Finding Closeness Between EHRMDS And Open-source Electronic Health Record Systems: An Analytical Approach

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Abstract. The use and adoption of electronic health records (EHR) are growing rapidly around the world. To drive the implementation of EHR in healthcare, the Ministry of Health and Family Welfare of the Government of India published recommendations for EHR standards including EHRMDS (Electronic Health Record Minimum Data Set) in September 2013 and revised in 2016. EHRMDS is a recommendation for adopting EHR for data capture, storage, visualization, presentation, transmission, and interoperability in clinical records. The current work investigates the closeness of EHRMDS to the available open-source electronic health record systems (OS-EHRS). The results of this study reveal the most suitable OS-EHRS for India in terms of clinical metadata coverage as required by EHRMDS. The current study also develops EHRMDS-ext, an extension of the current EHRMDS. The EHRMDS-ext is aligned with the clinical data exchange standards, such as SNOMED-CT and UMLS terms, which support meaningful communication, cooperation, and decision-making in the clinical process.

Keywords: Electronic Health Record · Open Source · EHRMDS · Reference Model · Metadata · ontology.

1 Introduction

Metadata has been acknowledged as a method for managing, maintaining, preserving, and exchanging Electronic Health Records (EHR) of patients. It helps in capturing a patient's record at the "granular" or data element level [1]. This allows sharing of some parts of the health record while preventing sharing of other areas. According to ISO 18308:2011 [2], EHR is "the repository(s), physically or virtually integrated, of information in computer processable form, relevant to the wellness, health, and healthcare of an individual, capable of being stored and communicated securely and of being accessible by multiple authorized users, represented according to a standardized or commonly agreed logical information model. Its primary purpose is the support of lifelong, effective, high-quality, and safe integrated healthcare."

The use and adoption of EHR are rapidly leveraging worldwide. In the United States of America (USA), the first EHR guideline came in February 2009 entitled "Health Information Technology for Economic and Clinical Health (HITECH) Act" [3]. In France, the first guideline arrived in January 2011 entitled "Dossier Medical Personnel (DMP)" [4]. As a developing country, with the second-largest population in the world, India has an ever-increasing need for quality health care. The Ministry of Health and Family Welfare (MoHFW) of the Government of India published an EHR standard in September 2013, entitled "Electronic Health Record Standards of India" [5]. The aim is to establish a uniform system for the maintenance of EHR by hospitals and healthcare providers in India. Among others, the standard consists of a set of recommendations on the Electronic Health Record Minimum Data Set (EHRMDS) to adopt EHR for data capture, storage, visualization, presentation, transmission, and interoperability in clinical records. A brief overview of EHRMDS has been provided in Section 2.1.

The EHR systems (EHRS) are designed to capture and store data accurately and provide the state of patients across time. There is a wide range of Open-Source Electronic Health Record Systems (OS-EHRS) in use around the world. Most of the Northern European countries have adopted OpenEHR. GNU Health is popular in China, USA, Argentina, Germany, and Spain. OpenMRS is quite famous in Africa, India, and Southeast Asia [6]. OpenEMR has implementations in the USA, Brazil, the United Kingdom, and South Korea [7]. In the current work, we study EHRMDS in the context of the OS-EHRS. We design a systematic approach to study the resemblance between the elements of EHRMDS and OS-EHRS. Any organization is interested in the adoption of an OS-EHRS, especially in India, the findings of this study will provide helpful information regarding the coverage of OS-EHRS when compared with EHRMDS. The study will assist in the selection of an OS-EHRS in an organization.

The main contributions of this work are: (1) investigates the closeness between the EHRMDS and the OS-EHRS; (2) provides a systematic approach for the closeness study; (3) provides a crosswalk between EHRMDS and OS-EHRS; (4) develops an extended EHRMDS.

The rest of the paper is organized as follows: section 2 describes the EHRMDS and discusses the related works. Section 3 illustrates the entire study in step-by-step. It discusses the selection process of OS-EHRS for the current study, the crosswalk, and the closeness analysis between EHRMDS OS-EHRS. It also provides an extended EHRMDS. Section 4 concludes the paper with a note for study.

2 Background

2.1. EHRMDS

The Electronic Health Record Minimum Data Set (EHRMDS) is introduced by the Ministry of Health and Family Welfare, Government of India as part of the guidelines initiated and published in September 2013 entitled "Recommendations on Standards of electronic medical records in India" [5] to be adopted in the EHR for data capture, storage, visualization, presentation, transmission, and interoperability in clinical records. EHRMDS consists of a minimal but necessary set of data elements to implement in EHR systems for efficient retrieval and exchange of clinical information at the time of clinical encounter. The EHRMDS is primarily derived from the Continuity of Care Record (CCR), a health record standard specification developed jointly by ASTM International, the Massachusetts Medical Society (MMS), and others. According to the above-mentioned guidelines, an EHR system in India should cover all mandatory elements mentioned in EHRMDS. However, an EHR system may include additional elements in accordance with the clinical need. The EHRMDS provides a total of 91 elements covering the various aspects of health data, for example, demographics, insurance, diagnosis, medications, allergies, and care plans. Table 1 provides an overview of the EHRMDS elements arranged by their types and the number of elements in each category.

Table 1. Categorized elements of EHRMDS

Sl. no.	Category	Description	# of Elements	Example Elements
1	Identifiers	include the identity of the entity.	3	UHID, Alternate UHID, Insurance ID
2	Demographics	include identifying information.	42	Patient name, Age, Address
3	Status	establishes the state of particulars.	3	Organ Donor Status, Insurance Status, Allergy Status
4	Episode	is a distinctive healthcare event.	2	Episode type, Episode Number
5	Encounter	is a casual healthcare contact between patient and healthcare provider.	4	Encounter Type, Encounter Date & Time, Reason for Visit
6	History	is the aggregate of occurred or ongoing medical events.	8	Present History, Personal History, Immunization History, Allergy History
7	Clinical examination	establishes the nature, implications, and result of the clinical findings.	13	Clinical Exam Vitals Systolic BP, Clinical Exam Pulse Rate, Clinical Exam Temperature (°C), Clinical Exam Height (cms)
8	Diagnosis	is a decision on the clinical condition identifying the nature or cause	4	Diagnosis Type, Diagnosis (Description)
9	Treatment Plan	is a detailed plan on the patient's disease, goal and options of treatment, and approximate duration of treatment.	6	Treatment Plan Investigations, Treatment Plan Medication, Treatment Plan Procedure, Treatment Plan Referral
10	Medication	is for alleviating or treating the illness with medicine	6	Medication Name, Strength, Dose, Route, Frequency

2.2. Related work

This section represents various works undertaken to find the similarity between EHR metadata elements and various standards. It also discusses the many studies that have been made on the approaches of overlapping and crosswalking between metadata elements of EHR standards.

Chen, et al. [8] studied the similarity between the elements of Cambio COSMIC, a Sweden-based EHR system, and OpenEHR, an EHR standard. A semantic mapping between the Reference Model (RM) and Archetype Model (AM) of OpenEHR and the COSMIC has been provided. The study found many similarities between the COSMIC model and OpenEHR AM. Ferranti, et al. [9] have critically evaluated two EHR standards: the Clinical Document Architecture (CDA) of Health Level 7 (HL7) and the Continuity of Care Record (CCR) of the American Society for Testing and Materials (ASTM International). CDA is used for radiology reports, progress notes, clinical summaries, and discharge summaries [9][10]. The CCR is a minimal data set that contains information about the provider, insurance, and patient's health status including allergies, medications, vital signs, diagnoses, problems, recent procedures, etc. Ferranti, et al. have proposed a strategy for harmonizing CDA and CCR with a solution to define a set of common data elements using content and knowledge from both.

Muller, et al. [11] have developed a Hospital Information System (HIS) for electronic data transfer based on CDA. CDA elements have been mapped to their corresponding HIS terms. Automatic mapping was performed using a mapping engine developed in Microsoft Excel. The HL7 International Electronic Health Record Technical Committee [12] has done a crosswalk between key criteria between the Lifecycle Model, CDA R2 Header, and RM-ES Profile to determine related metadata terms and has developed a single list of metadata concepts and term definitions. They have proposed an overlap of concepts between the Interoperability Model and CDA R2. Cucchiara [13] has generated a crosswalk and alignment between the Patient-Centered Medical Home (PCMH) model and Meaningful Use (MU). This work has concluded many areas of overlap between PCMH and MU. Coffin, et al. [14] have discovered that an intersection or crosswalk can accurately explain how specific MU criteria can meet PCMH requirements. As can be observed from the above discussion, none of the existing works, study EHRMDS India and investigate its closeness to the OS-EHRS.

3 Closeness analysis and EHRMDS-ext

The entire study is conducted in three phases as shown in Fig. 1. In phase I, we identify the open source EHR systems and their respective metadata elements; in phase II, we select the metadata elements from EHRMDs; and in phase III, we study the closeness of EHRMDS to each OS-EHR system. In this phase, we also produce an extended EHRMDS i.e., EHRMDS-ext. The phases are detailed in the following subsections.

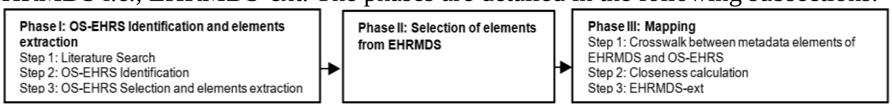


Fig. 1. Overview of methodology

3.1. Phase I: OS-EHRS identification for elements selection

The identification and selection of OS-EHRS for the current study have been conducted in three steps as follows.

Step 1: Literature Search - In order to select the OS-EHRS, scholarly publications are studied. They have been retrieved from PubMed (https://pubmed.ncbi.nlm.nih.gov/), ScienceDirect (https://www.sciencedirect.com/), Springer (https://link.springer.com/), IEEE Xplore (https://ieeexplore.ieee.org/), and Google Scholar (https://scholar.google.com/). For the selection of relevant literature, we have used the PRISMA flow diagram [15] shown in Fig. 2. The articles were retrieved from the databases using the following keywords – "electronic patient records", "computerized patient record", "computer-based patient record", "computerized health record", "computer-based health record", "open-source electronic health record systems", "comparison of open-source electronic health record tools", "best electronic health record system", "analysis of open source EHR system", "electronic health record system free", "rank list of OS-EHRS". We have considered the articles in English, original articles published during 2013-2021, and discuss open source EHR systems.

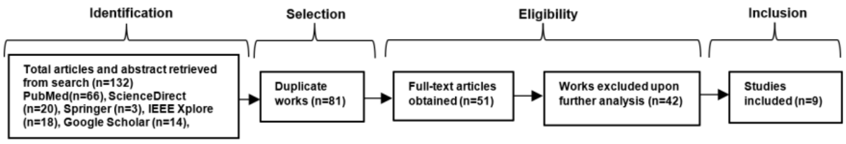


Fig. 2. The PRISMA flowchart describing the systematic search process for the selection of relevant literature

Initially, we found a total of 132 publications. From this list, duplicates were removed. The literature was reduced to 81. But then we had access only to 51 full-text literature of the 81. 42 works were again excluded based on articles published in English, between 2013 and 2021, dealing with only open source EHR systems. This process yielded 9 core literatures as provided in Table 2 for the identification of EHR systems.

Step 2: OS-EHRS identification - From the selected 9 literature, 70 EHRS were identified as shown in Table 2. After removing the duplicates, 42 OS-EHRS were identified.

Table 2. Referred EHR tools in selected literature

Ref. No.	Description	Tools referred
[16]	Studied the functionalities of free and open source EHRs.	CHITS, GNUmed, Open-EMR, OpenMRS, OSCAR, and PatientOS
[17]	Evaluated multiple EMR systems by considering, acceptance in the healthcare community, inpatient and outpatient support, community support, and frequency of updates.	OpenVistA, WorldVistA, Astronaut, ClearHealth, VistA, WebVista, OpenMRS, Care2x, OpenEMR, OSCAR, Patient OS, GNUHealth, GNUmed, THIRRA, FreeMED.
[18]	This study analyses open-source EHRs based on a set of criteria.	HOSxp, OpenEMR, and OpenVistA
[19]	This study analyses available open-source EHRS.	FreeMED, GNUmed, OSCAR, GNU Health, Hospital OS, Solismed, OpenEMR, THIRRA, OpenMRS, WorldVista, ZEPRS, ClearHealth, MedinTux.
[20]	This study evaluates open-source EHRs based on a set of criteria.	GNUmed, OpenEMR, and OpenMRS ZEPRS
[21]	This study discusses the top 26 FREE and Open-source EMR-EHR for Windows, Linux, and Mac OSX.	HospitalRun, Open-MRS, Bahmni, FreeMed, OpenEMR, Cottage Med, GNU med, Open-Clinic, OpenEyes, World-VistA, OpenMAXIMS, GNUHealth, FreeMed-Forms, ZEPRS, SMARTPediatric Growth, OpenHospital, Libre-HealthEHR, THIRPA, FreeHealth.io, Medin-Tux, DoliMed EMR, NoshEMR, ODOO EMR, Chikitsa.
[6]	This study identifies the most popular OS-EHRS based on Alexa web ranking and Google trends.	OSHERA VistA, GNU Health, the Open Medical Record System (Open-MRS), Open Electronic Medical Record (Open-EMR), and OpenEHR
[22]	This study analyses and lists the 3 best open source EHRs solutions listed on Capterra.	75Health, OpenEMR, OpenMRS
[23]	This study analyses and compare between best free and open source EHRs	TalkEHR, 75Health, OpenEMR, One-TouchEMR, OpenMRS.

Step 3: OS-EHRS selection and element extraction – Studying the metadata elements of all 42 OS-EHRS is beyond the scope of the work. To select the EHR systems for the current study, the criteria such as frequency of occurrence in the literature (FOiL) and Online Demo Availability (ODA) were applied. FOiL has allowed in gauging the popularity of the EHR tools. From 42 tools, we selected ten tools for the study. They are 75Healh (T1) (http://www.75health.com), OpenEMR (T2) (http://www.open-emr.org), OpenMRS(T3) (http://www.openmrs.org), Solismed (T4) (http://www.solismed.com), GNUMed (T5) (http://www.gnumed.org), NoshEMR (T6) (http://www.noshemr.com), Freehealth (T7) (http://www.freehealth.io), GNUHealth (T8) (https://ftp.gnu.org), Onetouchemr (T9) (http://www.onetouchemr.com), Openclinic (T10) (http://openclinic.sourceforge.net). Table 3 provides the selected OS-EHRS and their corresponding number of elements. For example, the EHRS, such as

75Health provides 48 elements and OpenEMR provides 41 elements to describe the clinical data. For the elements from each tool, see Table 5. The elements were extracted manually by vising each system.

Table 3. Shows the OS-EHRS and their corresponding number of elements

OS-EHRS	75Health (T1)	OpenEMR (T2)	OpenMRS (T3)	Solismed (T4)	GNUMed (T5)	NoshEMR (T6)	Freehealth (T7)	GNUHealth (T8)	Onetouchemr (T9)	Openclinic (T10)
# of elements	48	41	28	49	26	38	28	31	38	21

3.2. Phase II: Selection of elements from EHRMDS

In the current study, we have selected all the mandatory elements from EHRMDS related to clinical data. The total number of metadata elements in EHRMDS is 91. We have selected 42 elements (provided in Table 5) and excluded the rest 49. The reasons for the exclusion and inclusion of elements are as follows.

Reason for Exclusion- excluded metadata that specifies demographic details (i.e., patient age, name, address, contacts), care provider details, insurance details, and patient's unique number (i.e., UHID, Aadhar, etc.) as all fields are mostly present across all the EHR tools.

Reason for Inclusion- included all the EHRMDS elements marked as mandatory to include in any EHR tool.

3.3. Phase III: Mapping

In this phase, we study the closeness between EHRMDS and OS-EHRS. Also, develops EHRMDS-ext. This phase consists of three steps as follows.

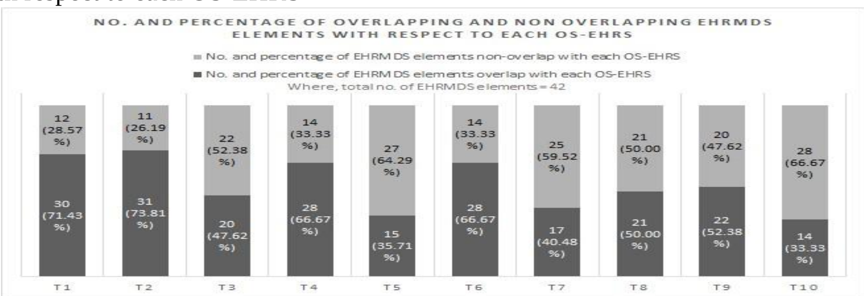
Step 1: Crosswalk between metadata elements of EHRMDS and OS-EHRS – Following the extraction of metadata elements from OS-EHRS (see phase II, step 3) and EHRMDS (phase II), we perform the crosswalk to study the closeness. For the crosswalk, we consider the EHRMDS minimum data set as a reference model (RM). We tally each metadata element of the OS-EHRS, both syntactically and semantically against the EHRMDS. The Syntactic analysis helps to signify the structure of terms without considering their meaning. It basically emphasizes the structure, layout, or morphology of the terms with their appearance or lexicographical similarity. For example, the terms "Temp", "T", "temps" and "Temperature" are syntactically the same. The Semantic analysis helps us to find out the terms bearing the same meaning and not necessarily lexicographically similar. For example, "HPI" and "Present history" are semantically the same (abb. HPI= History of Present Illness). For the purpose of mapping, Microsoft Excel has been used. Mapping is basically a mathematical intersection process [24], and can be represented as follows:

$$\bigcap_{i=0}^{n} Tool_i$$

Where $Tool_0$ is EHRMDS data elements and $Tool_1$ to $Tool_{10}$ are data elements of ten OS-EHRS. In this process, we have taken not only the syntactically same but also semantically the same elements. Suppose, the intersection of two data sets T_1 and T_2 denoted by ($T_1 \cap T_2$) consists of all the elements that are both in T_1 and T_2. Therefore, the intersection of the set of terms for tool T_1 and tool T_2 is $(T_1) \cap (T_2)$ = {Allergy Name, Allergy Type, Allergy Note, Severity, Allergic reaction} ∩ {Allergen, Allergy Type, Severity, Reaction} = {Allergy Name OR Allergen, Allergy Type, Severity, Allergic Reaction OR Reaction}. We have included both *AllergyName* from (T_1) and *Allergen* from (T_2). *AllergyName* is semantically the same as *Allergen*. *AllergyType* is present in both the tools (T_1 and T_2), and they are *syntactically* the same. Similarly, *AllergicReaction* and *Reaction*. Similarly, *AllergicReaction* is semantically the same as *Reaction*. Like this, Immunization and Vaccine have been placed together since both of them are semantically the same. Table 5 shows the mapping.

Step 2: Closeness calculation - Following the above step 1 Crosswalk, we find the closeness of EHRMDS to each OS-EHR system. For this purpose, we count at what percentage the EHRMDS elements match with an EHR system. The finding of this closeness calculation will reveal which EHR system is more suitable for India in terms of clinical metadata coverage as mandated by EHRMDS. Fig. 3 shows the closeness in terms of overlapping and non-overlapping EHRMDS elements with respect to each OS-EHRS. As can be seen from the figure that EHRMDS is closer to T_2, i.e., OpenEMR. Of the 42 EHRMDS elements, 31 elements (73.81%) are available in T_2 and only 11 elements (26.19%) elements are not available. On the other hand, T_{10}, i.e., Openclinic has the least number of EHRMDS elements i.e., 33.33%. It can be observed from this analysis that there are many clinical elements still there that are considered by the EHR tools but not available in EHRMDS. In the following step, we develop an extended EHRMDS, namely EHRMDS-ext.

Fig. 3. Shows the number of overlapping and non-overlapping EHRMDS elements with respect to each OS-EHRS



Step 3: EHRMDS-ext – Following the crosswalk, we develop the extended EHRMDS, namely EHRMDS-ext. The EHRMDS-ext can be considered for an enriched clinical metadata set. It is prepared by extending the present EHRMDS and by adapting the elements from the OS-EHR systems. Table 4 shows the total number of elements of each tool, and out of which how many are found and not-found in EHRMDS. For example, T1 i.e., 75Health has a total of 42 elements, out of which 30 elements are found in EHRMDS and 12 elements are not found in EHRMDS. These uncovered elements are adapted from OS-EHRS in preparing the EHRMDS-ext. For this purpose, we first analyse the non-found elements of OS-EHRS to prepare a unique list of elements. This unique list was then merged with EHRMDS to produce EHRMDS-ext. The extended EHRMDS consists of 89 elements as listed in the second last column of Table 5. The 89 elements include 42 existing elements of EHRMDS and

47 unique elements derived from OS-EHRS. The 47 unique elements that have come from OS-EHRS are highlighted in bold. The last column of the table provides the UMLS CUI Ids for the EHRMDS-ext elements. The corresponding UMLS terms, SNOMED CT terms, and Ids for the EHRMDS-ext elements can be found in the extended table available from https://figshare.com/s/b606590c3e4bd6d2b722.

Table 4. Shows the number of OS-EHRS elements found and not-found in EHRMDS

	T1 (48)	T2 (41)	T3 (28)	T4 (49)	T5 (26)	T6 (38)	T7 (28)	T8 (31)	T9 (38)	T10 (21)
# of elements found in EHRMDS	30	31	20	28	15	28	17	21	22	14
# of elements not found in EHRMDS	18	10	8	21	11	10	11	10	16	7

4 Conclusion

From the current study, we can observe the diversity that exists in the present health record-keeping tools. Therefore, it is the basic need of clinicians to find reliable EHR tools among all available options [25][26]. Among others, it is the similarity between the elements specific to a tool and the minimum requirements, which measure the effectiveness of such a tool. If a tool sufficiently expresses all patient's health data, the tool would be expected to have more users. Based on the closeness calculation, it is found that of the ten OS-EHRS, the OpenEMR adequately meets the minimum data set requirements as prescribed in EHRMDS. It is also found that the Openclinic does not sufficiently satisfy the EHRMDS. Thus, the current study has the potential to assist the stakeholders (e.g., hospitals) in making informed decisions in selecting OS-EHR tools. The designed approach used in the current study can be applied to similar studies. The current study also developed EHRMDS-ext, an enriched set of medical metadata that has come after a thorough analysis of elements of EHRMDS and OS-EHRS, and their crosswalk. The EHRMDS-ext can be considered an enriched medical dataset for acquiring effective clinical information exchange among healthcare providers. Our future work will focus on the semantic representation of EHRMDS-ext using the technologies, such as RDF and OWL followed by the evaluation.

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Table 5. Shows crosswalk between EHRMDS and OS-EHRS. It also provides the extended EHRMDS i.e., EHRMDS-ext

EHRMDS	OS-EHRS										EHRMDS-ext.	UMLS CUI
	75Health	OpenEMR	OpenMRS	Solismed	GNUMed	NoshEMR	Freehealth	GNUHealth	Onetouchemr	Openclinic		
Encounter Type	Encounter type	Encounter type	Encounter type	Encounter	Encounter type	Encounter	Encounter type	Encounter type	Encounter type	Encounter	Encounter Type	C0586016
Encounter Number	Encounter no	Patient Encounter no	Patient Encounter number	Encounter number	Encounter no	Encounter Number		Encounter Number			Encounter Number	C4086434
Encounter Date & Time	Encounter Date	Encounter Date	Encounter Date		Encounter Date			Encounter Date			Encounter Date	C4067739
Reason for Visit	Visit Reasons	Visit Reason		Reason		Reason		Indication		Reason	Reason for Visit	C1704447
	Physical Examination			Physical Exam							**Physical Examination**	C0031809
				Review of Systems							**Review of Systems**	C0489633
Present History		Present History	History and Examination	HPI		Present Medical History			Present Medical History		Present History	C1827596
									Conservative Therapy		**Conservative Therapy**	C0459914
				Surgical History		Surgical History	Patient Overview: Surgical		Surgical History		**Surgical History**	C0455610
Past History		General History		Past Medical History			Patient Overview: Past				Past History	C0455458
Personal History		Life Style					Patient Overview: Personal	Individuals, lifestyle		Personal Antecedents	Personal History	C0585172
Family History	Family Health	Family History		Family History		Family History	Patient Overview: Family	Families	Family History	Family Antecedents	Family History	C0241889
Menstrual & Obstetric History			Obstetrics Gynecology				patient overview: obstetric	OB/GYN	Last Menstrual		Menstrual & Obstetric History	C0425963
Socio-economic Status	Social History			Social History		social history		Socioeconomics	Social History	Social Data	Social History	C0424945
Immunization History	Vaccine & Immunization			Immunizations		Immunizations		vaccine	Imm/ Injections		Immunization History	C0552506
Clinical Exam Vitals Systolic BP	Patient Health Record vital: Blood Pressure	BP Systolic	Blood Pressure	Blood Pressure	BP Systolic	Systolic	BP		Blood Pressure		Systolic Blood Pressure	C0871470
Clinical Exam Vitals Diastolic BP	Patient Health Record vital: Blood Pressure	BP Diastolic			BP Diastolic	Diastolic					Diastolic Blood Pressure	C0428883
Clinical Exam Pulse Rate	Patient Health Record vital: Heart rate/ pulse	Pulse	Pulse	Pulse	Heart Rate	Pulse			Pulse		Pulse Rate	C0577836
Clinical Exam Temperature (°C)	Patient Health Record vital: Temperature	Temperature	Temperature (C)	Temperature	Body Temp (degree c)	Temperature	T	Temperature	Temperature		Temperature	C0039476
Clinical Exam Temperature Source		Temp Location			Rectal temp						Temperature Source	C0204688
Clinical Exam Respiration Rate	Patient Health Record vital: Respiratory rate	Respiration	Respiratory rate	Respiratory	RR	RR			Respiratory Rate		**Respiratory Rate**	C0231832
				Breathing Pattern							Breathing Pattern	C0517967
Clinical Exam Height (cms)	Patient Health Record vital: height & Patient Health Record vital: Height at > 25	Height/Length	Height (cm)	Height	Height	Height	Height	Height	Height	Height	Height	C0005890
Clinical Exam Weight (kgs)	Patient Health Record vital: weight	Weight	Weight (kg)	Weight	Weight	Weight	Weight	Weight	Weight	Weight	Weight	C0005910
Blood Group											Blood Group	C0600103

Clinical Exam Observation			Latest observation	Observation						Observation	Clinical Exam Observation	C1274016
Investigation Results				Lab Result	Lab Results	Results	Consultation reports Lab test report		Labs		Investigation Results	C0587081
Clinical Summary	Problems	Medical Problems		Problem list		Problem list		Problem	Problem list	Medical Problem	Clinical Summary	C0033213
			Health Maintenance therapy	Health Maintenance summary							**Health Trend Summary**	C0677908
Diagnosis Type	Diagnosis Type	Diagnosis Type		Diagnosis Type			Diagnosis Type				Diagnosis Type	C0332131
Diagnosis Code Name	Diagnosis Code Name	Diagnosis Code Name		Diagnosis Code Name		Diagnosis Code Name				Diagnosis Code Name	Diagnosis Code Name	C2985803
Diagnosis Code	Diagnosis Code	Diagnosis Code		Diagnosis Code		Diagnosis Code				Diagnosis Code	Diagnosis Code	C1550350
Diagnosis (Description)	Diagnosis (Description)	Diagnosis (Description)	Diagnosis	Diagnosis (Description)	Diagnosis	Diagnosis (Description)			Diagnosis	Diagnosis Description	Diagnosis (Description)	C0011900
Treatment Plan Investigations											Treatment Plan Investigations	
Treatment Plan Medication	Plan of Treatment	Treatment Plan		Treatment	Treatments	Medical Action Plan		Treatments	Health Maintenance Plans		Treatment Plan Medication	C4545837
Treatment Plan Procedure	Procedure	Procedure		Procedures			Programs	Procedures	Procedure		Treatment Plan Procedure	C0237403
Treatment Plan Referral	Referral	Referral		Referrals							Treatment Plan Referral	C0814457
Other Treatment Plan Type											Other Treatment Plan Type	
Other Treatment Plan Details											Other Treatment Plan Details	
Current Clinical Status			Conditions: Active Conditions: History Of Conditions: Inactive		Conditions	Condition					Current Clinical Status	C3899485
Medication Name	Medication: Medicine name	Medication	Medication	Medication List: Drug		Medication RXNorm	Long-term Medication	Medicaments	Medication RxNorm	Drugs	Medication Name	C2360065
Drug Code	Drug code	Drug Code	Drug Code			Drug code			Drug code		Drug Code	C54185
Strength	Medication: Medicine Strength	Strength	Strength			Strength	Strength	Strength	Strength		Strength	C1705922
Dose	Dose	Dose	Dose	Medication List: Direction Dose		Dosage	Dose	Dose			Dose	C0178602
Route	Route	Route	Route			Route	routes	Administration Route			Route	C0013153
	Medication: Instructions			Narration & Instruction		Special Instructions					Special Instructions	C1442085
Frequency	Frequency	Frequency				Frequency	Duration	Frequency			Frequency	C89081
	Medication: Refills	Refills		Refills			refill	Refills	Refill Allowed		Refills	C4289665
	Medication: Start Date						Date and time	Start: Date and time	Start Date		**Medication: Start Date**	C5141805
	Medication: End Date						limits	End: Date and time	End Date		**Medication: End Date**	C5141806
	Medication: Company Name			Medication List: Package Description							**Medication: Company Name**	C0815266
Allergy Status	Allergy: Status	Allergies		Allergy status		Allergies		Patients: Patient allergies and Critical Information	Allergies: Status	Allergy	Allergy: Status	C4521222
Allergy History	Allergy: Allergen Name		Allergies	allergy: agent					Allergies: Agent		Allergy: Allergen Name	C0002092
	Allergy: Type		Allergy type	Allergy: type			Drug Allergies		Allergies: Type	Allergy type	**Allergy: Type**	C1550403
	Allergy: Reactions		Reactions	Allergy: reactions		Reaction			Allergies: Reaction		**Allergy: Reactions**	C1527304

	Allergy: Severity		severity	Allergy: severity		Severity			Severity		**Allergy: Severity**	C1550404
	Allergy: From Date		Allergy Date	Allergy:date recorder					Start Date, End Date		**Allergy: From Date**	C2209280
									Allergies: Source		**Allergies: Source**	C1690571
						Substance or Medication					**Substance or Medication**	C3266231
				Allergy: conditions							**Allergy: conditions**	C0851444
	Patient Health Record vital: Oxygen Saturation	Oxygen Saturation	Blood oxygen saturation	SpO2	SPO2				SpO2	Spo2	**SpO2**	C0513686
	Blood Glucose										**Patient Health Record vital: Glucose by Glucometer**	C3869205
	Patient Health Record vital: BMI	BMI	(Calculated) BMI	BMI	BMI	BMI Status	BMI		BMI	BMI	**BMI**	C0578022
		Head Circumferen ce		Head Circumference		Head Circumferen ce	Head Circumference		Head Circ		**Head Circumference**	C0262499
		Waist Circumferen ce		Waist Size	Waist Circum				Waist		**Waist Circumference**	C0455829
	Test order	Past Test Order		Lab Order Status		Orders	Lab Order Fulfillments				**Lab Order**	C4302923
	Implantation process										**Implantation procedure**	C0021107
	Goals										**Goals**	C0557971
		Surgeries						Surgeries			**Surgeries**	C0543467
		Dental treatment									**Dental procedure**	C0011331
					Posture						**Posture**	C1262869
		Diagnostic Imaging			Pacs orders			Imaging		Imaging	**Imaging**	C0011923
				Pathology Order	Pathology Orders						**Pathology order**	C4302922
				Radiology Order	Radiology Orders						**Radiology Order**	C4302924
				Radiology Result	Radiology				Radiology	Radiology	**Radiology**	C1290916
					Disposition						**Disposition**	C0743223
					followup						**Follow-up**	C0589120
						sensitive level					**sensitive level**	C1455667
						Supplement				Supplements	**Supplement**	C0242295
					Urine Sugar						**Urine Sugar**	C1456823
							Drug Intolerance				**Drug Intolerance**	C0277585
								Pediatrics History			**Pediatrics History**	C0587599
								Pediatrics Growth Charts			**Pediatrics Growth Charts**	C2718056
								Recreational Drugs			**Recreational Drugs**	C1318616
								Medical Specialities			**Medical Specialities**	C0037778
								Pages of Life: Genetics			**Genetics**	C3887703
							Patient overview: Risk factors				**Risk factors**	C0035648
	Advance Directive: Assessment								Advance Directive		**Advance Directive**	C0587820
	Medication: Directions for use or SIG CODE	SIG code	SIG code				SIG code			SIG	**Medication: Directions for use or SIG CODE**	C3476380