

Sigfried Gold, MFA, MA<sup>1</sup>, Margaret Blacketer, MPH<sup>1,2</sup>, Anthony Sena<sup>1,2</sup>, Frank J. DeFalco<sup>1,2</sup> <sup>1</sup>Observational Health Data Sciences and Informatics (OHDSI), New York, NY; <sup>2</sup>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.

## Results

- duration of more than a day, horizontal rectangles.
- domain selector, and textual search box.
- appear visually and textually in a searchable, sortable, filterable table.
- 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.
- containing the typed text.
- earlier or later portions of the complete patient history (Figure 2b).

## 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.

# **CHRONOS: Cohort exploration through individual patient profiles**



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

• 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

• Interactive filtering and highlighting link the five central user interface elements: timeline, frequent concept list, tabular patient event listing,

• 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

• The most commonly occurring concepts also appear in a concept list below basic patient demographic information. By hovering over a dot in

• 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

• 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

**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.

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Outpatient Visit		-567	-567
Adjustment disorder with mixed emotional features		-567	-567
Family psychotherapy (conjoint psychotherapy) (with patient prese	nt)	-567	-567
Office or other outpatient visit for the evaluation and management requires these 3 key components: A detailed history; A detailed exa making of low complexity. Counseling and/or coordination of care	t of a new patient, which amination; Medical decision with	-566	-566
No matching concept		-566	-566



TRUVENCCAE_V441 - 2876951402	
FEMALE 1196 events Age 45 at index	
Disease type AND/OR category unknown (48)	V
Sumatriptan 100 MG Oral Tablet (41)	1
Neck pain (33)	1.7 - 2-9-9-13.
Chiropractic manipulative treatment (CMT); spinal, 3-4 regions (33)	- ha
Adjustment disorder with mixed emotional features (31)	
Shoulder joint pain (29)	1 to 1
Family psychotherapy (conjoint psychotherapy) (with patient present) (28)	·
Mental Health Substance Abuse Coverage Indicator (28)	=
Generalized anxiety disorder (26)	1.2
Pain in thoracic spine (24)	
Disorder of sacrum (24)	2
Finding of limb structure (24)	
Therapeutic procedure, 1 or more areas, each 15 minutes; therapeutic exercises to develop strength and endurance, range of motion and flexibility (23)	an Labora es
Chronic mixed headache syndrome (21)	TARAS.
Psychotherapy, 60 minutes with patient and/or family member (21)	1997 (1997) 1997 - State State State 1997 - State St
Strain of rotator cuff capsule (19)	a faith a faith an an a
Citalopram 40 MG Oral Tablet (19)	10 A 10
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TRUVENCCAE_V441 - 2876951402	
FEMALE 1196 events Age 45 at index	
Sumatriptan 100 MG Oral Tablet (4) Neck pain (3) Citalopram 40 MG Oral Tablet (3) Pain in thoracic spine (3) Disorder of sacrum (3) Mental Health Substance Abuse Coverage Indicator (3)	Pain in thoraci Disorder of sacrum Neck pain Neck pain Pain in thoracic spine
Chiropractic manipulative treatment (CMT); spinal, 3-4 regions (2) topiramate (2)	
Benign neoplasm of skin of trunk (2) topiramate 100 MG Oral Tablet (2) Chronic mixed headache syndrome (2)	
Sumatriptan (1) Office or other outpatient visit for the evaluation and management of an established patient, which requires at least 2 of these 3 key components: A problem focused history; A problem focused examination; Straightforward medical decision making. Counselin (1)	
Accidents caused by cutting and piercing instruments or objects (1) Office or other outpatient visit for the evaluation and management of a new patient, which requires these 3 key components: A detailed history; A detailed examination; Medical decision making of low	Chiropractic manipulative treatme Chiropractic m Outpatient Visit
complexity. Counseling and/or coordination of care	-140 -130

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

### **lethods**

- 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.





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