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Towards an OHDSI-based Data-Sharing Infrastructure in Germany

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Abstract

The German Federal Ministry of Education and Research paves the way towards a nation-wide clinical research infrastructure across university hospitals. MIRACUM is the largest of four consortia to provide tools for data integration and data sharing and evaluate them in medical use cases. The OMOP CDM and the OHDSI tools are major components of the MIRACUM data integration centers and solution architecture. As a consequence, German hospitals and research institutions will be enabled to participate in and profit from the OHDSI collaboratory.

Introduction

In November 2015, the German Federal Ministry of Education and Research has announced the Medical Informatics Initiative MI-I[1], to foster IT innovations for healthcare research and medical care. The goal is to take advantage of digitalization in medicine, to link data and generate medical knowledge, and to develop and apply innovative IT solutions for a better, data-based healthcare delivery system.

The MI-I funds four research consortia to set up data integration centers (DIC) at university hospitals and to prove their effectiveness in medical use cases. On top, a national steering committee (NSG) with currently three working groups on cross-cutting topics such as consent management, use and access policies, and interoperability are funded to harmonize developments on a national level.

MIRACUM[2] (Medical Informatics for Research and Care in University Medicine) is the largest of the four consortia funded by the MI-I. Starting today with almost 20 partners at 8 locations within 5 states of Germany, it will add more sites during the next years of the project.

Data Integration Centers

A DIC is an organizational as well as a technical infrastructure. For the organizational part, each site establishes a Use and Access Committee (UAC). A UAC evaluates the requests for data filed by researchers and decides whether access may be granted or not. If granted, the technical infrastructure of the DIC is used to fulfill the request.

The technical components of the MIRACUM data integration centers are built upon a Medical Informatics ReusAble eCO-system of open source Linkable and Interoperable software tools (MIRACOLIX)[2] which are based on own developments and best of breed open source tools. The MIRACOLIX tools will not only provide a data warehouse like architecture to export data for external use by a researcher, but also provide the computational infrastructure for performing local analysis (bring the analysis to the data)[3]. The OMOP CDM as well as the OHDSI software tools have been identified as important components in MIRACULIX.

The OMOP Pilot Study of MIRACUM

During a preceding nine-month conceptual phase, an OMOP-based pilot implementation was accomplished. All MIRACUM sites have set up an appliance provided by the authors and imported data based on a subset of the core data elements defined by the interoperability working group of the MI-I national steering committee.

A query about the kind of treatment of colorectal cancer was distributed among MIRACUM sites, performed locally on the OMOP CDM; the results were returned, integrated, and visualized using Sunburst Plots[4] (Figure 1). The details of the methods and the required terminology mappings will be published elsewhere in a paper currently under review.

Current Issues and Work

While common terminologies are essential for data sharing, major terminologies used in Germany such as ICD-10-GM (German Modification) and the OPS (surgery and procedure key) are not yet provided by Athena, so that additional mapping efforts are required and have been performed as part of the pilot study. On the other hand, OMOP relies on SNOMED, for which a national license is until now only under negotiation by the German government.
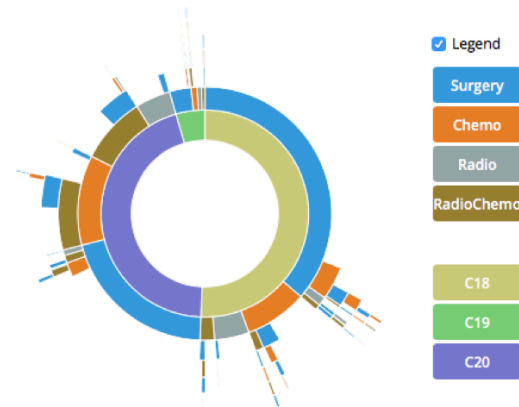

Figure 1. Combined SunBurst plot of 16,701 colorectal cancer patients from eight German university hospitals (the inner ring codes the location of the tumor, the outer segments the kind of treatment received).

MIRACUM is working on various extensions to the OHDSI tools, for example:

- Automatic data sharing: Following the li2b2 architecture (https://github.com/li2b2), a central repository hosts research queries that can be reviewed and approved or rejected by a site. If approved, the query gets automatically downloaded, performed and the results are uploaded for access by the researcher thus automating the so far manual process in the OHDSI query workflow.
- Interactive geovisualization: We configured Kibana (https://www.elastic.co/de/products/kibana) to visualize the catchment of sites depending on the diagnosis and to identify rural vs. urban differences in the treatment of stroke patients.
- App infrastructure: We currently combine our OMOP/OHDSI appliance with the OMOP on FHIR (http://omoponfhir.org) and the SMART (https://smarthealthit.org) frameworks to enable data ingestion via FHIR and to build research apps based on data in the OMOP database.

Conclusion

The MI-I in general and MIRACUM in particular will shape the clinical research infrastructures in Germany. OMOP as a CDM and OHDSI as toolset is a major element in this endeavor. Once the terminology problems are resolved, German clinical researchers can participate and profit from the OHDSI collaboratory.

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