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Introducing the Database Schema Handling FHIR Data in the INTERPOLAR Project

Matthias REUSCHE[a,1], Sebastian STÄUBERT[a], Alexander STRÜBING[a], Florian SCHMIDT[a], Maryam YAHIAOUI-DOKTOR[a], Marcel von BORZESTOWSKI[a], Daniel NEUMANN[a], and Markus LOEFFLER[a]
[a] *Institute for Medical Informatics, Statistics and Epidemiology (IMISE), University of Leipzig*, Germany
ORCiD ID: Matthias Reusche 0000-0002-7395-7255

Abstract. The INTERPOLAR project of the German Medical Informatics Initiative investigates medication related problems. A relational database as part of a core data set tool chain was designed to process patient data from routine care represented as FHIR resources. Having the patient data available via SQL makes it easy to perform analyses, reports and connect to existing electronic data capture systems to get feedback from clinical users, like pharmacists.

Keywords. Database Schema, Database Structure, Core Data Set, Medical Informatics, Medical Informatics Initiative, HL7 FHIR, Data Sharing, Medical Data Science

1. Introduction

As part of the Medical Informatics Initiative (MII) in Germany, Data Integration Centers (DICs) have been established to provide researchers access to this data via FHIR endpoints based on the MII core dataset (CDS) [1–2]. However, the General Data Protection Regulation typically prevents the direct sharing of patient-related data with external research projects.

The MII project INTERPOLAR aims to identify medication-related problems (MRPs) and retrospectively analyze pharmacists' decisions [3]. To achieve this, a solution was developed to import FHIR resources into SQL databases [4], making them accessible for analysis scripts and validation using data collection tools (REDCap [5]).

2. Methods

The transformed FHIR resources are stored in a PostgreSQL database, enabling the use of complex SQL queries, functions, and scheduled automations via a Cron-job plugin. An Excel-based template defines the FHIR resources to be imported and serves as the basis for generating the final SQL scripts. The software is developed using a public GitHub repository [6], which hosts SQL and R scripts as well as documentation.

[1] Corresponding Author: Matthias Reusche, IMISE, Universität Leipzig, Härtelstraße 16-18, 04107 Leipzig, Germany; E-mail: matthias.reusche@uni-leipzig.de.

3. Results

The database is structured into a core that is responsible for persistence, time-controlled functions and the audit log, and other schemas that act as interfaces. The database continuously imports transformed FHIR data via SQL, tracks changes and structures the data for further processing taking access control into account.

The following functions are currently supported: 1. importing FHIR data (CDS2DB), 2. exchanging data with external processing scripts (DataProcessor) and 3. exchanging data with a REDCap frontend (CDS2Frontend).

4. Discussion, Conclusions, and Outlook

Using a database processing FHIR resources offers advantages, e.g. high degree of flexibility in dealing with an asynchronous data flow, which provides continuously updated and supplementary data from patient care and a integrated audit trail system which ensures complete traceability with regard to exact time point of reception, processing and changes made. It also has some disadvantages and challenges, e.g. converting high structured FHIR resources into tabular form including flexible referencing between resources, which must be realized by the business logic.

The next steps are to develop user-friendly reports for researchers and to implement additional functionalities, such as automatic monitoring of database schema changes, while enhancing processing performance.

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