CHRONOS: Cohort exploration through individual patient profiles

Sigfried Gold, MFA, MA[1], Margaret Blacketer, MPH[1,2], Anthony Sena[1,2], Frank J. DeFalco[1,2]

[1]Observational Health Data Sciences and Informatics (OHDSI), New York, NY; [2]Janssen Research and Development, Raritan, NJ

Background

- The Chronological Health Report for the OHDSI Network of Subjects (CHRONOS) is an interactive timeline visualization and patient profile tool built into the ATLAS framework of OHDSI applications.

- ATLAS is the central OHDSI tool for cohort definition, generation, and analysis. The cohort definition process is generally iterative: researchers formulate cohort criteria, generate cohorts from OMOP data sources, and then examine the results.

- With a single-page, interactive view of a patient's entire set of records researchers can see comorbidities, concomitant medications, event sequences, and other aspects of patient records that may show how the criteria need to be refined to better address the proposed analysis.

- Integrated into ATLAS, CHRONOS speeds up the process of cohort definition refinement, enriches analytic capabilities, and eliminates the need for tedious data export and manipulation for analysis in external tools like Spotfire.
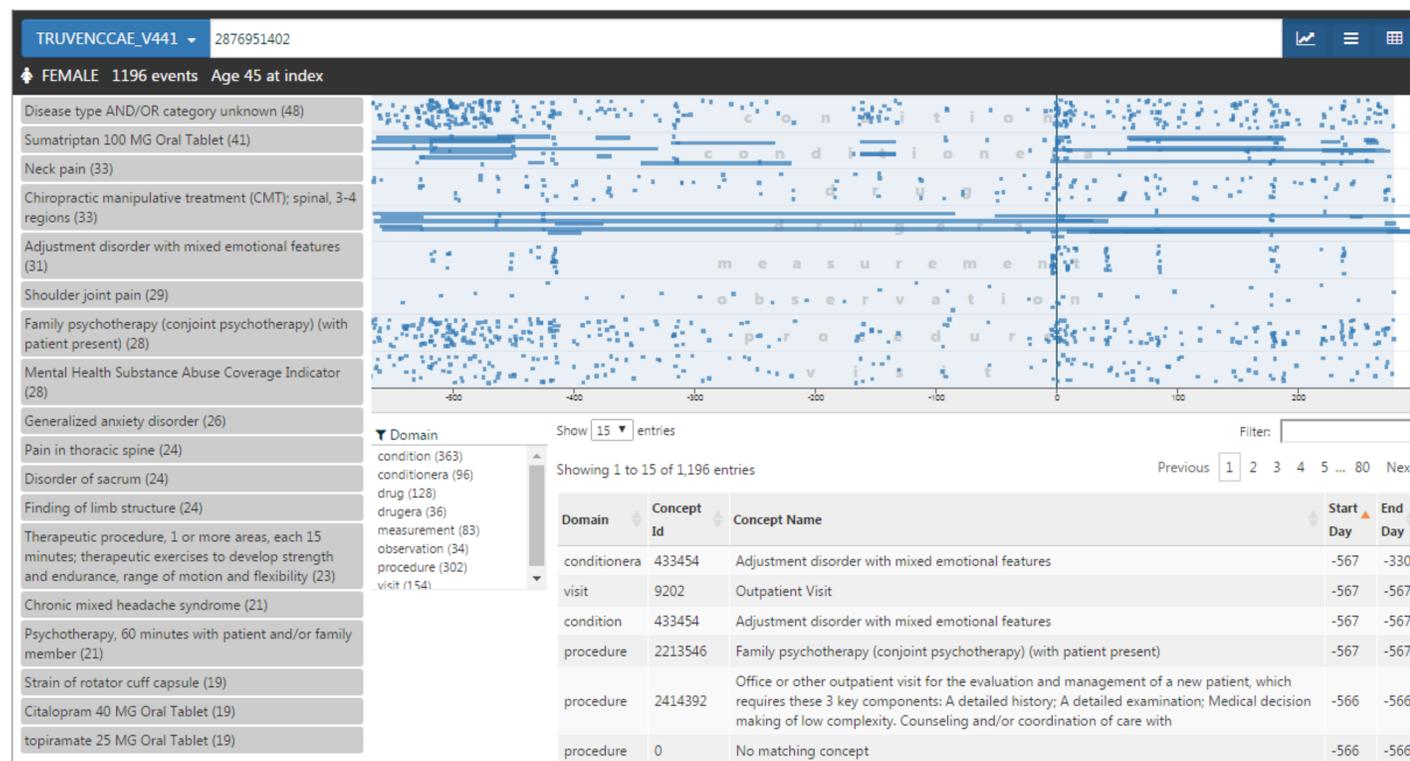

Figure 1: An example of how the CHRONOS tool displays a full patient profile

Methods

- CHRONOS fetches data from the OHDSI WebAPI, an Apache Tomcat application providing RESTful access to the OMOP Common Data Model hosted on various DBMS platforms (SQL Server, PostgreSQL, Oracle, Redshift).

- CHRONOS uses the person service in the OHDSI WebAPI to reduce patient events from multiple domains (conditions, drugs, measurements, etc.) to a common record format containing: a concept name and id, a start date, and an end date.

- On the client (browser) side, CHRONOS builds on JavaScript code already existing in ATLAS. It uses the D3.js visualization library for managing chart display and interaction.

Results

- On the visual timeline records are separated into a horizontal band for each domain and represented as squares or, in the case of events with duration of more than a day, horizontal rectangles.

- Interactive filtering and highlighting link the five central user interface elements: timeline, frequent concept list, tabular patient event listing, domain selector, and textual search box.

- As shown in **Figure 1**, the CHRONOS patient profile initially displays all events from all domains for a single patient in the timeline. Events also appear visually and textually in a searchable, sortable, filterable table.

- The most commonly occurring concepts also appear in a concept list below basic patient demographic information. By hovering over a dot in the timeline, users will see a tooltip showing a concept label for that dot.

- Hovering over an entry in the concept list will highlight all dots representing that concept in the timeline.

- Typing into the filter search box above the table will filter the table, the timeline, and the concept list to only the events representing concepts containing the typed text.

- Dragging over a portion of the timeline, will zoom to the period dragged over; the table and concept list will also be filtered to events in that period (**Figure 2a**). When zoomed into a region a small reference visualization will appear inset at the upper right of the timeline showing the entire timeline with the zoomed area highlighted. This highlighted area can then be dragged left or right to allow panning of the short period to earlier or later portions of the complete patient history (**Figure 2b**).

Figure 2a: The brushing function is used to zoom into a particular portion of a patient's record
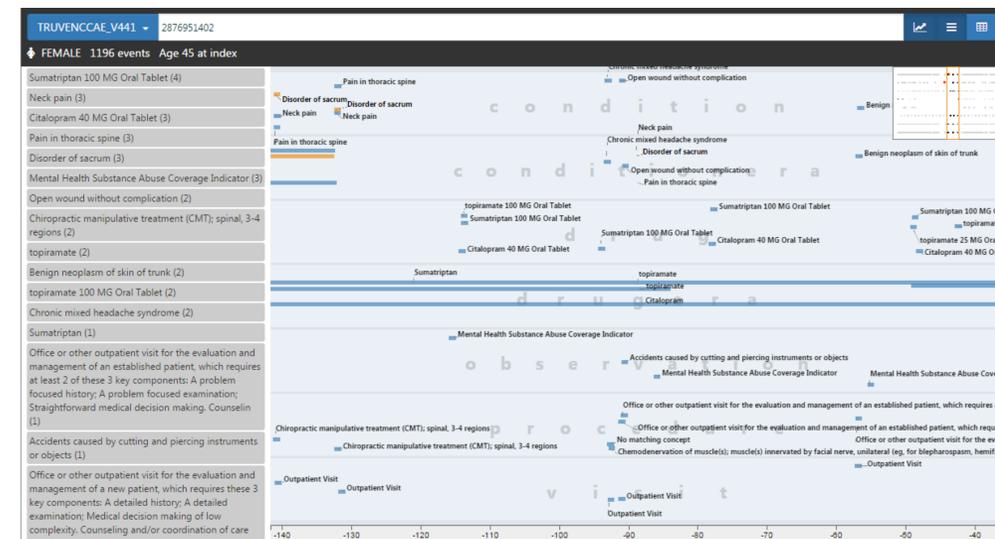

Figure 2b: After zooming the concept labels appear on the timeline and an inset window appears in the top right corner showing the current portion of the record

Conclusions

CHRONOS answers a great demand on the part of the OHDSI user community. It eliminates the need for the time-consuming, repetitive data wrangling for use of external tools. It has been enthusiastically received by early users.

CONFLICT OF INTEREST STATEMENT

Margaret Blacketer, Anthony Sena, and Frank DeFalco are full time employees of Janssen Research and Development, a unit of Johnson and Johnson. The work on this study was part of their employment. They also hold pension rights from the company and own stock and stock options.

Contact: sigfried@sigfried.org