Suitability of LOINC Document Ontology as a reference terminology for clinical document types: A case report of a research-oriented EHR

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Abstract

A detailed electronic record of delivered clinical care is important for providing clinical decision support and for conducting research using existing clinical data. Knowing the type of document filed within an EHR (e.g., bronchoscopy report), helps to derive important procedural or phenotypic information that may not be obtainable from other sources. A comprehensive document ontology can also greatly facilitate review of clinical documents integrated from multiple sources within a health information exchange (HIE) platform.

The Clinical LOINC (Logical Observation Identifiers Names and Codes) terminology includes a Document Ontology (DO) that is intended to provide a standardized set of document types. We analyzed the frequency of clinical document types from the National Institute of Health's (NIH) Clinical Center as mapped to LOINC DO. Our work complements prior work with results from a research-oriented healthcare institution, and has implications for LOINC developers as well as EHR system administrators.

Methods

We used clinical documents data from the NIH Biomedical Translational Research Information System (BTRIS), which contains documents from several systems. Using the RELMA mapping tool, two experts mapped the most frequent document types to LOINC DO (v2.36, containing 661 document types). A consensus process was used to resolve any mapping differences and produce a single mapping for each document type.

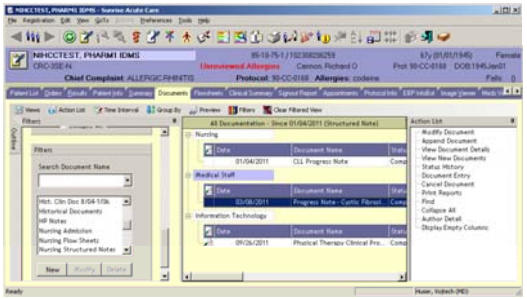

Figure 2: View hierarchy and ability to filter by Document Type Class within NIH EHR System (Sunrise Clinical Manager

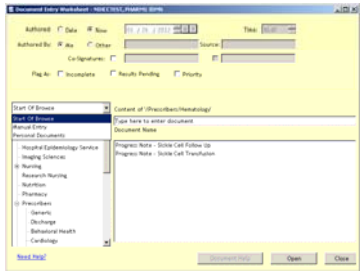

Figure 3: Choosing Document Type when authoring a new document whithin NIH EHR system. Standard tree, search by name and personalized tree are possible choices to browse available document types. On the right, document types within Prescriber/Hematology category are shown.

Code	Document Type Name	Absolute Usage	Proportion	Cumulative	LOINC code	Mapped LOINC Document Type Name
C114148	Vital Sign Observations Document	841,450	14%	14%	8716-3	Vital signs
C114079	Pain Management	402,569	7%	21%	34858-1	Pain management Evaluation and management note
C114054	Intake and Output Flowsheet Document	347,018	6%	27%	61148-3	Intake and output
C114110	Respiratory Observations	334,799	6%	32%	34838-3	Respiratory therapy Evaluation and management note
C114089	Physical Safety Observations Document	316,739	5%	38%	55750-4	Patient safety report Event Document
C114029	Elimination Observations Document	269,604	5%	42%		
C114064	Mobility Observations Document	263,824	4%	47%		
C114123	Skin and Hygiene Observation Document	248,976	4%	51%		
C114107	Psychosocial Observations Document	247,275	4%	55%		
C114127	Sleep Observations Document	205,902	3%	59%	28633-6	Polysomnography (sleep) study
C114022	Circulation Observations Document	200,138	3%	62%		
C114043	Food & Fluid Needs Observations Document	189,000	3%	65%	34801-1	Nutrition+Dietetics Evaluation and management note
C3153343	VAD Observation Flowsheet	182,391	3%	68%		
C114065	Neuro Vital Sign Observations Document	179,225	3%	71%		
C114067	Neurological Assessment Document	166,604	3%	74%	34797-1	Neurology Consult note
C114005	Admission Assessment	157,250	3%	77%	51849-8	Admission history and physical note
C141336	Pain Assessment/Reassessment Document	156,455	3%	79%	54558-2	Pain assessment interview
C114138	VAD Observations Document	135,714	2%	82%		

Figure 1: Mapping of most frequent document types ordered by usage in descending order. The first two columns display the NIH Research Entity Dictionary (RED) term. Absolute usage shows the number of documents of a given document type stored in data repository. The proportion column shows percentage from all available documents and the cumulative columns shows cumulative proportion which includes all documents types above a given document types. The last two column are conesus mappings to LOINC DO. Mapping terms are empty for terms where not mapping was found within LOINC.

Preliminary Results

The current BTRIS repository has a total of 174 different document types, with 18 document types accounting for 80% of all documents and 67 document types accounting for 99% of all documents. The two mappers agreed eight times that there is no corresponding term within LOINC DO and agreed on the mapped term in 6 cases; they agreed on LOINC mapping for the four remaining document types after subsequent discussion. Therefore, the mappers identified a corresponding LOINC code for 56 % of NIH document types (10 out of 18 types; see Fig. 2).

Discussion and Conclusion

Our result of 56% LOINC DO coverage of documents types is comparable to findings by Chen[1]. The mapping revealed a possibility to use LOINC DO as a way of linking retired, view-only, legacy document types (e.g., legacy code C114110, respiratory observations) to the current active types at the integrated data repository (IDR) level. In order to improve DO coverage, we are in the process of submitting a request for new terms to the clinical LOINC committee as we have done in the past[2]. To expand our initial mapping and improve our analysis of LOINC DO, we have also created a draft mapping of all 174 NIH document types (single mapper only).

To fully utilize LOINC DO as a reference ontology, mapping of standardized document types would ideally occur during introduction of new document types within the EHR rather than during import to the IDR. Unfortunately, most EHR vendors do not support mapping of internal document types to a common reference terminology. Moreover, the current hierarchy within LOINC DO is undergoing revisions and it was not originally developed to support a clinician picking the most relevant document type to view or author within an EHR system (see Fig. 2 and 3). Our future work includes creating a subset of commonly used document types from LOINC DO which would be similar to the "best of" Lab LOINC subset to facilitate adoption of LOINC DO and mapping efforts at other institutions. We also want to explore the use and possible roles for LOINC parts concepts within LOINC DO.