There are no conflicts of interest.

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