SEMANTIC INTEROPERABILITY AND CLINICAL TERMINOLOGY STANDARDS IN ELECTRONIC HEALTH RECORDS

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ABSTRACT

This study aimed to investigate how clinical standards and terminologies, such as *Systematized Nomenclature of Medicine Clinical Terms (SNOMED-CT)*, *Logical Observation Identifiers, Names, and Codes (LOINC)*, *International Classification of Diseases and Related Health Problems (ICD)*, *International Classification of Primary Care – second edition (ICPC-2)*, *Digital Imaging and Communications in Medicine (DICOM)*, and the *Management System of the Procedures, Medications, and Orthoses, Prostheses, and Special Materials Table of the Unified Health System (SIGTAP)*, contribute to semantic interoperability in Electronic Health Records (EHR) in Brazil and what is the impact of these contributions on the integration and continuity of care in the Unified Health System (SUS). The research was conducted through a bibliographic search, reviewing scientific literature and regulatory documents on clinical terminologies and interoperability standards. The analysis focused on the practical application of each standard and terminology, evaluating their effectiveness in promoting interoperability and improving data quality in EHRs. It was identified that clinical standards and terminologies, such as SNOMED-CT and LOINC, significantly improve semantic interoperability, facilitating the exchange and understanding of data between systems. ICD-10 and ICD-11 help standardize disease coding, while ICPC-2 and DICOM contribute to the classification and communication of clinical data. SIGTAP demonstrates effectiveness in managing SUS procedures. The importance of adopting and integrating clinical terminologies and standards to enhance interoperability in EHRs is highlighted. Overcoming the associated challenges is crucial to improving the continuity and quality of care in SUS.

Keywords: Semantic Interoperability; Clinical Terminologies; Electronic Health Records (EHR).

INTRODUCTION

Clinical terminologies play a fundamental role in health by ensuring the accuracy, consistency, and interoperability of Electronic Health Records (EHR). These standardized terminologies allow different health systems to share and understand data uniformly, ensuring that patient information is interpreted correctly at all levels of care. Electronic Health Records (EHR) are formed by a patient's health information from various health institutions. Repositories integrated by computers capable of storing and transmitting information securely and accessible to authorized users based on a regularly established information model have as their main objective comprehensive, effective, and secure support throughout the patient's life[1]. Some conditions are necessary for health decision-making to be based on reliable data

resulting from EHRs. Interoperability is a prominent condition because it is the ability of information systems to work together, interacting with each other, regardless of organizational boundaries, focusing on the same objective.

METHODOLOGY

The research was conducted through a bibliographic search, reviewing scientific literature and regulatory documents on clinical terminologies and interoperability standards. The analysis focused on the practical application of each standard and terminology, evaluating their effectiveness in promoting interoperability and improving data quality in EHRs.

RESULTS

Interoperability is organized into three dimensions that communicate and complement each other: organizational interoperability, semantic interoperability, and technical interoperability. Semantic interoperability, of greater relevance to this work, is defined as the ability of two or more heterogeneous and distributed systems to work together, sharing information between them with a common understanding of its meaning [...] it ensures that the exchanged data have their effective meaning correctly interpreted within the context of a given transaction or information search, within the culture, conventions, and terminologies adopted by each sector or organization and, thus, shared by the involved parties[1].

Therefore, semantic interoperability is the ability of shared data to be understood with well-defined concepts. In this context, clinical terminologies are used in clinical practice to assist health professionals with the enhancement and accessibility of integrated information about medical history, diseases, treatments, laboratory results, and other facts of patients' lives; as well as to assign semantic value to the data that are defined/recorded.

However, terminologies are structured vocabularies that define complex concepts for diseases, surgeries, treatments, medications, exams, professions, locations, physiological structures, and among numerous other health concepts. They serve as the basis for electronic health records and benefit users by improving the quality of care and, secondarily, with better cost-effectiveness; they allow access and retrieval of user data based on the meaning of clinical information; they monitor the health conditions of the population and any responses to changes in clinical practices

more broadly; they allow precise and targeted access to relevant information, reducing errors and duplication of costs with exams and treatments, among other benefits[1].

Regarding information standards for coding and/or establishing the interoperability of health systems, Ordinance No. 2,073 of August 31, 2011 "Regulates the use of interoperability and health information standards for health information systems within the Unified Health System, at the Municipal, District, State, and Federal levels, and for private systems and the supplementary health sector." In addition to the standards defined in the Ordinance, other standards or clinical terminologies are widely used, for example: *International Classification for Nursing Practice (ICNP)*; *Nursing Diagnosis Association (NANDA)*; *Health Sciences Descriptors (DeCS)*. The following table highlights and defines some of these terminologies:

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Quadro. Padrões ou Terminologias clínicas amplamente utilizadas.

SNOMED-CT	É a mais completa e precisa terminologia de saúde pois contempla uma coleção de códigos e termos para quase todos os conceitos da saúde, foi criada de forma colaborativa por vários especialistas em saúde e apoia na tomada de decisões e análises. Contribui para a precisão dos dados e para a interoperabilidade semântica entre sistemas de informação em saúde, possibilitando a conexão de registros eletrônicos de saúde a sistemas de apoio a decisões e sistemas de monitoramento epidemiológico[2].
LOINC	É um padrão específico para codificação de exames laboratoriais e outras observações clínicas que objetiva facilitar a troca de resultados para a assistência clínica, pesquisa e gerenciamento de desfechos. Foi criado como padrão para identificação de exames, facilitando a troca de exames por meio de um documento clínico[3].
CID10	Classificação Internacional de Doenças e Problemas Relacionados à Saúde: publicada pela Organização Mundial de Saúde (OMS) e tem como objetivo a padronização da codificação de doenças e de outros problemas relacionados à saúde fornecendo códigos para classificação de doenças e de vários sinais e sintomas, anormalidades, queixas, causas externas para ferimentos e doenças e até circunstâncias sociais. “A cada estado de saúde é atribuída uma categoria única à qual corresponde um código CID 10”[4].
CID11	Classificação Internacional de Doenças e Problemas Relacionados à Saúde: atualizada pela Organização Mundial da Saúde, a principal função do CID11 é monitorar a
	incidência e prevalência com mais de 55 mil códigos de doenças, através de uma padronização universal das doenças, problemas de saúde pública, sinais e sintomas, queixas, causas externas para ferimentos e circunstâncias sociais, apresentando um panorama amplo da situação em saúde dos países e suas populações[5].
CIAP-2	É uma ferramenta recomendada para a Atenção Básica que aborda e classifica os problemas diagnosticados pelo profissional de saúde, bem como os motivos da consulta (sofrimento ou enfermidade). Também é possível classificar as respostas propostas pela equipe, podendo ser utilizada por todos os profissionais de saúde. Visa evitar intervenções inadequadas ao conhecer melhor a demanda do paciente[6].
DICOM	É uma ferramenta de Comunicação de Imagens Digitais em Medicina que padroniza a forma de comunicação das imagens ou o armazenamento no formato eletrônico. Os diversos tipos de exames de imagens são armazenados em um único formato, o que garante a possibilidade de troca de informação, reconhecimento e visualização das imagens entre equipamentos distintos[7].

SIGTAP	É uma ferramenta de gerenciamento que permite acessar a tabela de procedimentos do SUS. É um ambiente virtual que permite acompanhar as alterações realizadas em cada recurso, possibilitando a auditoria do SUS, pois disponibiliza todas as informações necessárias para o faturamento do SUS[8].

Source – Prepared by the Author (2024).

It is important to highlight that Fast Healthcare Interoperability Resources (FHIR) is not a clinical terminology; it is a standard used to exchange information between different health establishments; however, this standard offers the structure for semantic resources known as CodeSystem and ValueSet. It is used as a starting point for the development of a platform that can establish an interoperable clinical decision support system. It provides a simplified data model used to exchange information in broad medical conformations. Thus, FHIR offers a mechanism for managing the codes and encodings required for each health information system[9].

Aiming to achieve the creation and implementation of the "Single Health Record," through the exchange of information between the various levels of care, the Ministry of Health through the *Rede Nacional de Dados em Saúde (RNDS - National Health Data Network)*[10] defines some of these codes, in order to allow the continuity of care in both the public and private sectors, favoring the connection of actors throughout the country.

CONCLUSION

The analysis of clinical standards and terminologies demonstrated that the use of tools such as SNOMED-CT, LOINC, ICD-10, ICD-11, ICPC-2, and DICOM is crucial for semantic interoperability in Electronic Health Records (EHR) in Brazil, promoting the integration and quality of health data. These standards facilitate communication between systems and improve the continuity of care, essential for the Single Health Record in the Unified Health System (SUS). The uniform adoption of them is fundamental to improving the efficiency and quality of care, reflecting the importance of continuous efforts to enhance interoperability and public health management.

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