Implementation of an Ophthalmology Data Mart for Intravitreal Injections from the Epic Electronic Health Record System

Florian M. Heussen[1], Olena Smetiuk[2], Damian Jaggi[1], Martin S. Zinkernagel[1]

1.Department of Ophthalmology, Inselspital, Bern University Hospital, University of Bern; Department for BioMedical Research, University of Bern, Switzerland

2. Insel Data Science Center, Inselspital, University Hospital Bern, Switzerland

Objective

The primary objective of this project was to develop an ophthalmology data mart specifically focused on patients undergoing intravitreal injections using the Epic electronic health record (EHR) system (Epic Systems Corporation, Verona, Wisconsin, USA) as the data source, which was implemented at the University Hospital Bern in March 2024. This data mart aims to improve clinical outcomes and support comprehensive research.

Figure 1

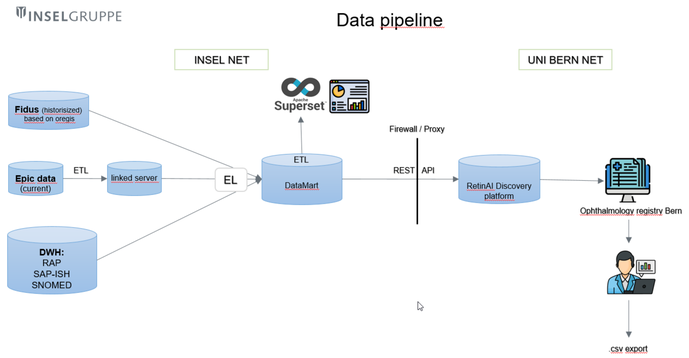


Figure 1 Architecture and data flow of the data mart and the resulting clinical registry.
The data mart consolidates information from multiple source systems. The existing data warehouse (DWH) supplies data from the core hospital information system (SAP-ISH), and patient scheduling via Polypoint RAP. Additionally, data is integrated from Fidus, a specialized electronic medical record system for ophthalmology in use until March 2024. Since its implementation at Inselspital in March 2024, Epic has become the key data source and replaced RAP and Fidus. These inputs feed into the data mart, which employs dedicated extract-transform-load (ETL) processes. Data visualization is facilitated through Apache Superset, offering interactive dashboards. The final registry is hosted on the Ikerian Discovery platform.

Methods

Based on the Swiss Ophthalmological Society National Minimum Data Set (SOG-NMD), the data mart was designed as an SQL database to contain data on patient demographics, clinical history, treatment regimens, visual acuity scores, injection details (such as frequency and type of injected agents), adverse events and follow-up visits. The data mart extracts data directly from the data warehouse (DWH) in which it resides and provides its own extract-transform-load (ETL) process to meet specific analytical purposes. Archived data from the pre-Epic era was also fed into the data mart to minimise data loss during the transition to Epic (Figure 1). Clinician feedback was provided in iterative steps to confirm accurate data handling.

Figure 2

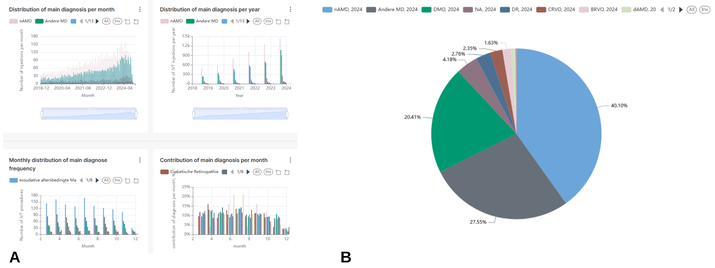


Figure 2 Temporal trends in main diagnoses among patients receiving intravitreal therapy.
(A) Monthly distribution of key indications (e.g., neovascular AMD, diabetic macular edema, retinal vein occlusion) over a five-year period, including the transition to Epic EHR in 2024.
(B) Yearly diagnosis proportions, highlighting changes in case mix and coding practices.
These interactive visualizations demonstrate the utility of the data mart in monitoring epidemiologic shifts and guiding resource allocation.

Results

The ophthalmology data mart was successfully implemented, providing a robust platform for advanced data visualisation and analysis. Data visualisation was implemented via the open source Apache Superset application (Apache Foundation, Wakefield, Massachusetts, USA) using interactive dashboards. The archived data required extensive data cleaning and standardisation, particularly in the handling of free-text diagnoses and adverse events. At the current stage of deployment, the data mart supports daily updates and queries. Initial analyses have demonstrated the utility of the data mart in supporting personalised treatment plans and providing a basis for benchmarking against the SOG-NMD.

Figure 3

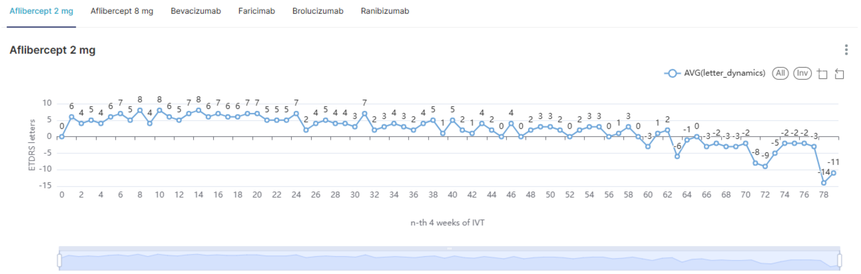


Figure 3 Interactive visual analytics of visual acuity outcomes in intravitreal therapy.
Mean change in best-corrected visual acuity (ETDRS letters) over time, stratified by anti-VEGF agent (Aflibercept 2 mg, Aflibercept 8 mg, Bevacizumab, Faricimab, Brolucizumab, and Ranibizumab). Data are aggregated in 4-week intervals post-treatment initiation. Dynamic dashboards powered by Apache Superset allow longitudinal tracking of functional outcomes for benchmarking and personalized care.

Conclusion

The data mart facilitates real-time monitoring of treatment efficacy and adverse effects, contributing significantly to improved patient care and resource allocation. In addition, its integration with hospital-wide health databases via Epic opened up new opportunities for interdisciplinary research.

Contact: florian.heussen@insel.ch

Conflicts of interest: Bayer, Roche Commercial Relationship: None