An Ontology-Based Database Design for Anti-Retroviral Therapy (ART) Medication Reconciliation

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Introduction

Electronic Health Records (EHR) capture a versatile set of data that can be used to support clinical care, of which medication history is a critical component[1]. To improve quality, medication reconciliation is a recommended method to correct discrepancies in medication history[2]. Although EHRs have mechanisms for Medication Reconciliation (MedRec), the quality and interoperability of these data, when used for research purposes, continue to have challenges. Therefore, there is a need to develop solutions for delivering high-quality, reliable EHR medication history data, specifically for MedRec, with streamlined solutions for secondary purposes, such as research. This project aims to design a relational, modifiable database for the Anti-Retroviral Therapy (ART) medication reconciliation process, which will support efforts to improve the accuracy and completeness of these data. The relational database will use standard ontologies such as RxNorm and Observational Medical Outcomes Partnership (OMOP) to provide solutions for improved semantic interoperability of the reconciled dataset with Health Information Systems (HIS) and research databases.

Methods

- Design-Oriented Information System (DOIS) research approach[3]
- Iterative process, involving stakeholder engagement (Fig.1), mapping processes (Fig.2), and Entity-Relationship Diagram (ERD) design (Fig.3) to connect three databases: legacy, current EHR, and future research databases.

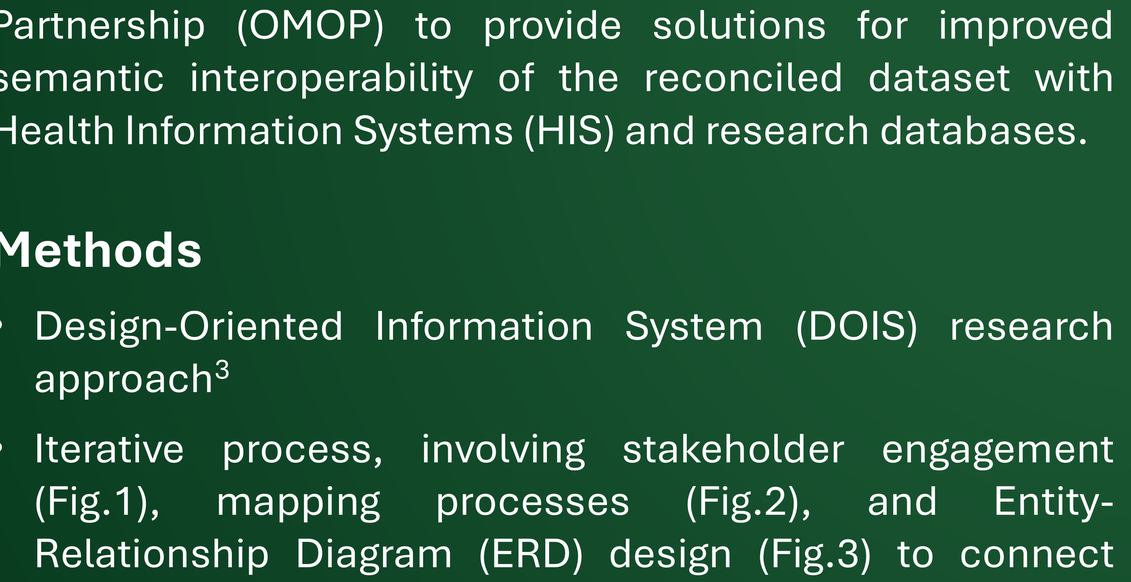

Figure 1. DOIS Approach

	Legacy Databases	Current State: Cerner	Future State: Standard Ontologies
Data Source	• MS Access • CPR database*	• Cerner data warehouse	• UMLS • Research repository at UAB • CNICS standard codes**
Unique ID	• Access code • CPR Code	• RxCUI • Multum ID	• RxCUI • OMOP Concept ID • CNICS codes
Process and Design	• Knowledge-based mapping in MS Excel	• Query-based data extraction	• Parse using Python • Query-based extraction • Knowledge-based mapping in MS Excel

Figure 2. Mapping Process

*CPR: Homegrown EHR
**CNICS: CFAR Network of Integrated Clinical Systems-HIV Cohort

Results

This database design project resulted in an ERD serving as a template for implementation and physical data modeling of the ART medication reconciliation database (Fig.3).

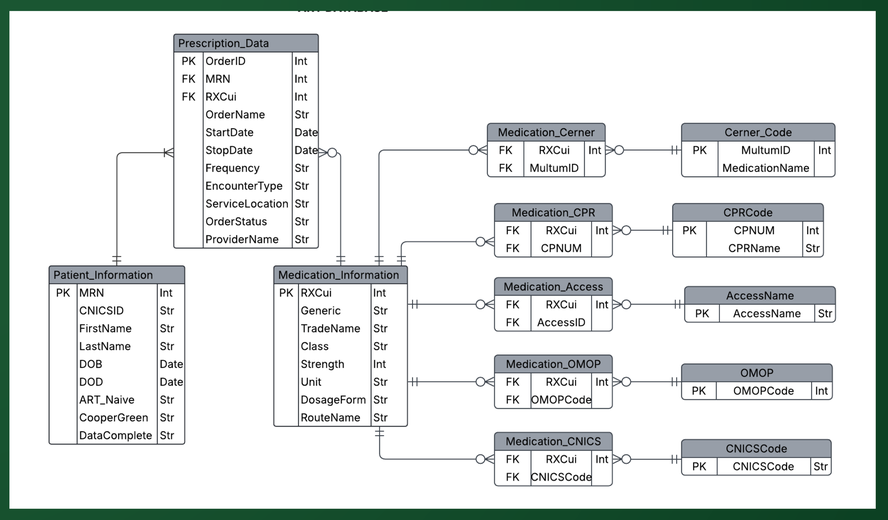

Figure 3. Entity Relationship Diagram (ERD)

Discussion and Conclusion

- EHR data are of suboptimal quality for secondary uses, such as research
- Implementing a modifiable database for medication reconciliation can improve data quality, adequacy, and accuracy
- Using standard ontologies in database design can enhance scalability and facilitate efficient data exchange between EHRs and research systems

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