

Information Models Properties in Learning Health Systems: A Literature Review

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Abstract. Learning Health Systems (LHS) are challenged by fragmented health data. In Valkyrie, information models (IM) are explored as translators for the underlying, fragmented data structures and can potentially extend to support a future LHS. In this paper, a literature review was performed to search for property requirements for semantic interoperable IMs in the context of an LHS. The literature was examined and property requirements elicited in the context of an LHS.

Keywords. information model, learning health system, electronic health record

1. Introduction

Problems with data quality and interoperability in Electronic Health Record (EHR) systems hinder healthcare improvements through learning health systems (LHS).

In Valkyrie [1], information models (IM) act as translators between disparate EHRs for interoperability improvements, and can potentially support a future LHS. In this paper, a review of requirements for IM in the context of an LHS was performed.

2. Methods

Medline (through PubMed), Scopus, Web of Science, and IEEE Explore were searched in title and abstract. The Scopus search string was: (TITLE-ABS-KEY (semantic* AND "learning health*") AND PUBYEAR>2007) AND (LIMIT-TO (LANGUAGE, "English")). Search strings in the other databases were in accordance. Additional searches were conducted in ACM Digital Library and Google Scholar. The screening of papers' title and abstract were screened with the inclusion criteria: frameworks, guidelines, principles and requirements for data, information and knowledge models. Duplicates were found and removed by sorting on title. Selected papers were read thoroughly and publications with no relevance to the topic were excluded. Property requirements were elicited from the resulting eleven papers.

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3. Results

Screening identified 78 publications; 35 duplicates were identified and removed, and 36 publications were excluded. Three publications were included from ACM Digital Library and one from Google Scholar. Table 1 shows the properties required of IMs to support data and knowledge models in the context of an LHS.

Table 1. Property requirements for data, information and knowledge models in LHS

Property requirements for data, information and knowledge models in LHS
Data Accessibility, Timeliness, Authorization, Credibility, Definition, Metadata, Accuracy, Consistency, Integrity, Completeness, Auditability, Fitness, Readability, Structure [2]. Findable, Interoperable, Accessible, Completeness, Reusable common data elements (CDE), Metadata, Integrity, Traceability [3]
Information Software/data model agnostic, Reuse [4]. Provenance, Trust, Reproducibility, Requirements stemming from the context of the LHS: System transparency, Auditability of recommendations, Understandability of data, Validation readiness, Traceability of evidence, Responsibility, Privacy and security, Usability and scalability [5]. Reusability to other domains, Linked data, Flexible, Adaptable (single point of change), Scalable, Maintainable, Sustainable [6]. Provenance, Flexibility, Extensibility, Modularity, Terminology mapping, Consistency [7]. Definition, Metadata, Reuse, Vocabulary mapping [8]. Human readability, Backward compatibility, Vocabulary mapping, Scalability, Extensibility, Sustainability [9]. Provenance, Metadata. Confidentiality, Extensible, Common vocabulary, Reuse [10].
Knowledge Need for metadata to make Computable biomedical knowledge artifacts (CBK) FAIR+T: Findable: Type, Domain, Identification, Purpose Accessible: Location Interoperable: Authorization and rights management, Technical, Integrity, CBK-relations Reusable: Preservation Trustable: Evidence from use, Evidential basis, Provenance [11]. FAIR, Local adjustments, preferences and monitoring, Explanation, Debiasing, Account for generalizability and semantic uncertainty, Elasticity, Extensibility [12].

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