

OBSERVATIONAL MEDICAL OUTCOMES PARTNERSHIP

The Observational Medical Outcomes Partnership: Demonstration of distributed population queries

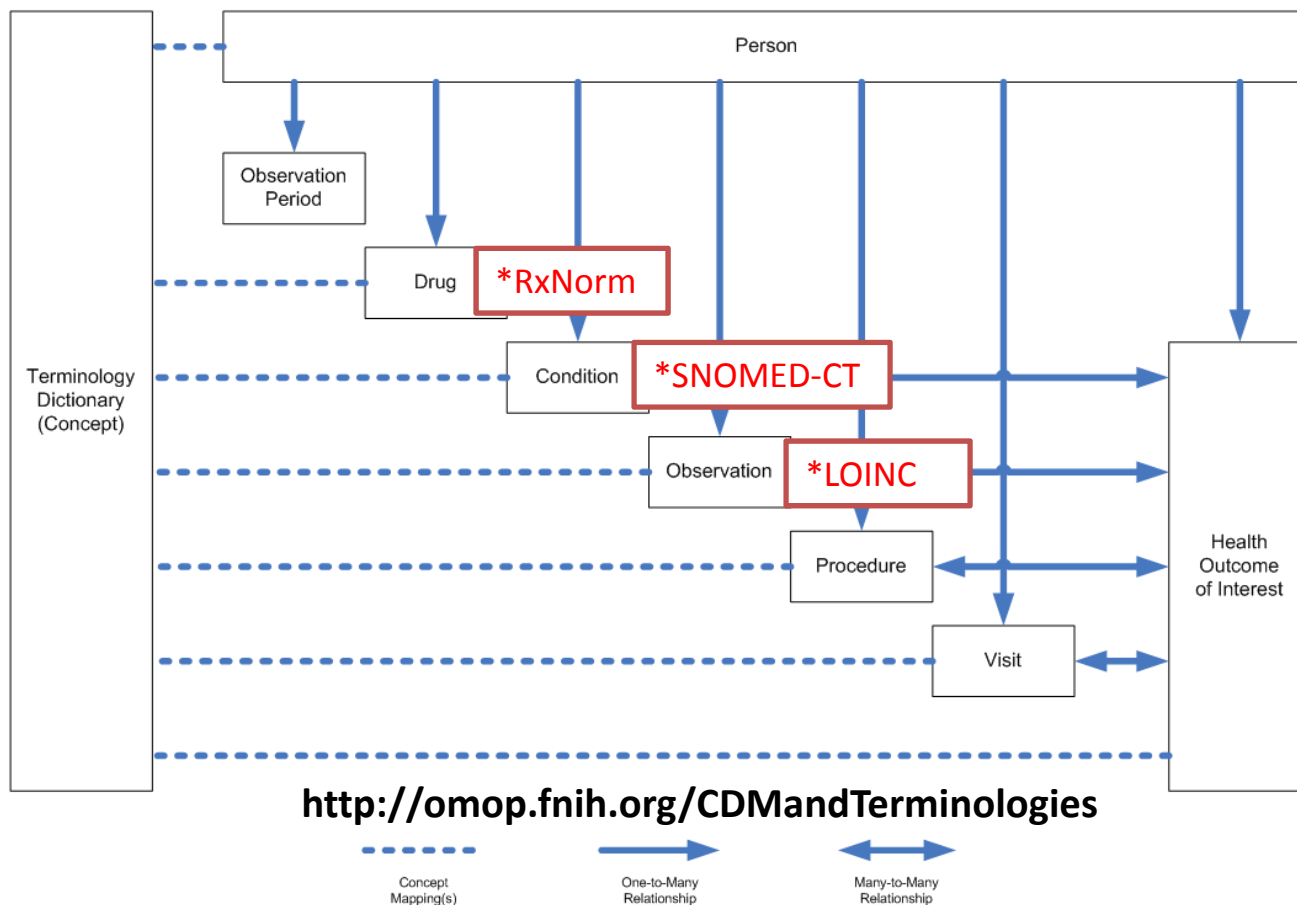
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on behalf of OMOP Research Team
August 29, 2011

Observational Medical Outcomes Partnership

Public-Private Research Partnership established to inform the appropriate use of observational healthcare databases for studying the effects of medical products:

- Conducting methodological research to empirically evaluate the performance of alternative methods on their ability to identify true associations
- Developing tools and capabilities for transforming, characterizing, and analyzing disparate data sources across the health care delivery spectrum
- Establishing a shared resource so that the broader research community can collaboratively advance the science

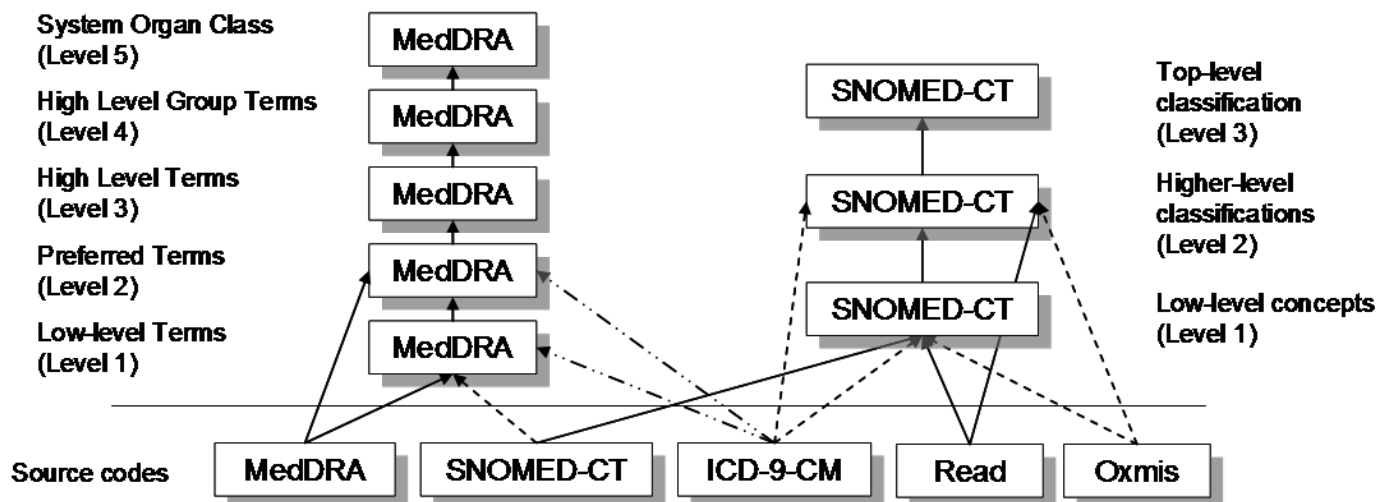
Establishing a common clinical information model



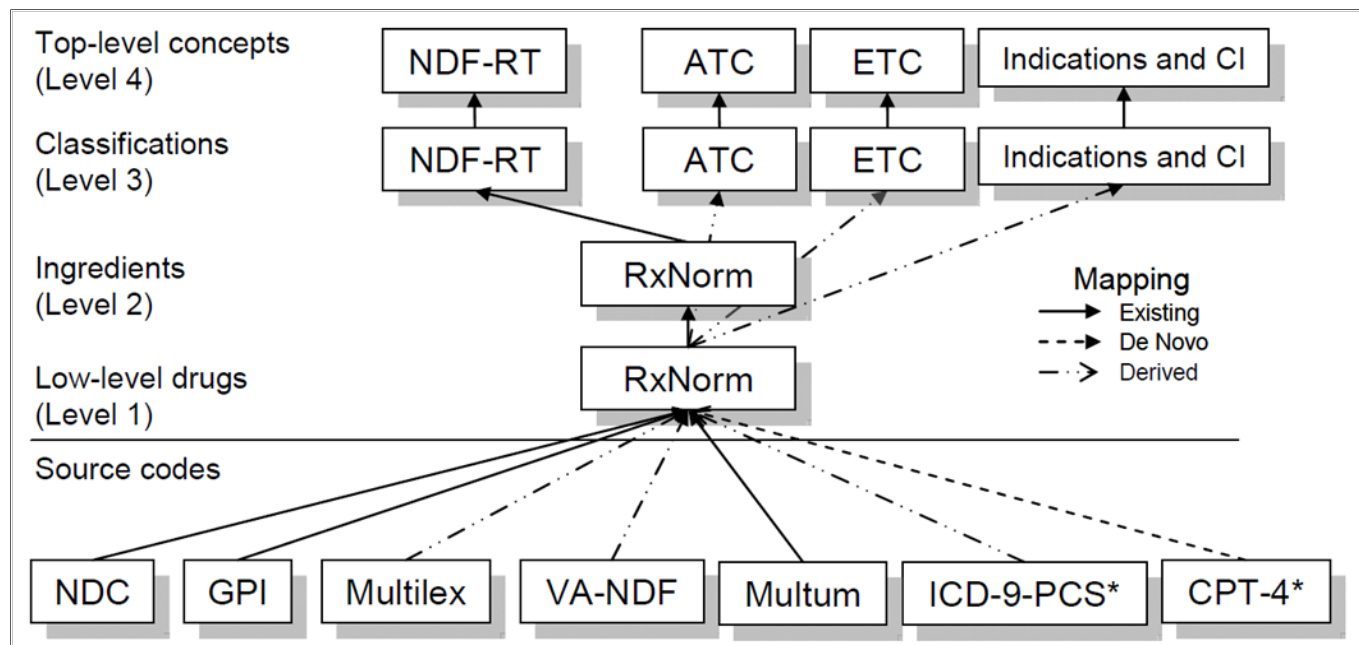
- Developed with broad stakeholder input
- Designed to accommodate disparate types of data (claims and EHRs)
- Optimized to use case of standardized large-scale analytics
- Conceived for active medical product surveillance, but extensible for other use cases
- Applied successfully across OMOP data community
- **Standards-based, conforming to ONC Meaningful Use Stage 2 recommendations**

Standardizing terminologies to accommodate disparate observational data sources

Standardizing conditions:

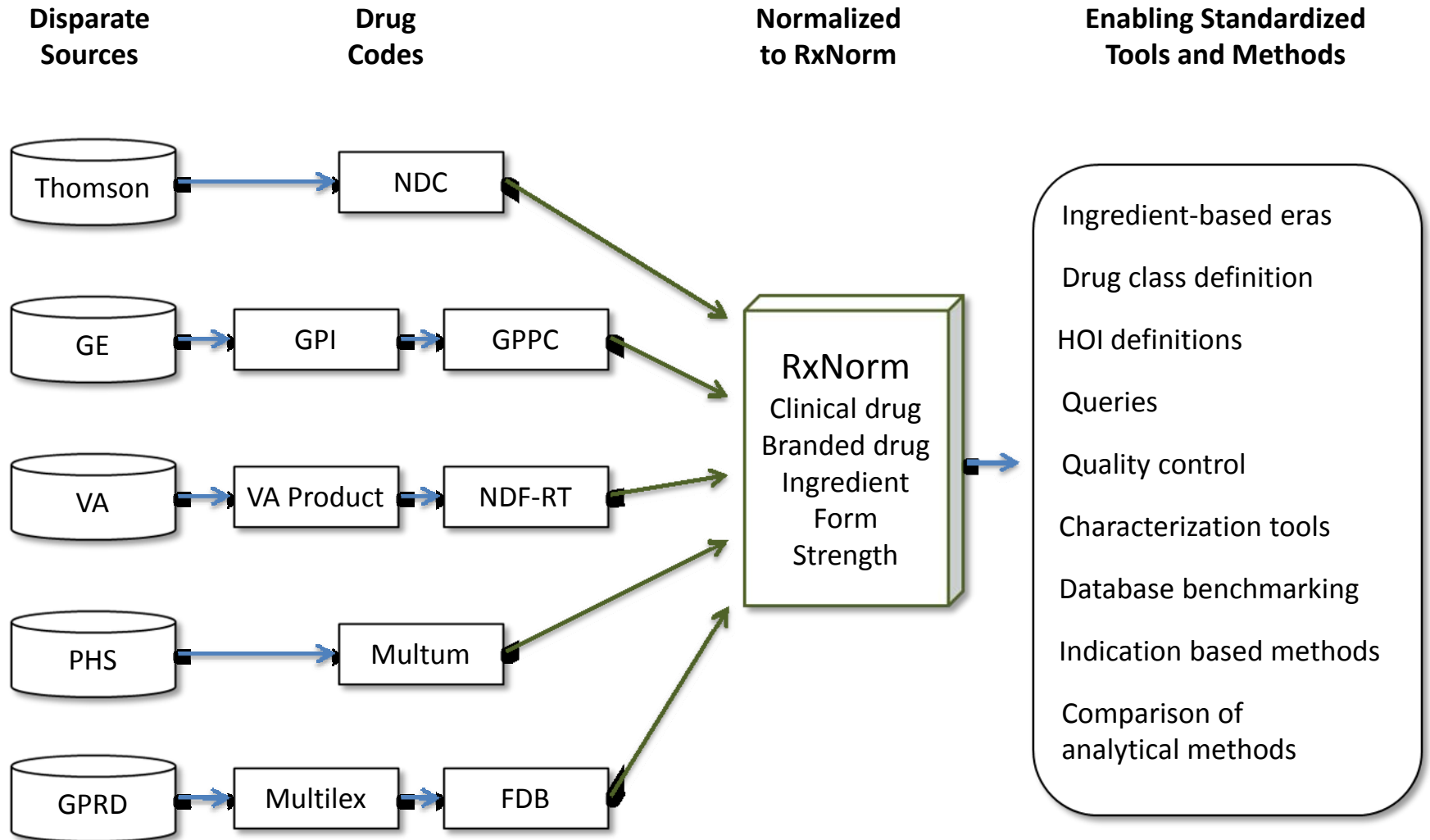


Standardizing drugs:

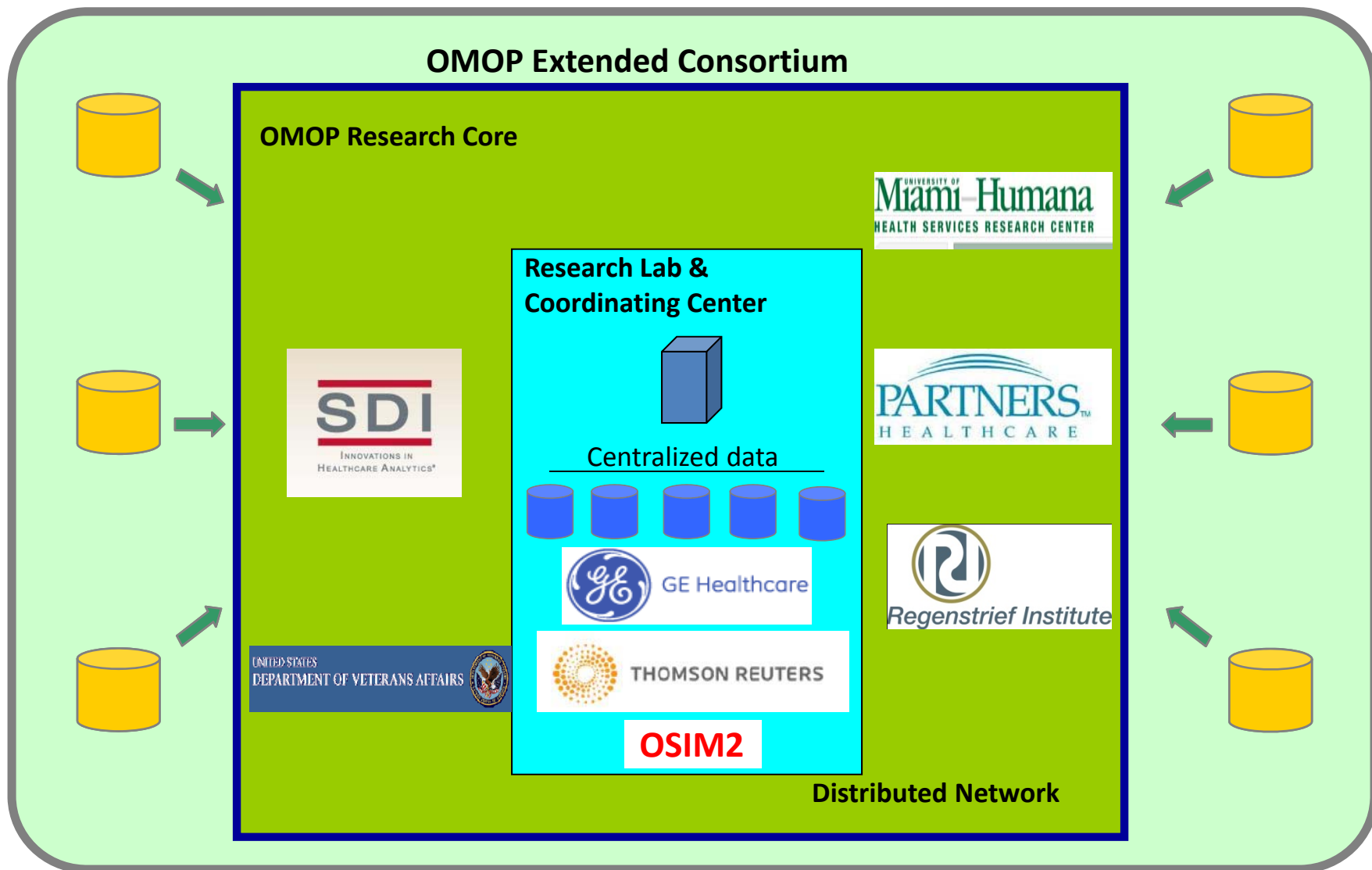


Example: RxNorm – Standardized Drug Terminology Enables OMOP Research

Beyond translation to enabling structured analytics



OMOP Data Community – First Two Years



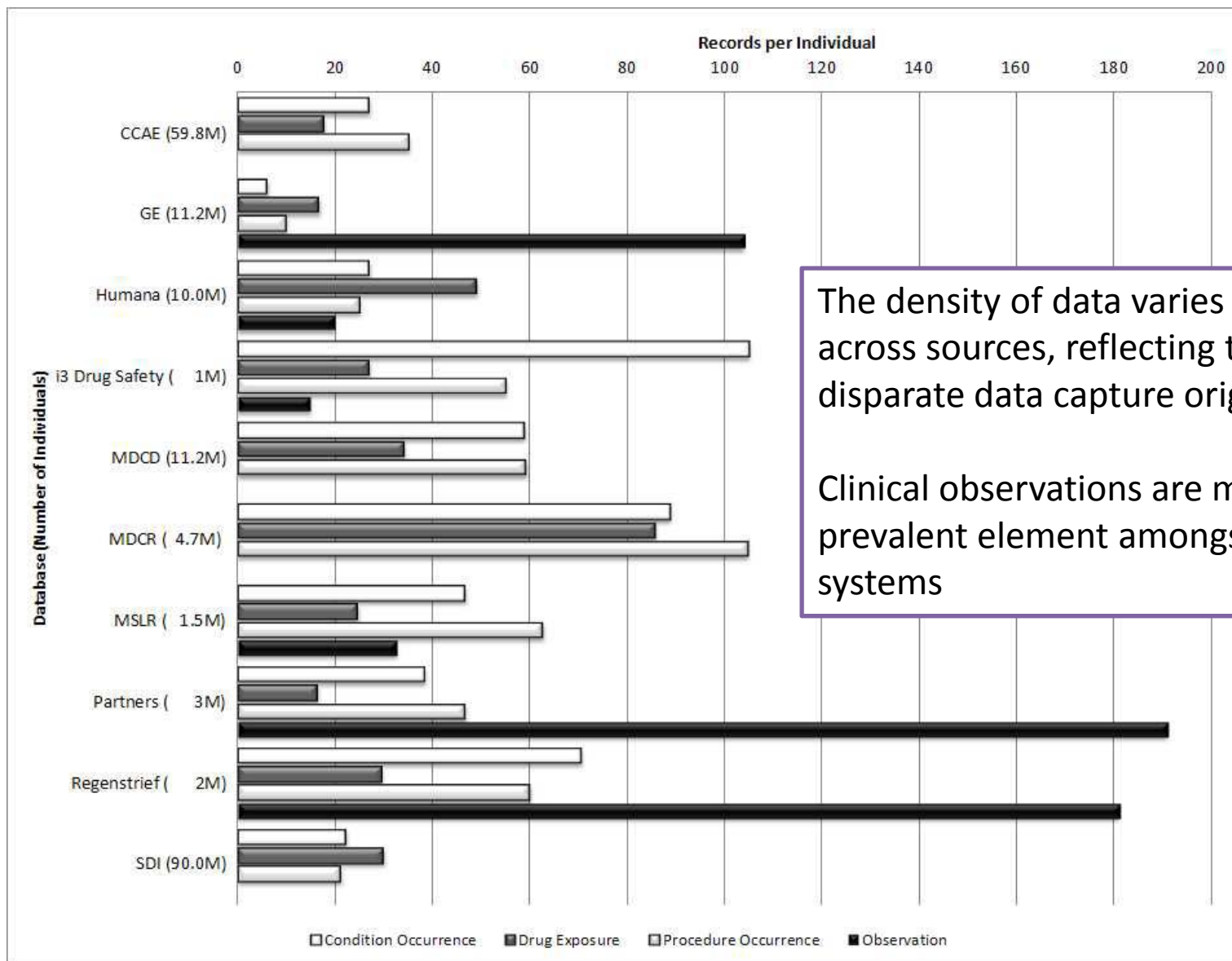
178 million persons with patient-level data

5.4 billion drug exposures, 5.8 billion procedures, 2.3 billion clinical observations

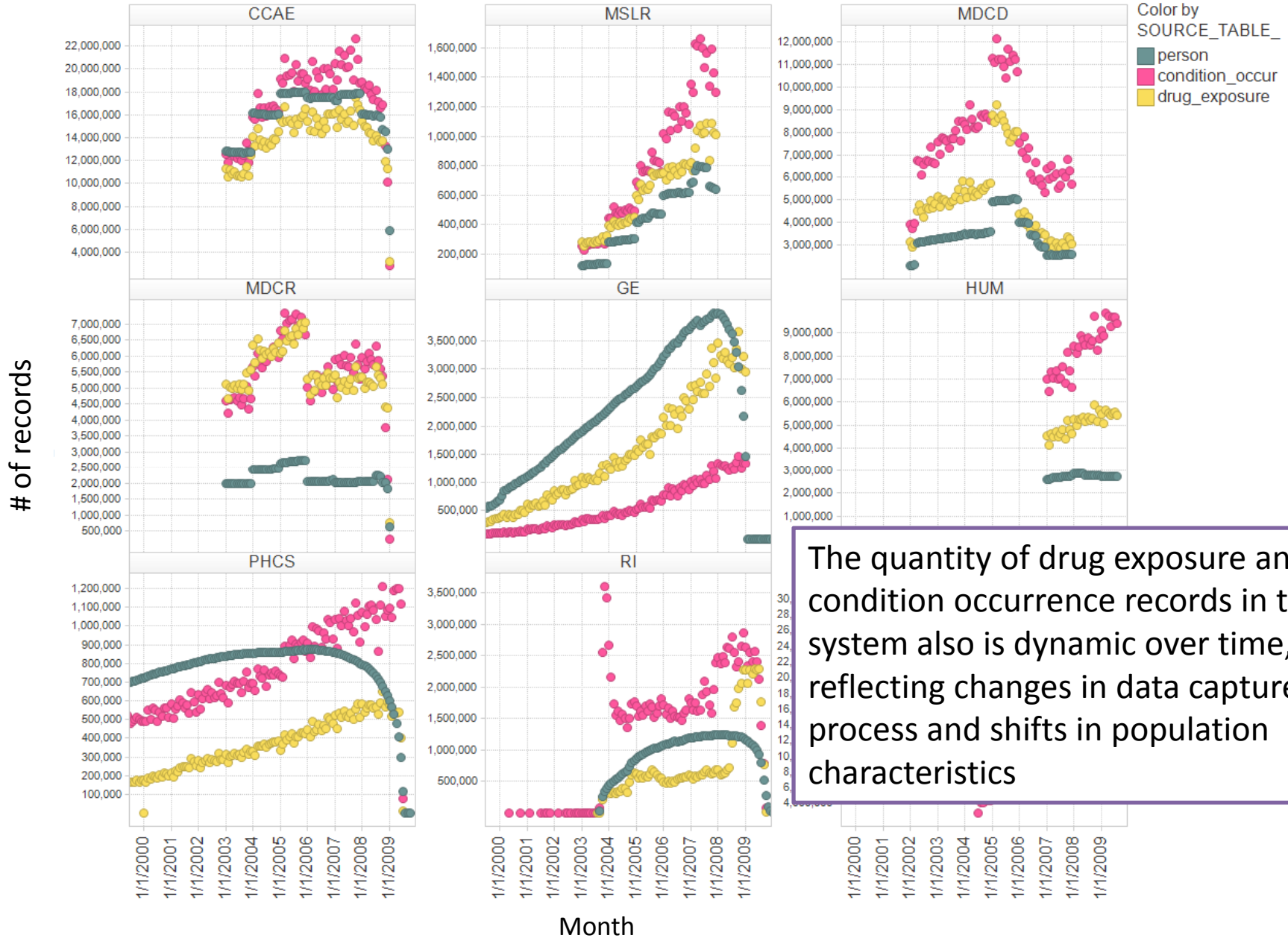
OMOP analytics development approach

- Open-source development community, all work products place in public domain on OMOP website (<http://omop.fnih.org>)
- Standard analytics are all developed against the OMOP common data model
- Programs are implemented and tested within the central research lab against multiple data sources
- Methods that pass independent feasibility testing by OMOP central team are made publicly available
- Analytics program are parameterized to allow for flexible use of other applications outside the original OMOP experiment
- Distributed data partners are encouraged to execute the programs and share summary outputs back with central coordinating center
- Analytics output is generally summary statistics in standardized format and can be customized to each site's tolerance for small cell counts
- This presentation shows example results from existing OMOP standard analytics tools that demonstrate some potential use cases

Data density across the OMOP community



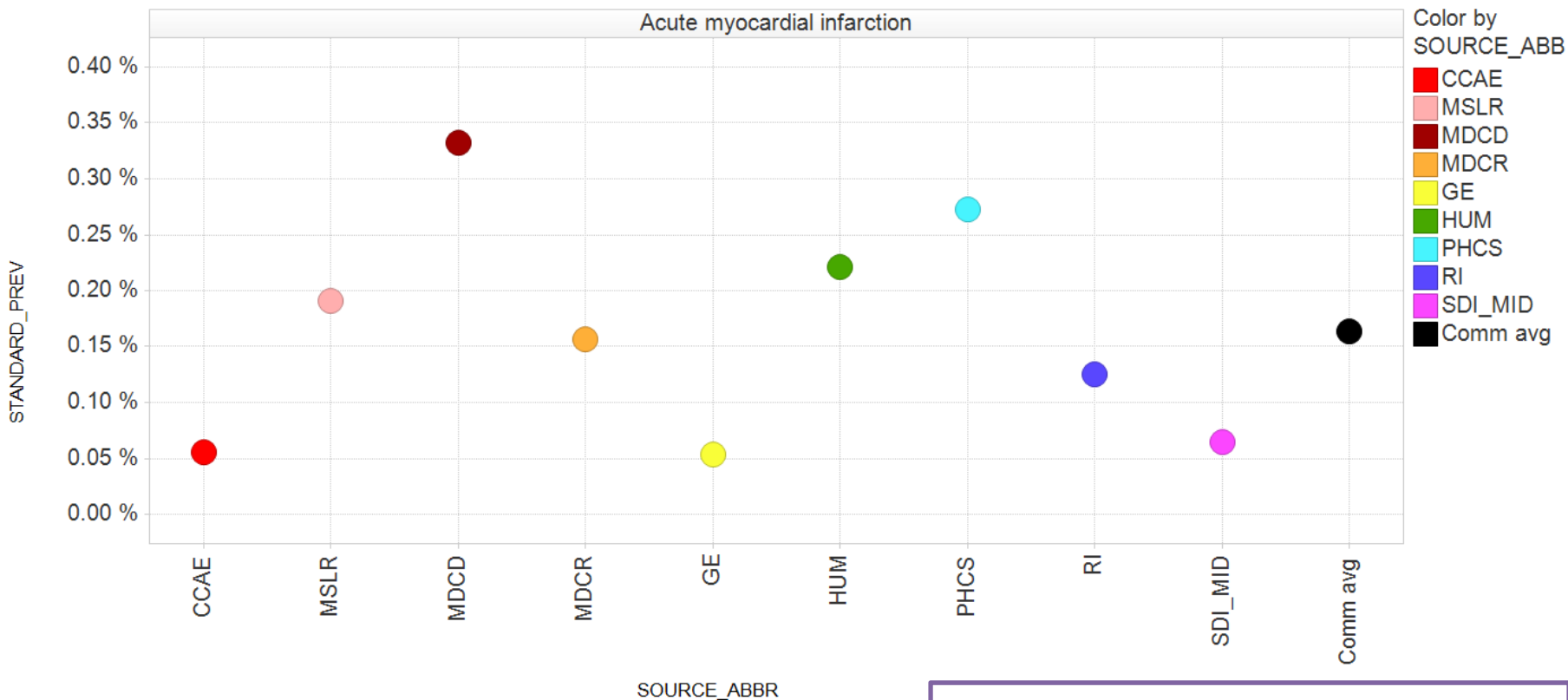
Standardized Records Over Time



Population health use case

- What is the background rate of disease?
- How does it vary across the data community?
- Is the prevalence consistent over time?
- Are there differences in patient subgroups, such as age or gender?

Exploring prevalence of disease: ex: Acute Myocardial Infarction



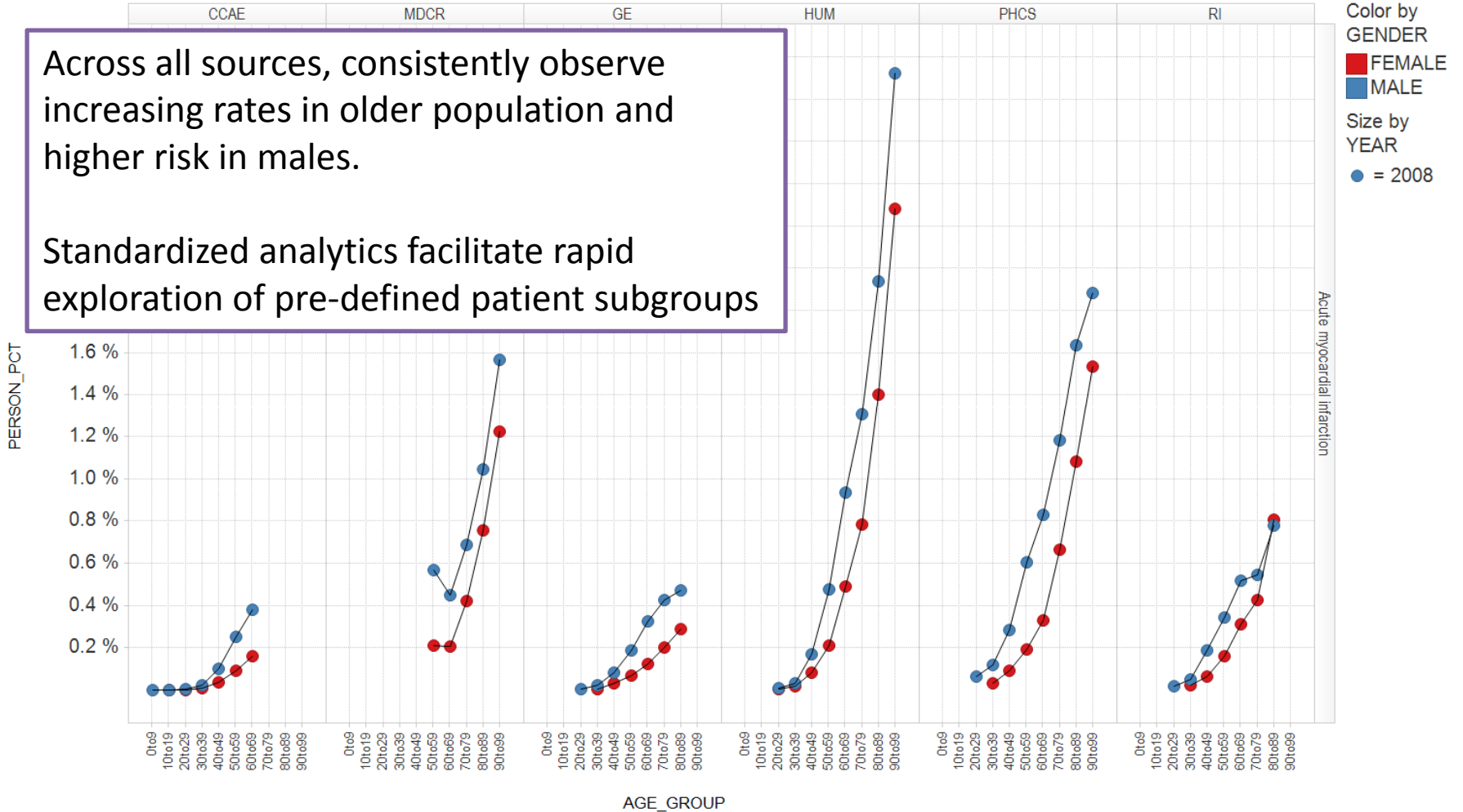
NQMC referent rates from Canada:
0.25% in 2003/4 decreased to
0.22% in 2008/9

Standardized condition prevalence = 5-yr annualized prevalence,
stratified by age and gender, standardized to US Census

Exploring prevalence of disease: ex: Acute Myocardial Infarction

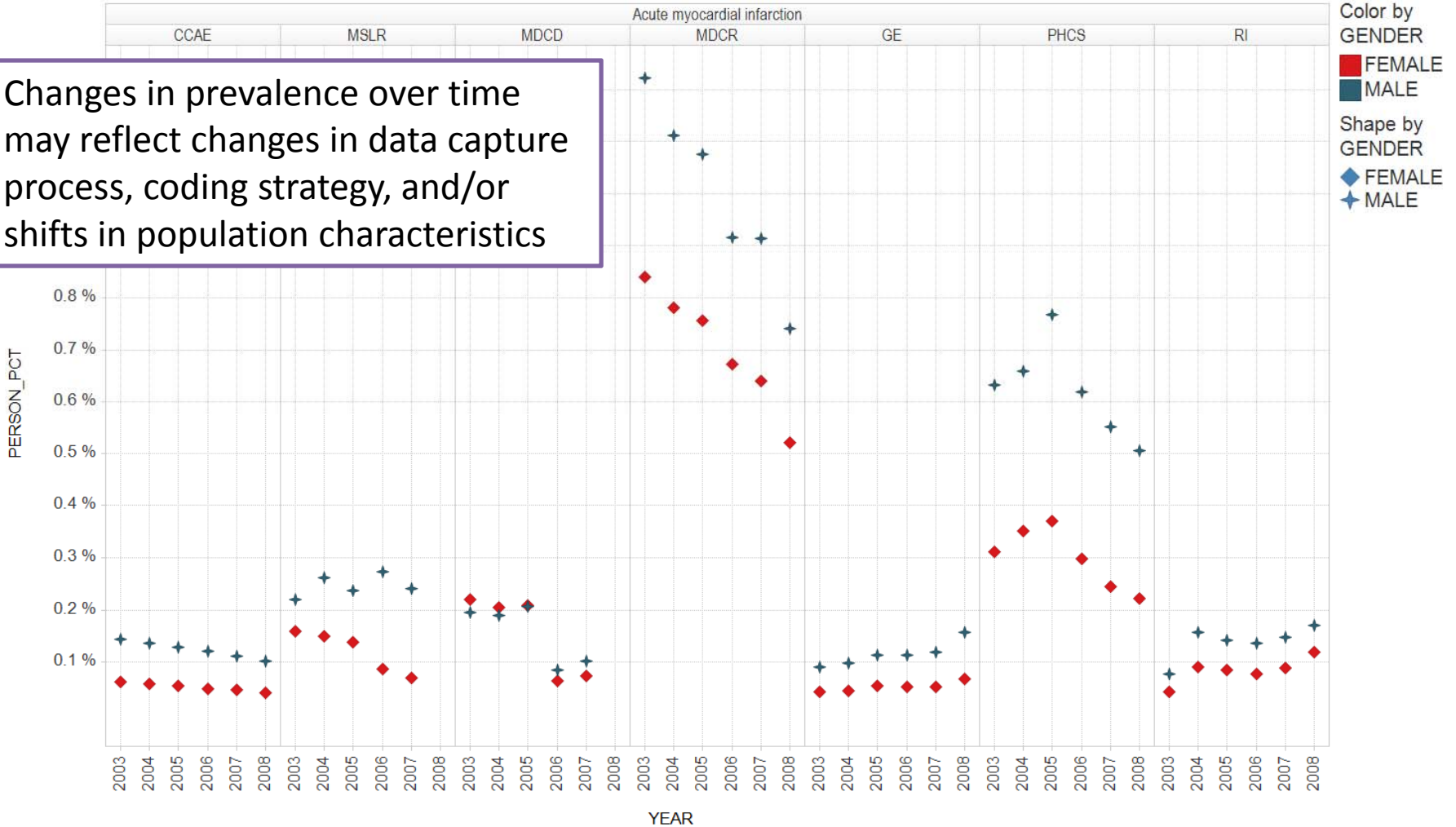
Across all sources, consistently observe increasing rates in older population and higher risk in males.

Standardized analytics facilitate rapid exploration of pre-defined patient subgroups



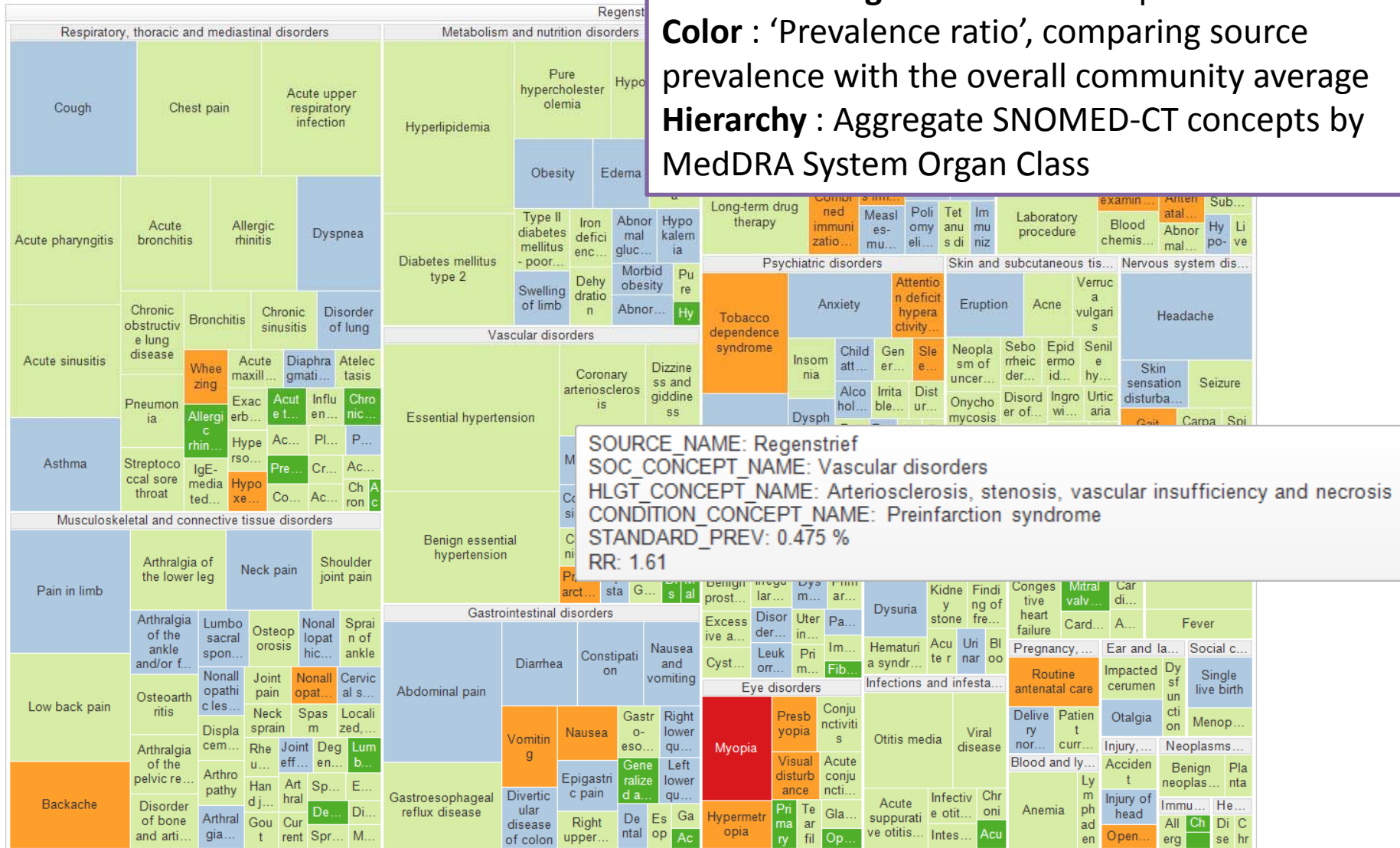
Exploring prevalence of disease: ex: Acute Myocardial Infarction

Changes in prevalence over time may reflect changes in data capture process, coding strategy, and/or shifts in population characteristics



Exploring prevalence of all diseases

Treemap displays 3 dimensions:
Size of rectangle : Standardized prevalence
Color : 'Prevalence ratio', comparing source prevalence with the overall community average
Hierarchy : Aggregate SNOMED-CT concepts by MedDRA System Organ Class



Quality Measure use case

- Within a disease subpopulation, how do those patients compare to the general population?
- Do diseased patients receive appropriate treatment?
- What are observed outcomes following disease onset?

Population summaries to support multiple use cases

Population

Patient received
treatment

Y

N

Another tool can be executed for each cohort of interest to compare temporal relationship with ALL co-occurring diseases, treatments, procedures

Patient has
disease

Y

N

| | | |
|---|---|---|
| | Y | N |
| Y | Patients receiving treatment that have disease <i>(within time window)</i> | |
| N | | |

Total that have disease

+
Total that do not have disease

=

Total population

Total receiving treatment

+

Total not receiving treatment

=

Marginal statistics are often insufficient for fully understanding patterns in patient health

One standard analytic tool can provide summary statistics for ALL diseases, treatments, procedures for ALL pre-defined subpopulations

Acute myocardial infarction and metoprolol

Population:

All patients

Patient received

Metoprolol

Y

N

Y

| | | |
|---|---|--|
| | Patients receiving metoprolol <u>in 365d before AMI:</u> 2,925 | |
| Patient has Acute Myocardial Infarction | | |
| N | | |

Total that have AMI:

21,690

Patient has Acute Myocardial Infarction

N

Total receiving metoprolol:

50,160

Total population:

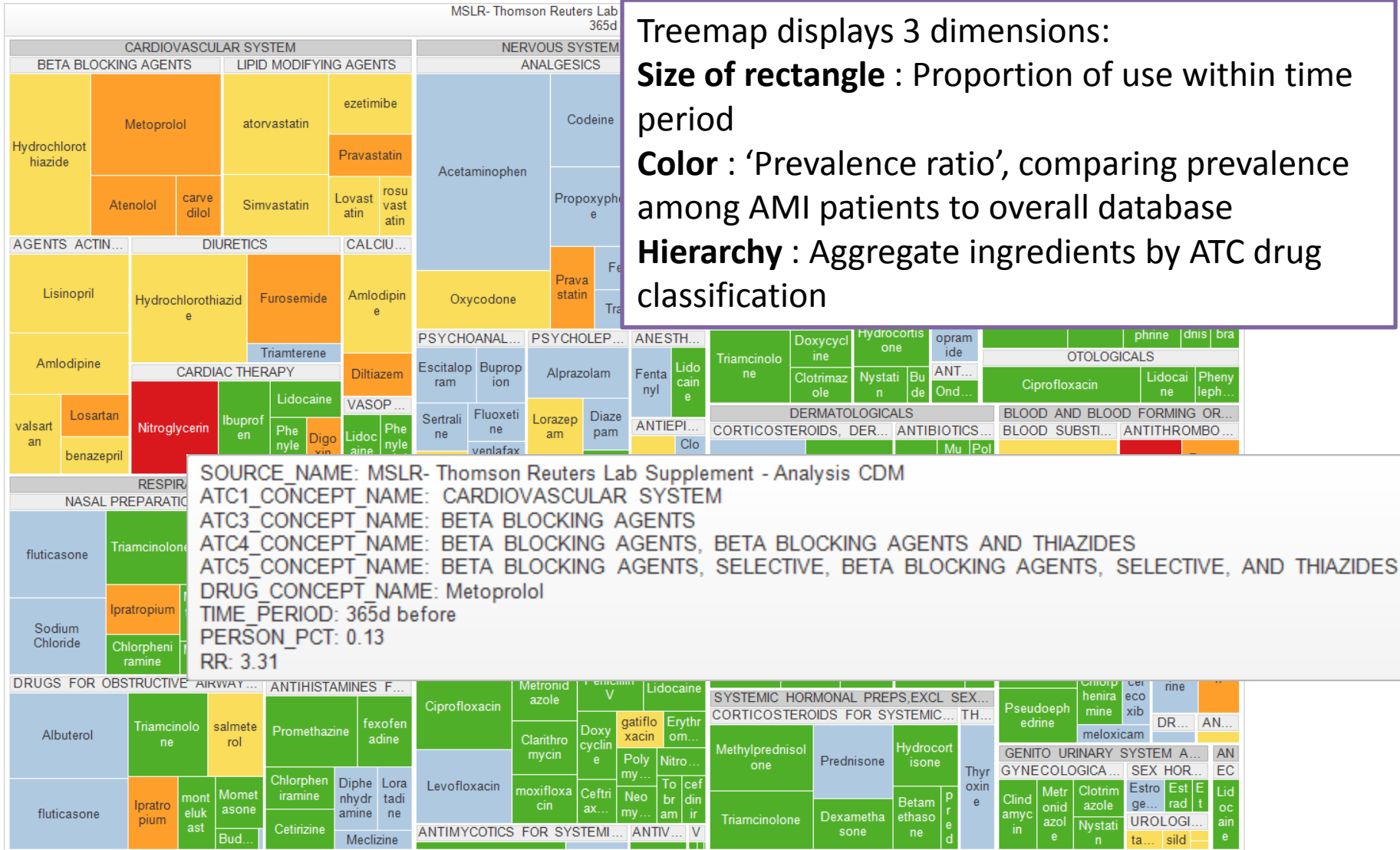
1,229,321

% of patients with metoprolol exposure: $50,160 / 1,229,321 = 4\%$

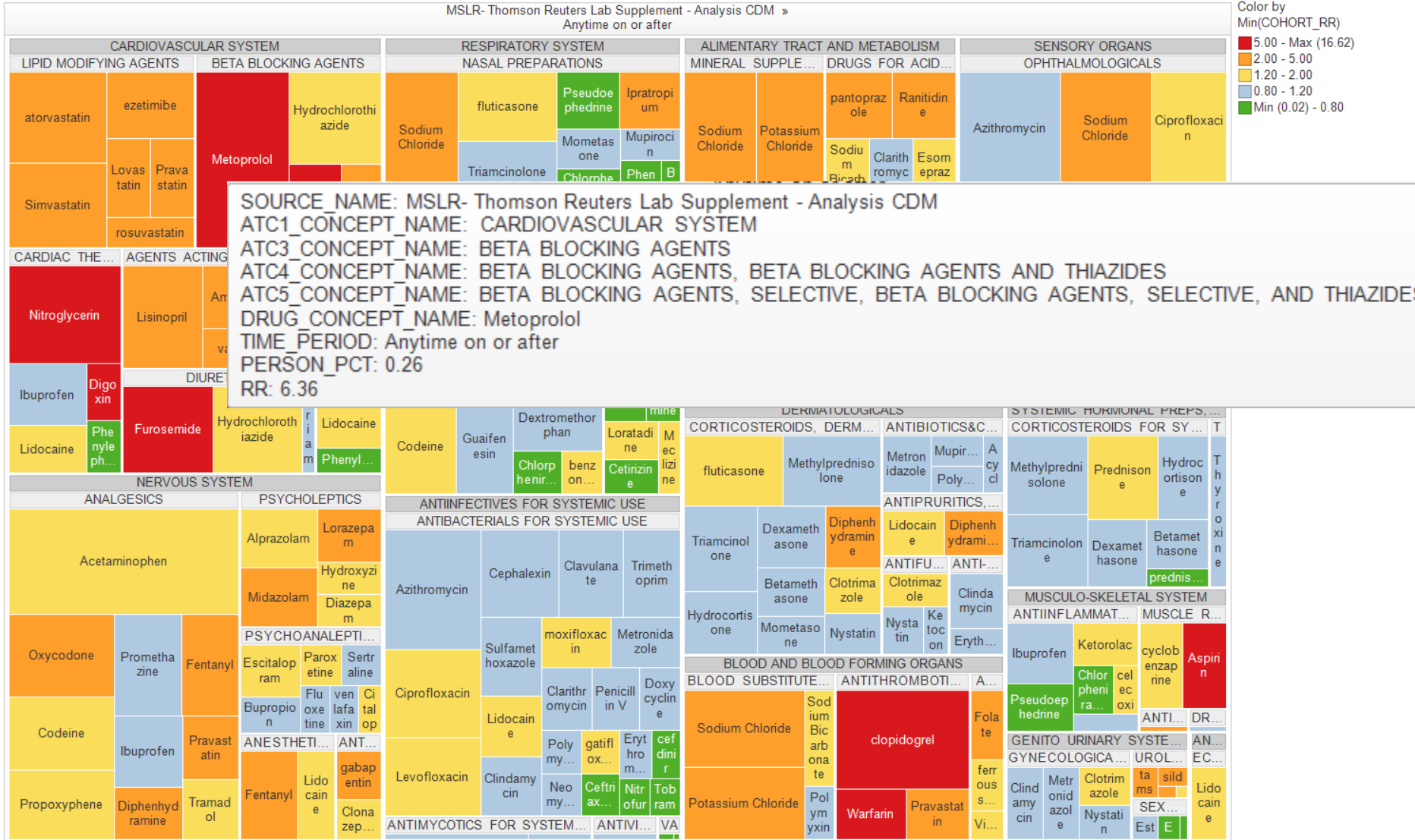
% of patients with AMI and prior metoprolol exposure: $2,925 / 21,690 = 13\%$

Prevalence ratio = $13\% / 4\% = 3.3$

Amongst patients with Acute Myocardial Infarction, what was the prevalence of drug use in the prior year?

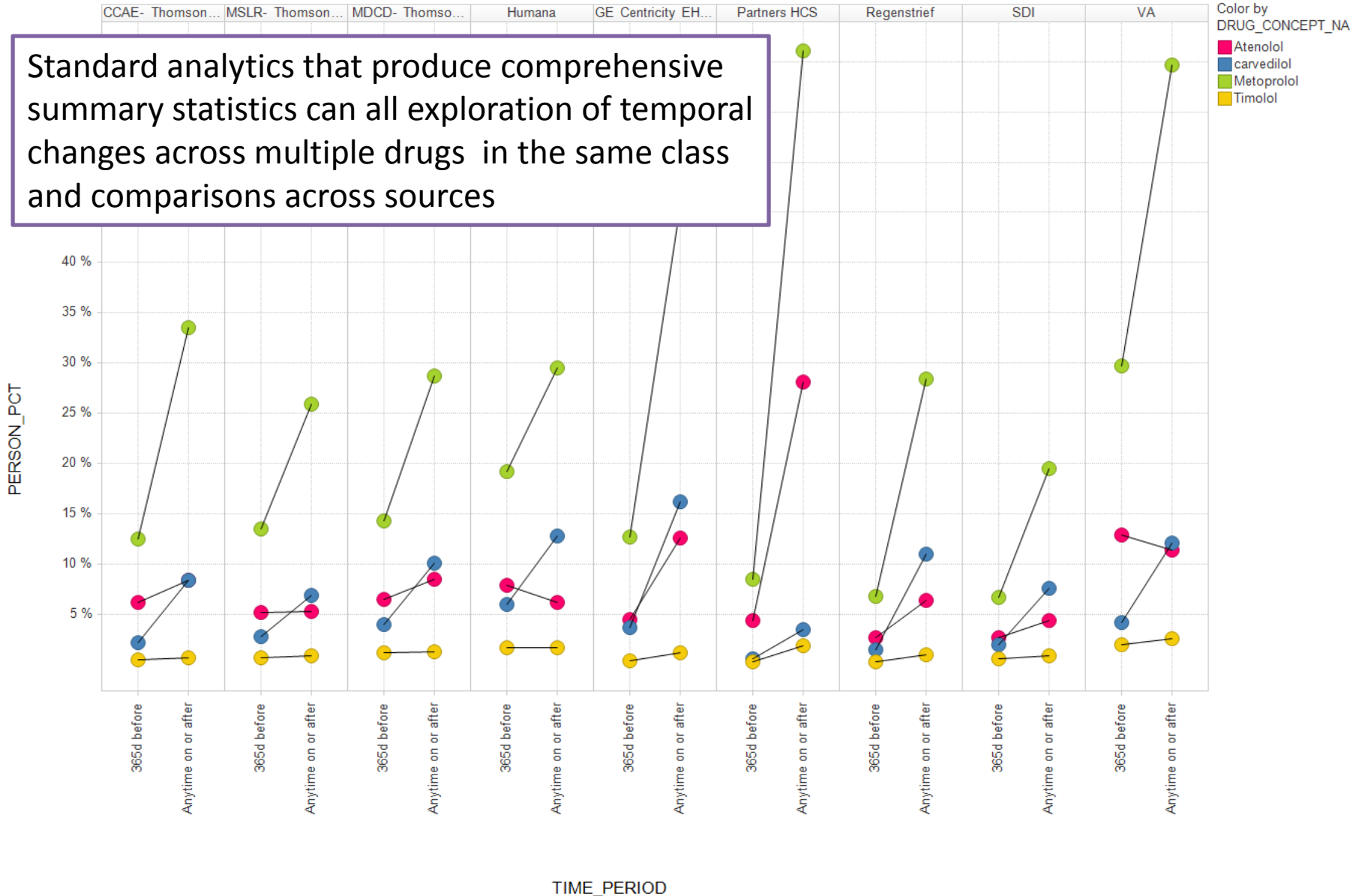


Amongst patients with Acute Myocardial Infarction, how do the rates of drug utilization change after the event?



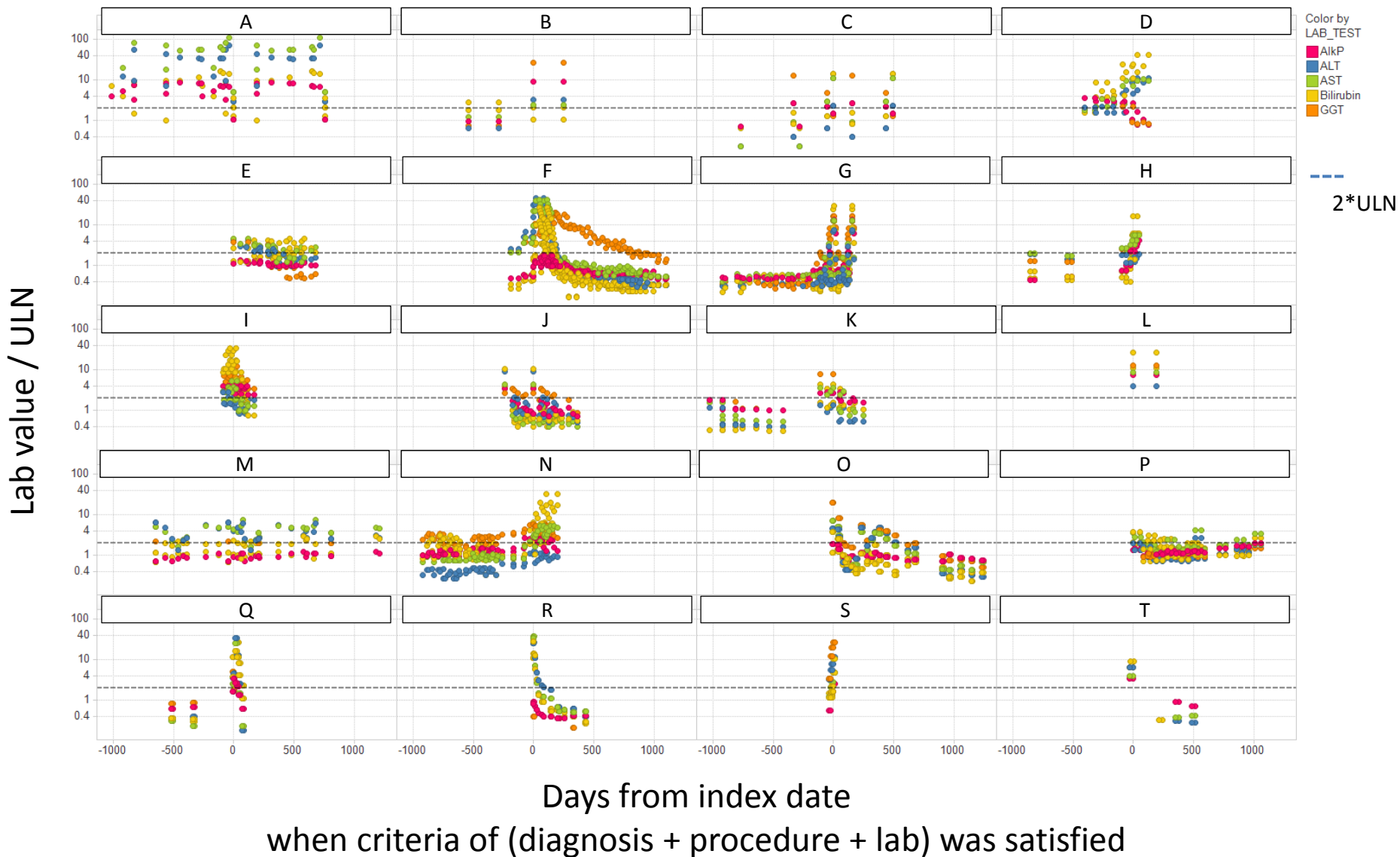
Amongst patients with Acute Myocardial Infarction, how does change in Beta blocker use compare across data sources?

Standard analytics that produce comprehensive summary statistics can all exploration of temporal changes across multiple drugs in the same class and comparisons across sources



Exploring clinical patterns in laboratory results

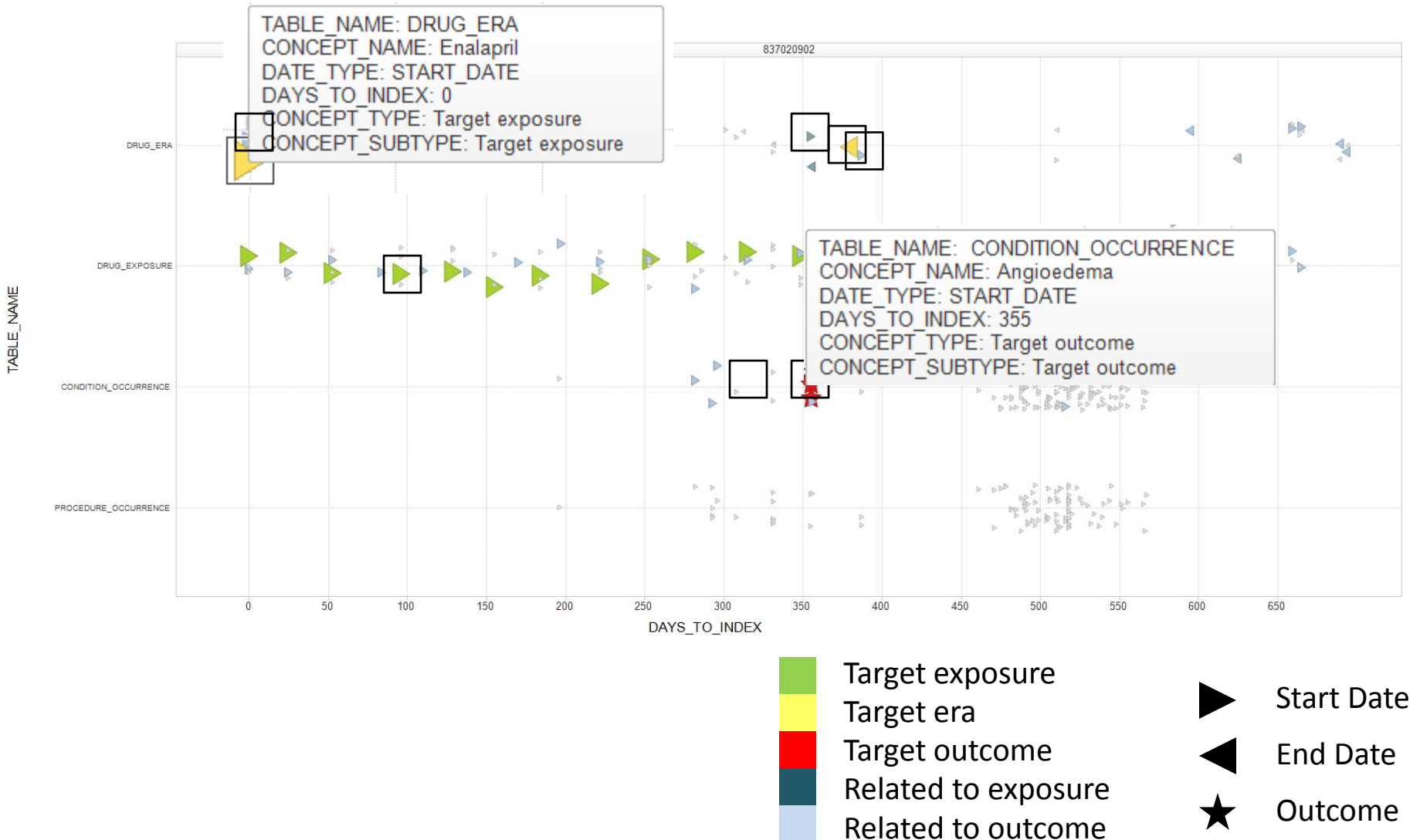
ex: Acute Liver Injury



Medical product safety use case

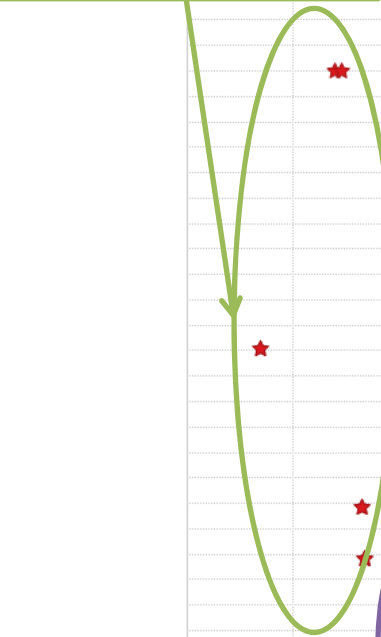
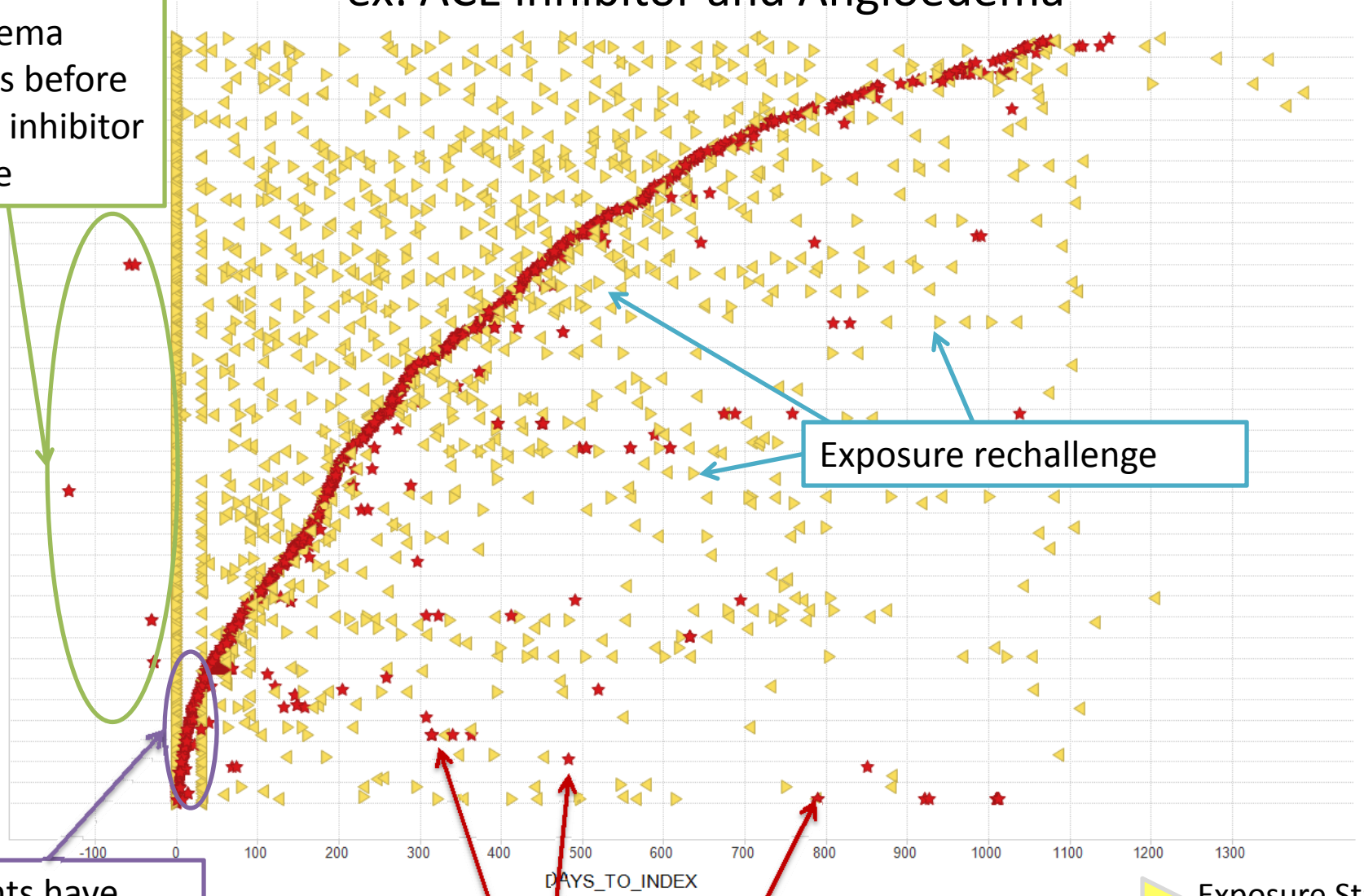
- When did the patient start taking the drug of interest?
- What other concomitant medications were they taking?
- Was the patient adherent to their medication?
- Does the patient have any comorbidities?
- When did the outcome occur?
- Was therapy discontinued?
- How confident are we that this case reflects a potential adverse drug event?
- Can we observe an temporal association between medical product exposure and adverse outcomes?

Patient-level exploration: ex: ACE inhibitor and Angioedema



Exploring patients with exposure and outcome ex: ACE inhibitor and Angioedema

Patients with angioedema diagnosis before first ACE inhibitor exposure



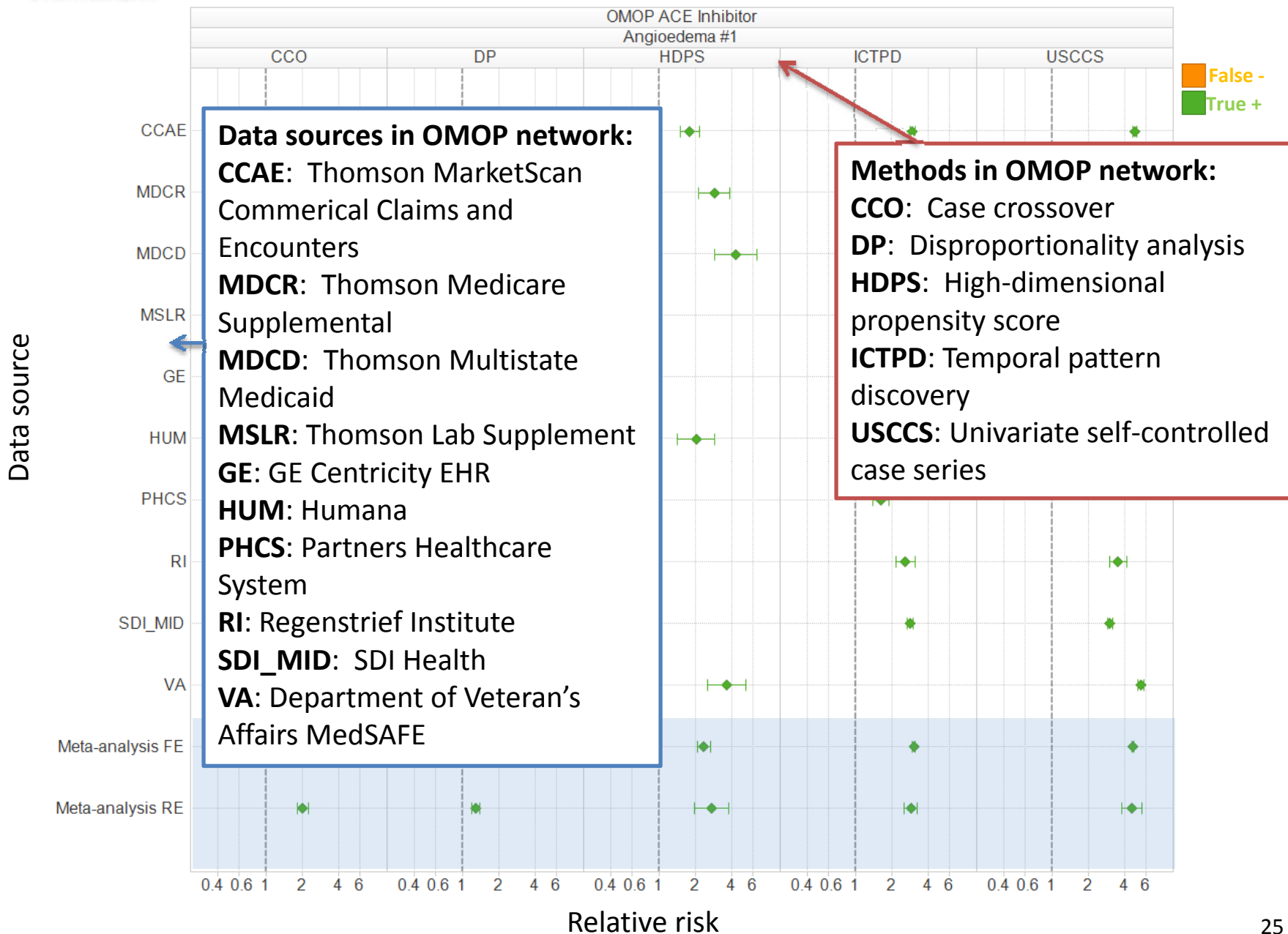
Exposure rechallenge

Patients have event within first 30d prescription

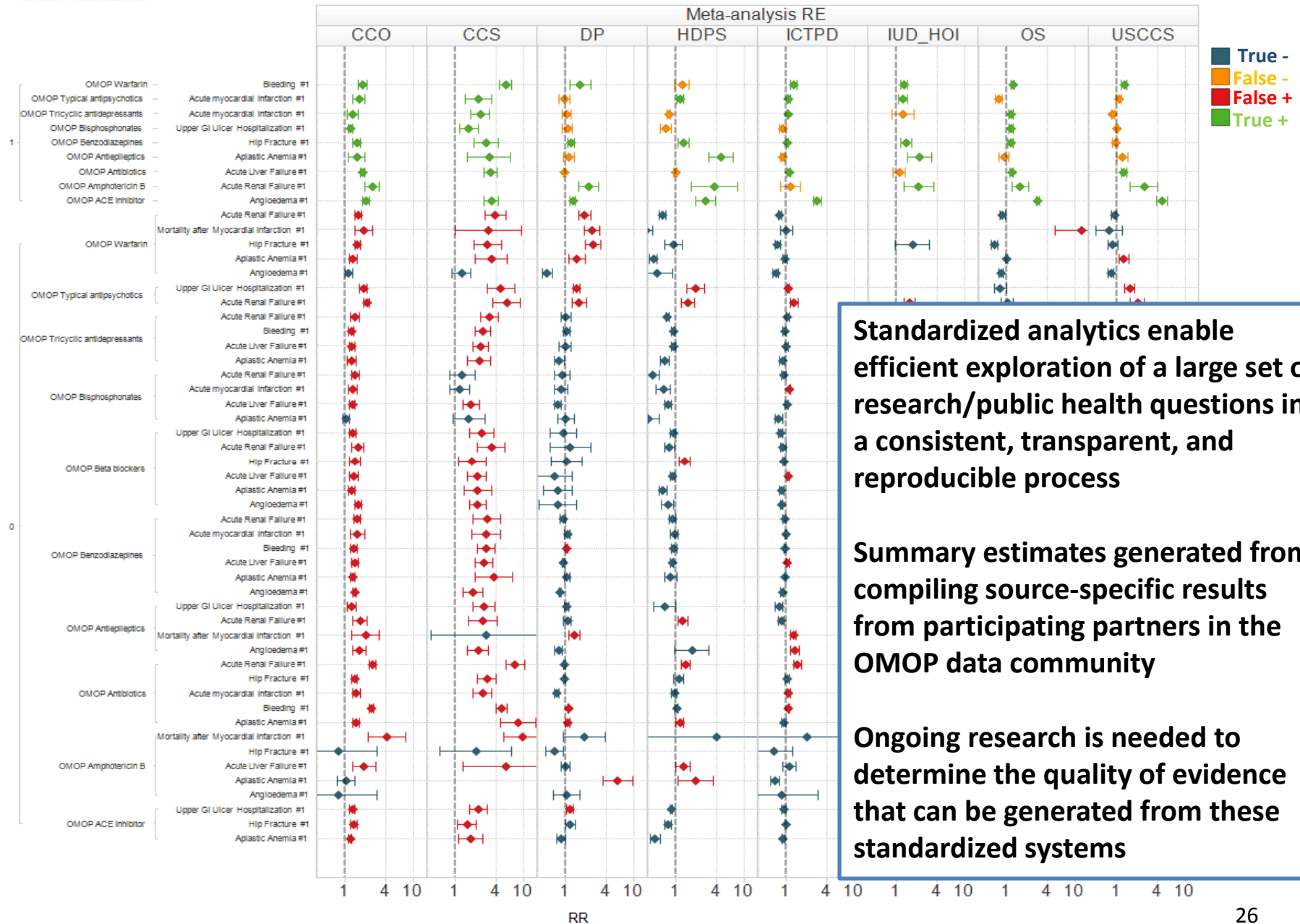
Subsequent occurrence of angioedema diagnoses

- ▶ Exposure Start
- ◀ Exposure End
- ★ Outcome

Estimating the strength of association between exposure and outcome



Distribution of estimates across all drug-outcome pairs



Standardized analytics enable efficient exploration of a large set of research/public health questions in a consistent, transparent, and reproducible process

Summary estimates generated from compiling source-specific results from participating partners in the OMOP data community

Ongoing research is needed to determine the quality of evidence that can be generated from these standardized systems

Conclusions

- A standards-based common clinical information model is feasible and can accommodate disparate data sources
- Multiple analytical use cases can be satisfied within one framework, but scope of data needs may vary
- Standardized analytics enable efficient exploration of a large set of research/public health questions in a consistent, transparent, and reproducible process
- Large-scale analytics and interactive visualization can maximize value of EHR data resources by generating clinically meaningful knowledge for all stakeholders

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