Federated Mental Health Data Analysis Using Standard Tools in OMOP CDM-Based Ecosystems

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Background

This study investigated mental health research data analysis across institutions where privacy of data is key, regulatory restrictions, and variation in how data is structured and stored. These limitations are especially pronounced in resource-constrained settings and federated data analysis offers a promising solution. The Observational Medical Outcomes Partnership Common Data Model (OMOP CDM) served as a robust standard for harmonizing diverse mental health datasets, while DataSHIELD enables federated analytics across distributed environments. We aimed to demonstrate the use of standardized mental health tools mapped to OMOP CDM for federated analysis of mental health indicators.

Methods

Mental health datasets from distributed sources were mapped to the OMOP CDM, The study utilized standardized mental health tools such as Patient Health Questionnaire (PHQ-9), a screening tool for depression and Generalized Anxiety Disorder (GAD-7), a screening tool for anxiety. These were mapped into LOINC and SNOMED codes within the OMOP vocabulary. The harmonization process followed a typical extract, transform, and load (ETL) pipeline, with PostgreSQL serving as the database backend. Core tables mapped included person, observation, condition occurrence, and measurement standard OMOP tables. DataSHIELD was used to deploy federated analysis routines across harmonized OMOP CDM databases without sharing individual-level records

Results

Standardized tables were successfully generated across participating datasets, enabling federated queries on variables such as anxiety and depression severity, and demographic trends. DataSHIELD enabled seamless execution of statistical routines across all sites, returning only aggregate, non-disclosive outputs. This setup demonstrated that meaningful mental health analytics —such as trend comparisons and stratified summaries —can be conducted across institutions without compromising privacy. The solution adhered to FAIR principles and promoted collaborative mental health research across geographically distributed institutions.

Conclusion

The application of OMOP CDM and DataSHIELD has enabled privacy-preserving, federated analysis of mental health indicators using standardized tools. This approach demonstrates the feasibility of expanding traditionally siloed mental health data into collaborative analytic environments.

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