Welcome to the journey: OHDSI Symposium 2015

Wifi:
Network: HHONORS-MEETING
Passcode: OHDSI15

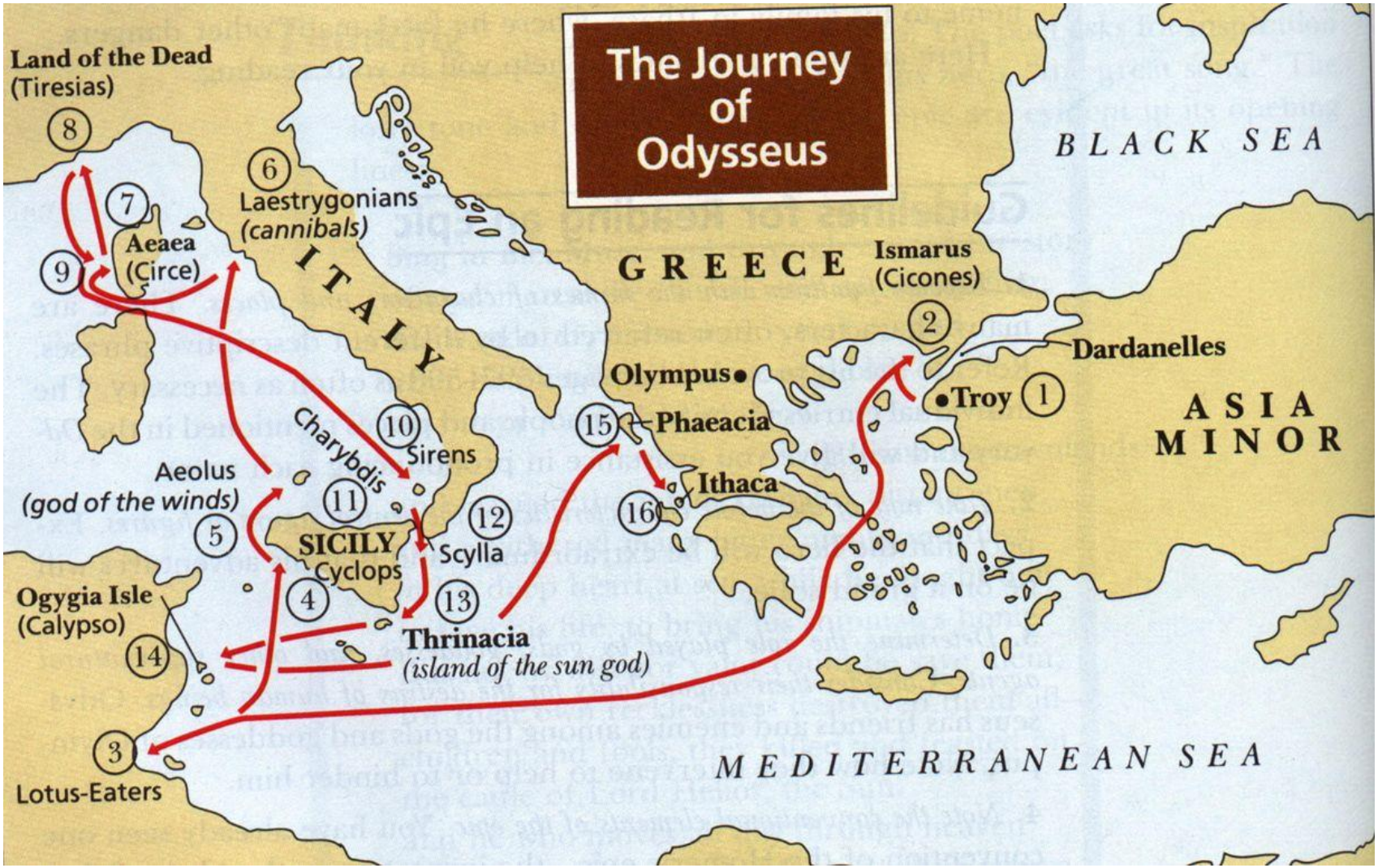
Welcome to the journey: Overview of OHDSI : past, present, future

Patrick Ryan, PhD
Janssen Research and Development
Columbia University Medical Center
20 October 2015

Odyssey (*noun*): \oh-d-si\

1. A long journey full of adventures
2. A series of experiences that give knowledge or understanding to someone

http://www.merriam-webster.com/dictionary/odyssey


The Journey of Odysseus
Land of the Dead (Tiresias)
8
7
Aeaea (Circe)
9
6
Laestrygonians (cannibals)
ITALY
GREECE
BLACK SEA
Ismarus (Cicones)
2
Dardanelles
Troy
1
ASIA MINOR
Olympus
15
Phaeacia
Ithaca
16
10
Sirens
Charybdis
11
12
Scylla
SICILY
Cyclops
4
13
Thrinacia
(island of the sun god)
Aeolus (god of the winds)
5
Ogygia Isle (Calypso)
14
3
Lotus-Eaters
MEDITERRANEAN SEA

A journey to OHDSI

INSTITUTE OF MEDICINE

eu-adr

edmforum
knowledge inspiring health

OBSERVATIONAL
MEDICAL
OUTCOMES
PARTNERSHIP

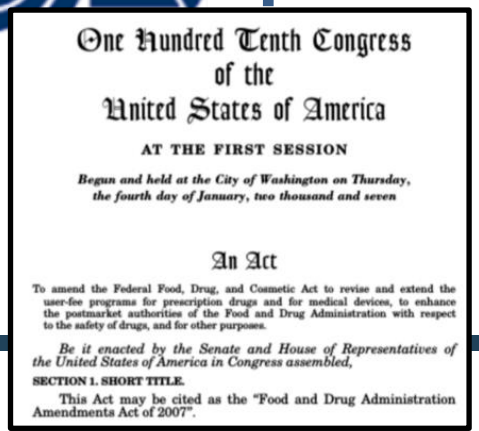
AHRQ

pcori

pcornet

FDA

Mini-Sentinel



One Hundred Tenth Congress
of the
United States of America

AT THE FIRST SESSION

Begun and held at the City of Washington on Thursday, the fourth day of January, two thousand and seven

An Act

To amend the Federal Food, Drug, and Cosmetic Act to revise and extend the user-fee programs for prescription drugs and for medical devices, to enhance the postmarket authorities of the Food and Drug Administration with respect to the safety of drugs, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Food and Drug Administration Amendments Act of 2007".

OHDSI

OMOP'S
GOLDEN TICKET

Greetings to you, the lucky finder of this GOLDEN TICKET from the OMOP Research Team

Present this ticket at the next OMOP Symposium in the morning and do not be late. You may bring with you one member of your own family...and only one....but no one else...

In your wildest dreams, you could not imagine the marvelous SURPRISES that await YOU!

Thanks to our sponsors

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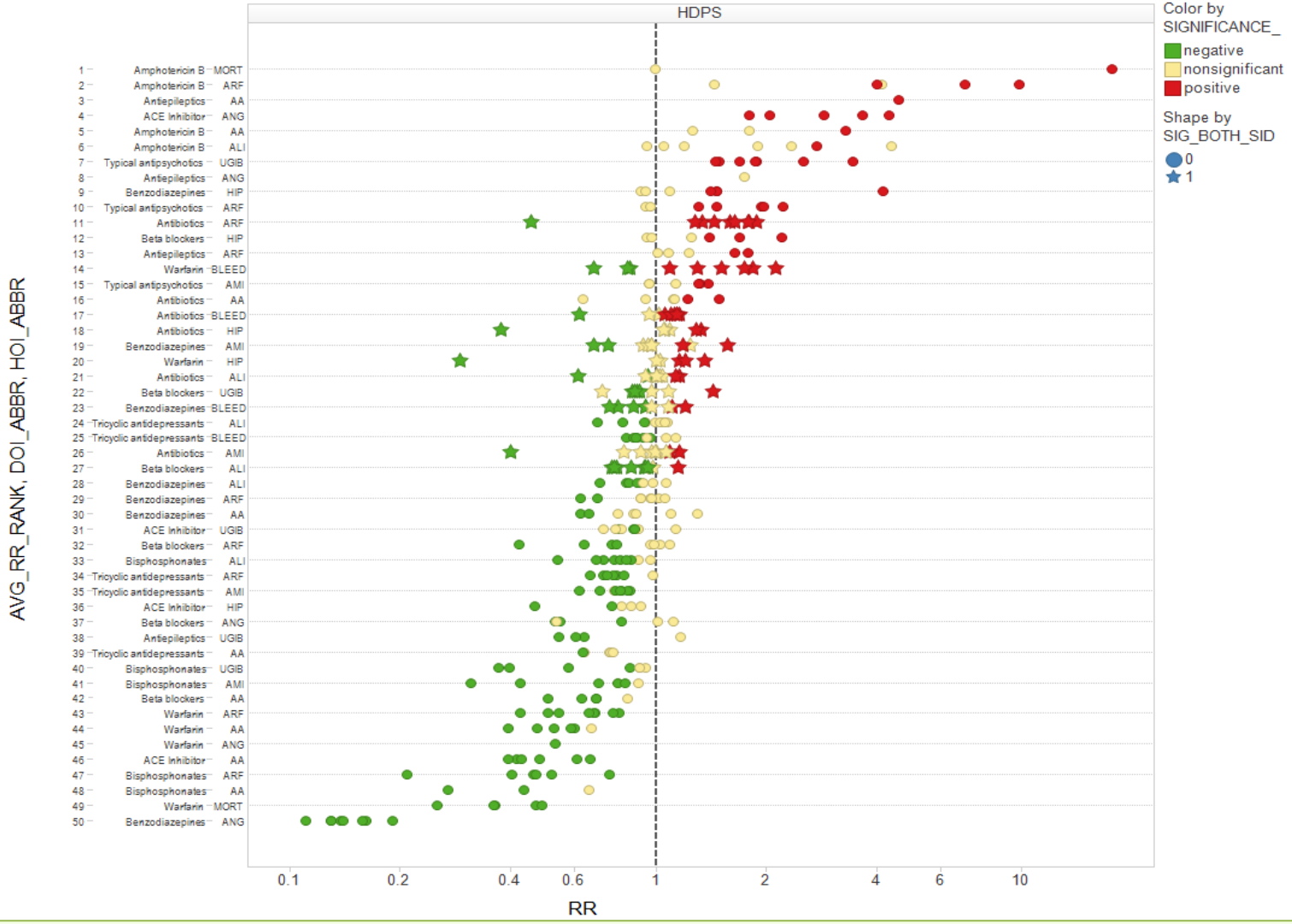
imshealth™ INTELLIGENCE APPLIED.

Thanks for the Eugene Washington Engagement Award

pcori PATIENT-CENTERED OUTCOMES RESEARCH INSTITUTE

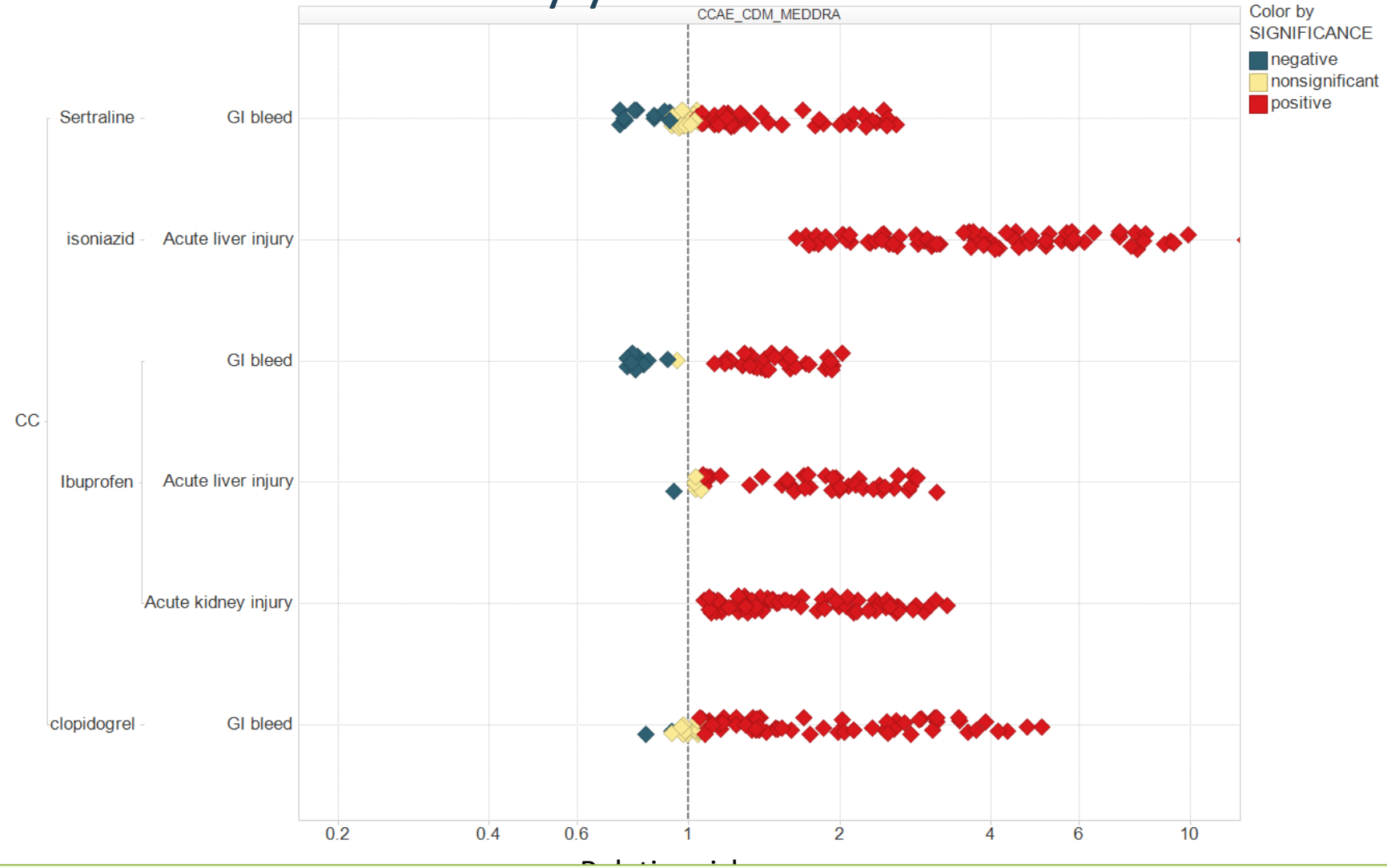
Lesson 1: Database heterogeneity: Holding analysis constant, different data may yield different estimates



Madigan D, Ryan PB, Schuemie MJ et al, American Journal of Epidemiology, 2013
"Evaluating the Impact of Database Heterogeneity on Observational Study Results"

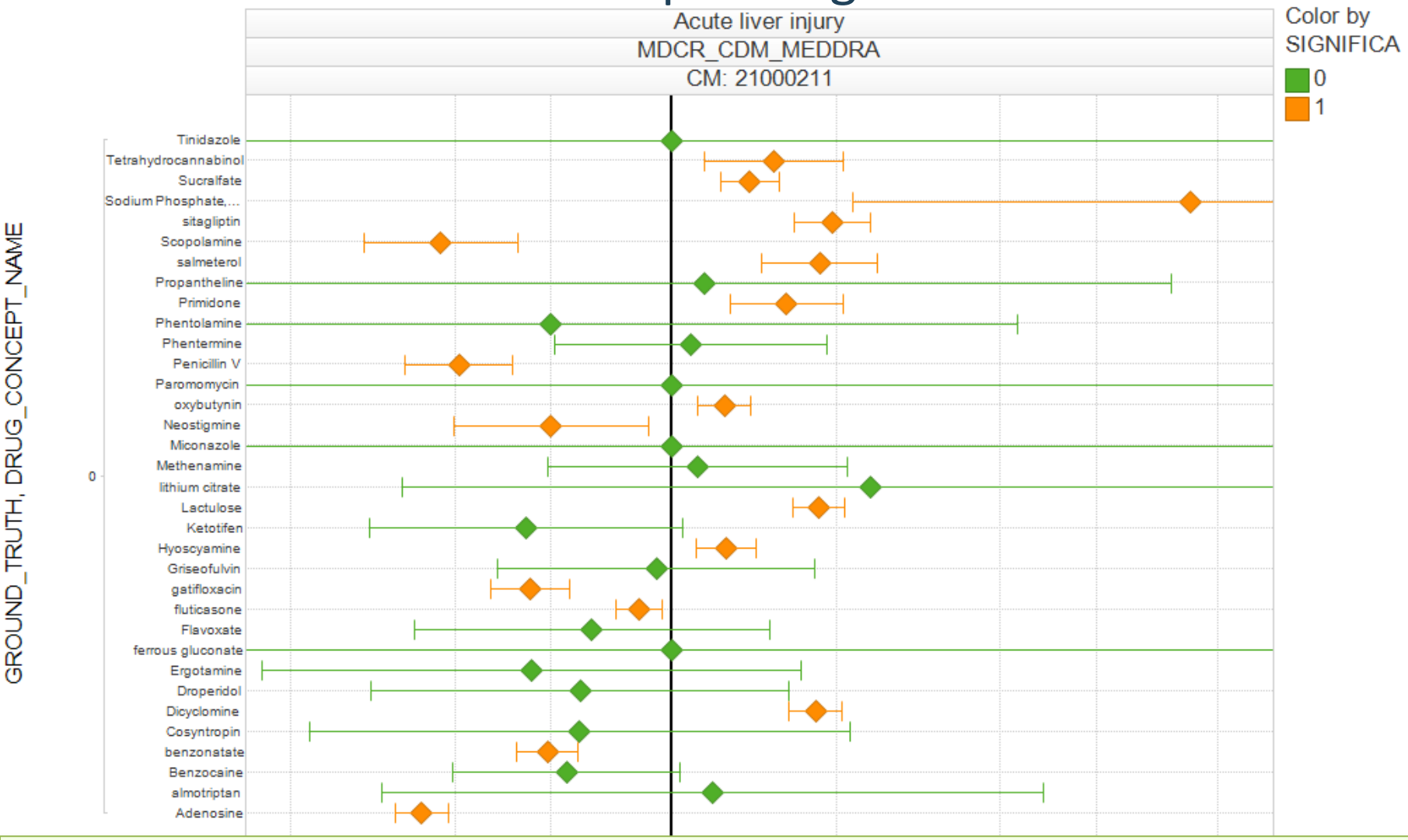
Lesson 2: Parameter sensitivity: Holding data constant, different analytic design choices may yield different estimates

Test cases from OMOP 2011/2012 experiment



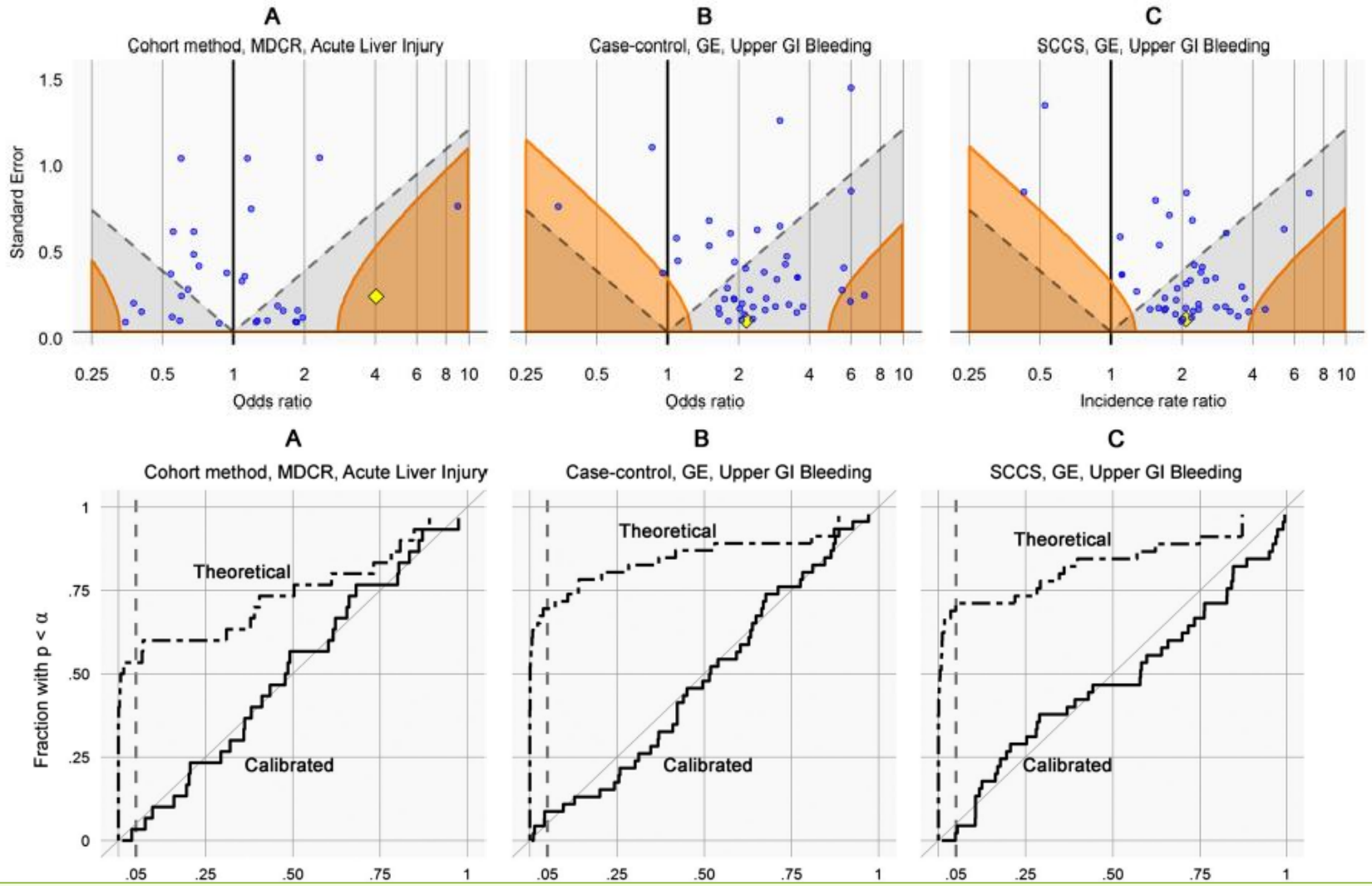
Madigan D, Ryan PB, Scheumie MJ, Therapeutic Advances in Drug Safety, 2013: “Does design matter? Systematic evaluation of the impact of analytical choices on effect estimates in observational studies”

Lesson 3: Empirical performance: Most observational methods do not have nominal statistical operating characteristics



Ryan PB, Stang PE, Overhage JM et al, Drug Safety, 2013:
"A Comparison of the Empirical Performance of Methods for a Risk Identification System"

Lesson 4: Empirical calibration can help restore interpretation of study findings



Schuemie MJ, Ryan PB, DuMouchel W, et al, Statistics in Medicine, 2013:
"Interpreting observational studies: why empirical calibration is needed to correct p-values"

Lesson 5: Reliable evidence generation isn't (just) a data/analysis/technology problem

- Understanding the problems requires input and perspective from multiple stakeholders: government, industry, academia, health systems
- Research and development of novel solutions require multi-disciplinary approach: informatics, epidemiology, statistics, clinical sciences
- Adoption and application requires active participation and buy-in from all interested parties (both evidence producers and evidence consumers)
- Major outstanding need: to establish a community of individuals based on shared attitudes, interests and goals where everyone has equal opportunity to participate and contribute

Introducing OHDSI

- The Observational Health Data Sciences and Informatics (OHDSI) program is a multi-stakeholder, interdisciplinary collaborative to create open-source solutions that bring out the value of observational health data through large-scale analytics
- OHDSI has established an international network of researchers and observational health databases with a central coordinating center housed at Columbia University

Thanks for all of the supporters of the OHDSI community

Full list of acknowledgements: http://www.ohdsi.org/who-we-are/support-for-ohdsi/

OHDSI's vision

OHDSI collaborators access a network of 1 billion patients to generate evidence about all aspects of healthcare. Patients and clinicians and other decision-makers around the world use OHDSI tools and evidence every day.

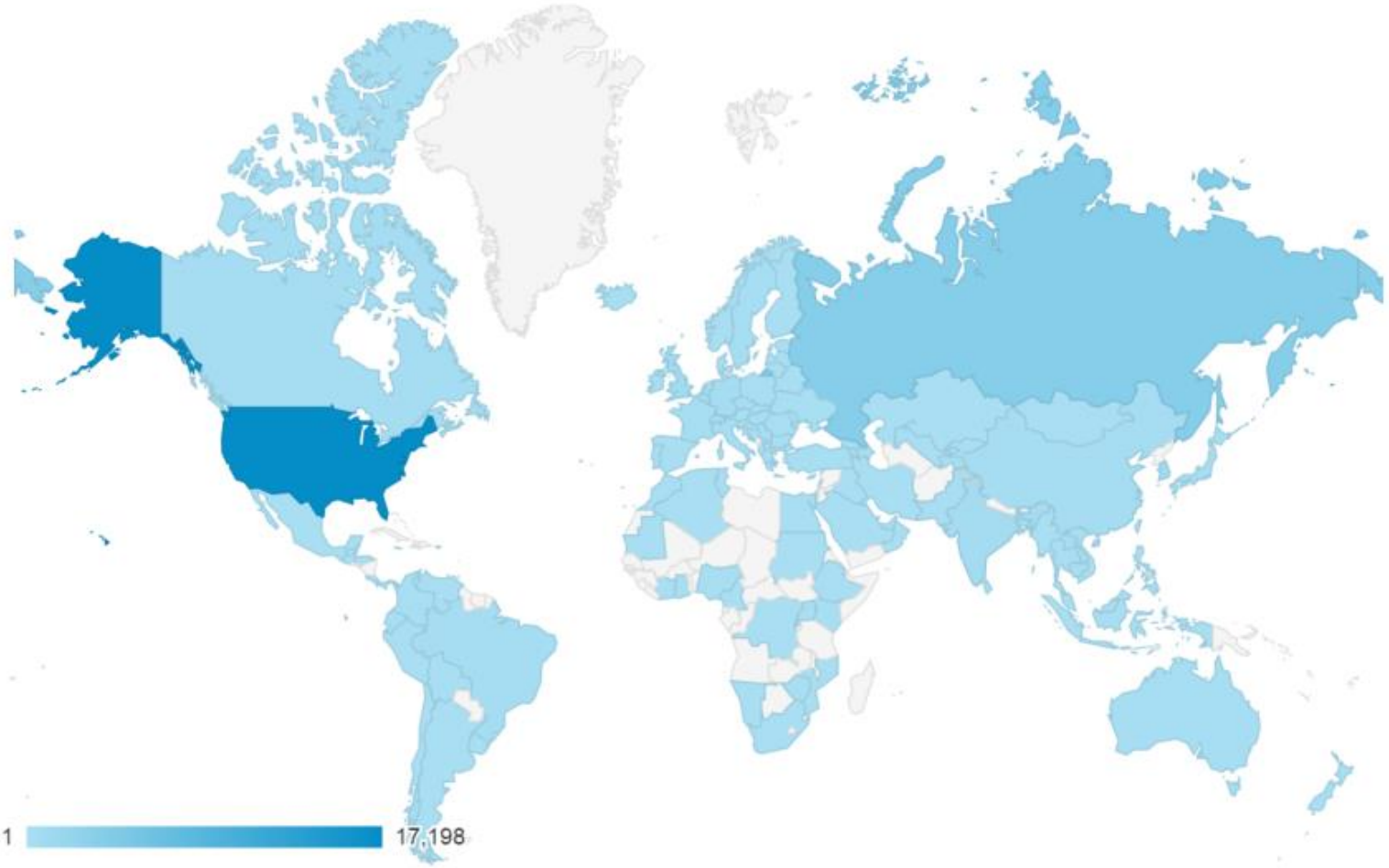
OHDSI: a global community

OHDSI Collaborators:

- >100 researchers in academia, industry, government, health systems
- >10 countries
- Multi-disciplinary expertise: epidemiology, statistics, medical informatics, computer science, machine learning, clinical sciences

http://www.ohdsi.org/who-we-are/collaborators/

Global reach of ohdsi.org

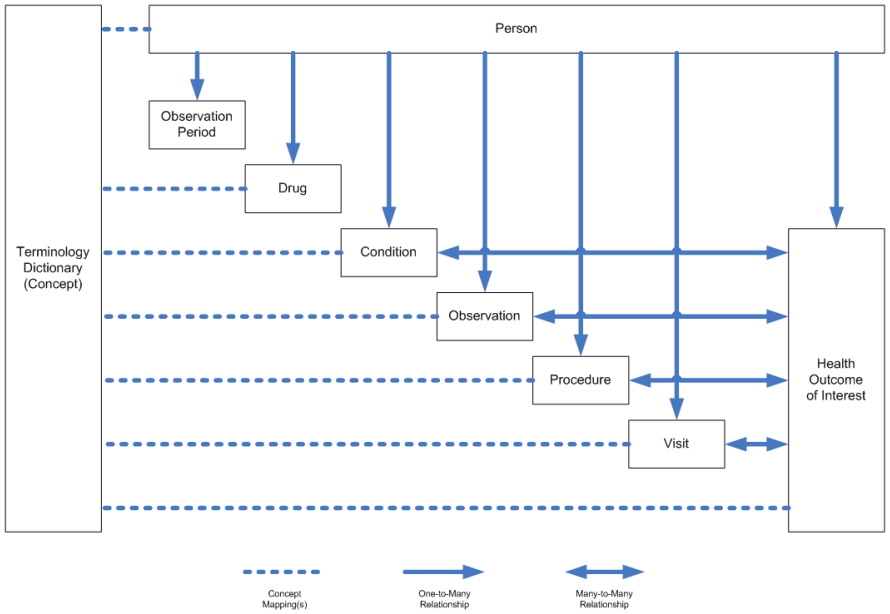


- >16,800 distinct viewers from 120 countries in 2015

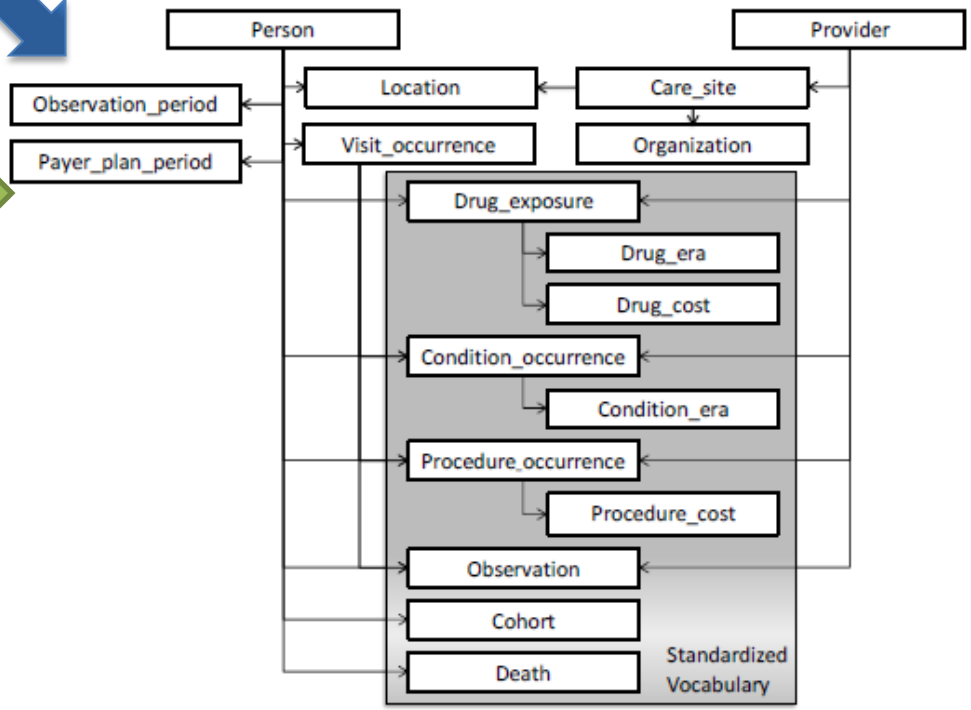
The journey of the OMOP Common data model

OMOP CDM now Version 5, following multiple iterations of implementation, testing, modifications, and expansion based on the experiences of the community who bring on a growing landscape of research use cases.

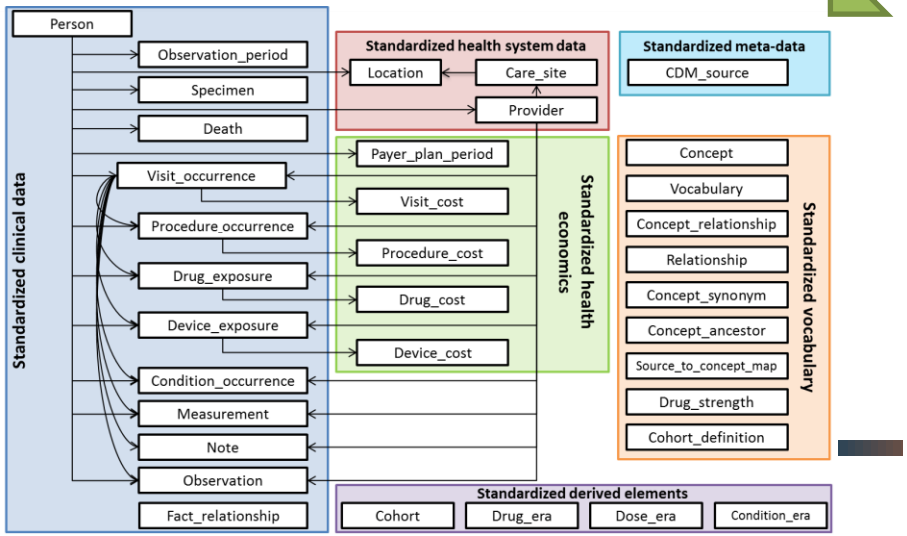
OMOP CDMv2



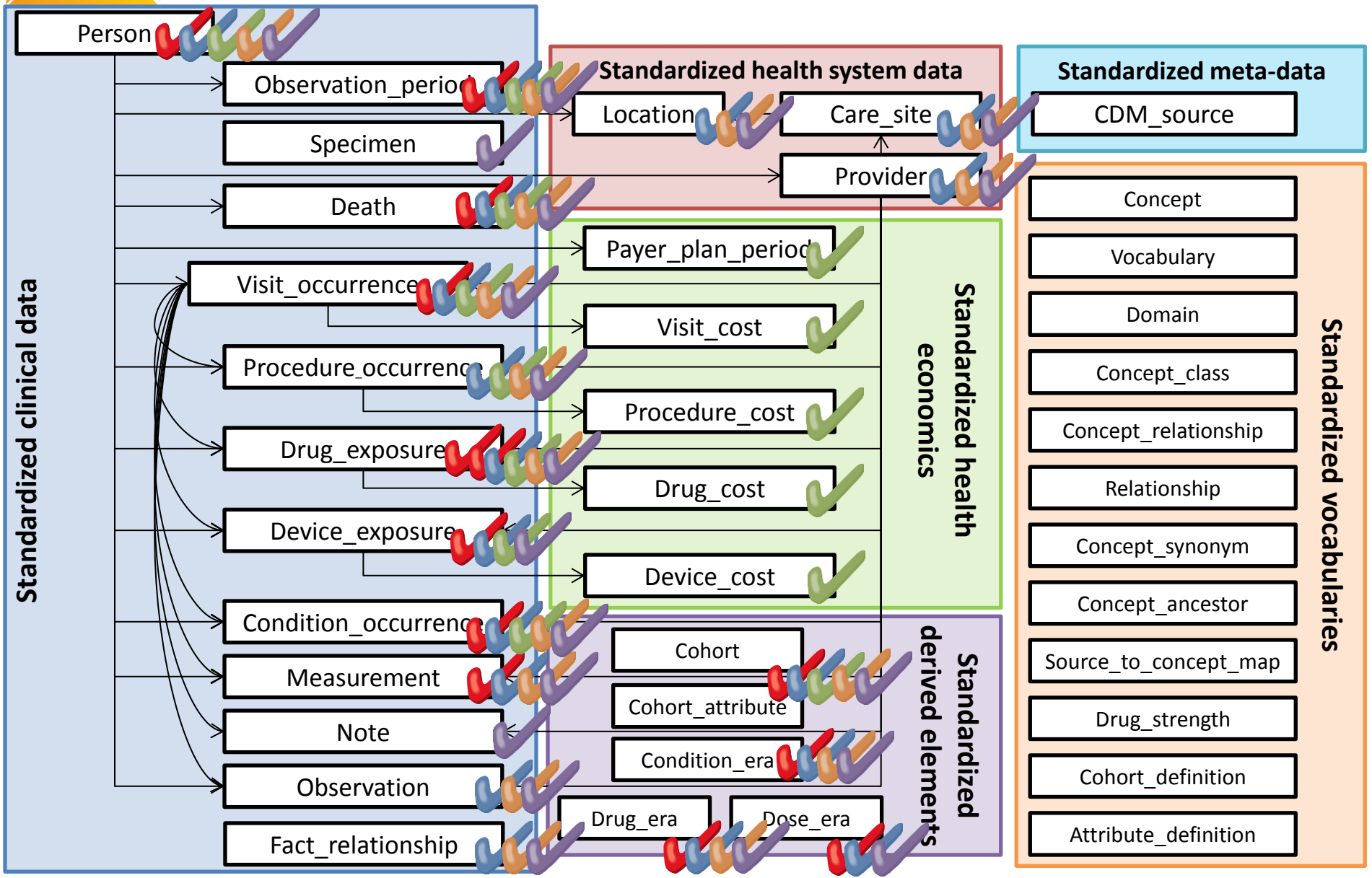
OMOP CDMv4



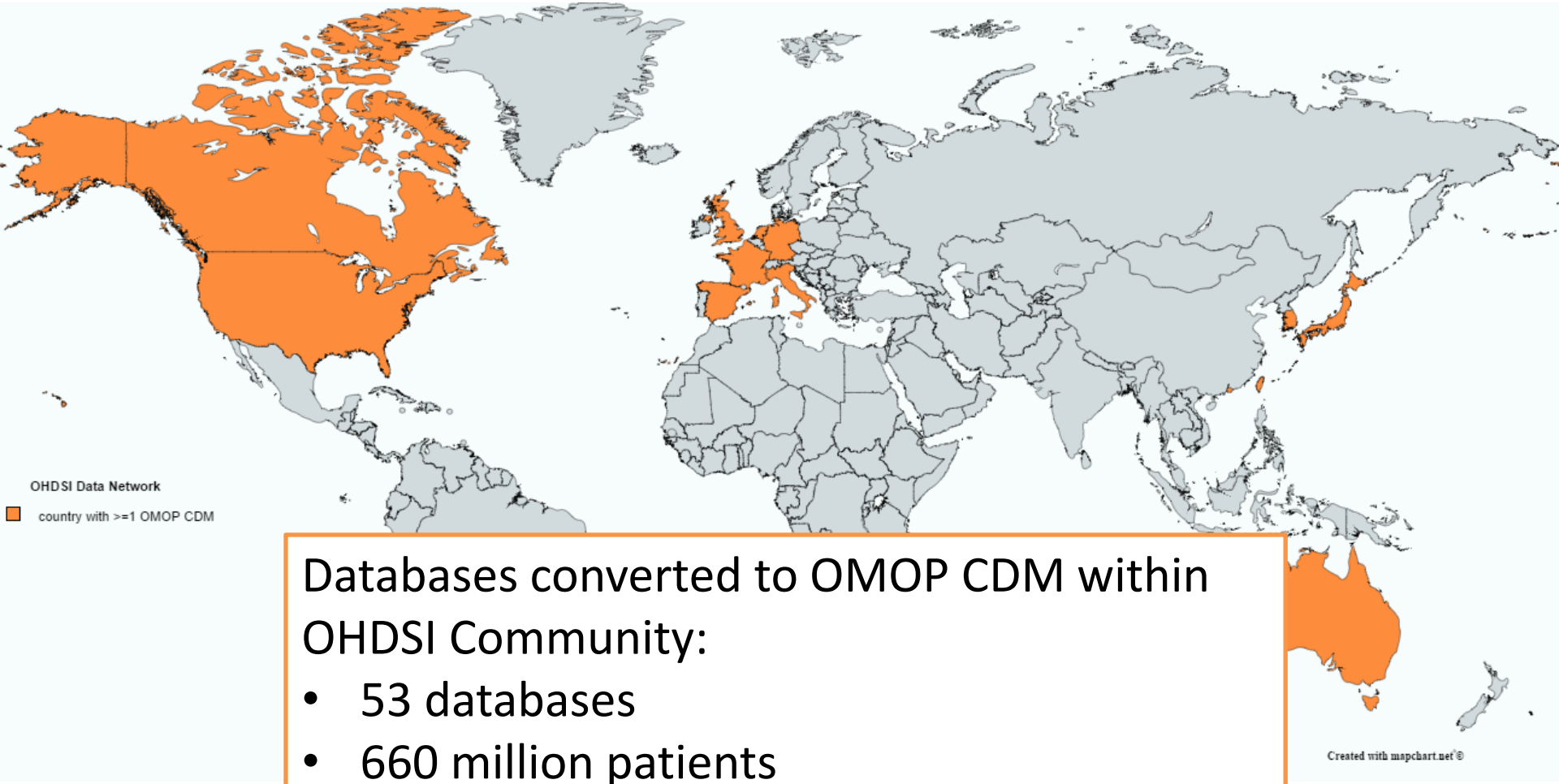
OMOP CDMv5



One model, multiple use cases



OHDSI data network



Databases converted to OMOP CDM within OHDSI Community:

- 53 databases
- 660 million patients
- 12 countries

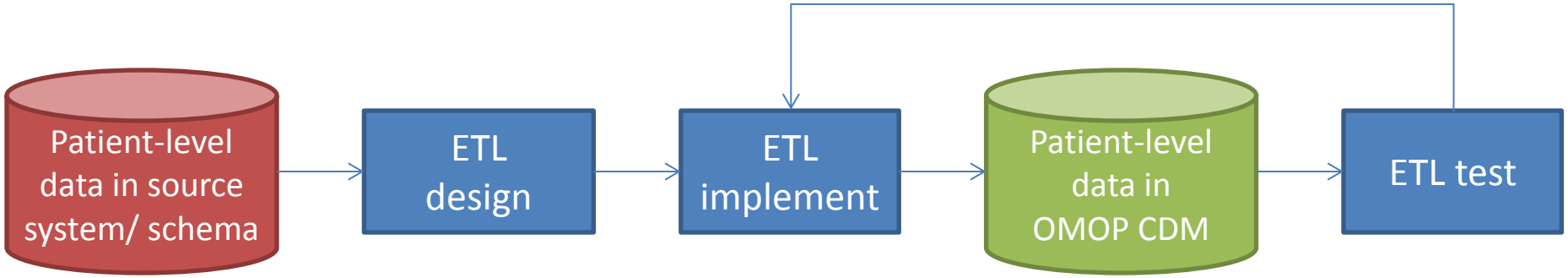
http://www.ohdsi.org/web/wiki/doku.php?id=resources:data_network

The odyssey to evidence generation

Patient-level data in source system/ schema

evidence

Preparing your data for analysis



OHDSI tools built to help

WhiteRabbit: profile your source data

RabbitInAHat: map your source structure to CDM tables and fields

ATHENA: standardized vocabularies for all CDM domains

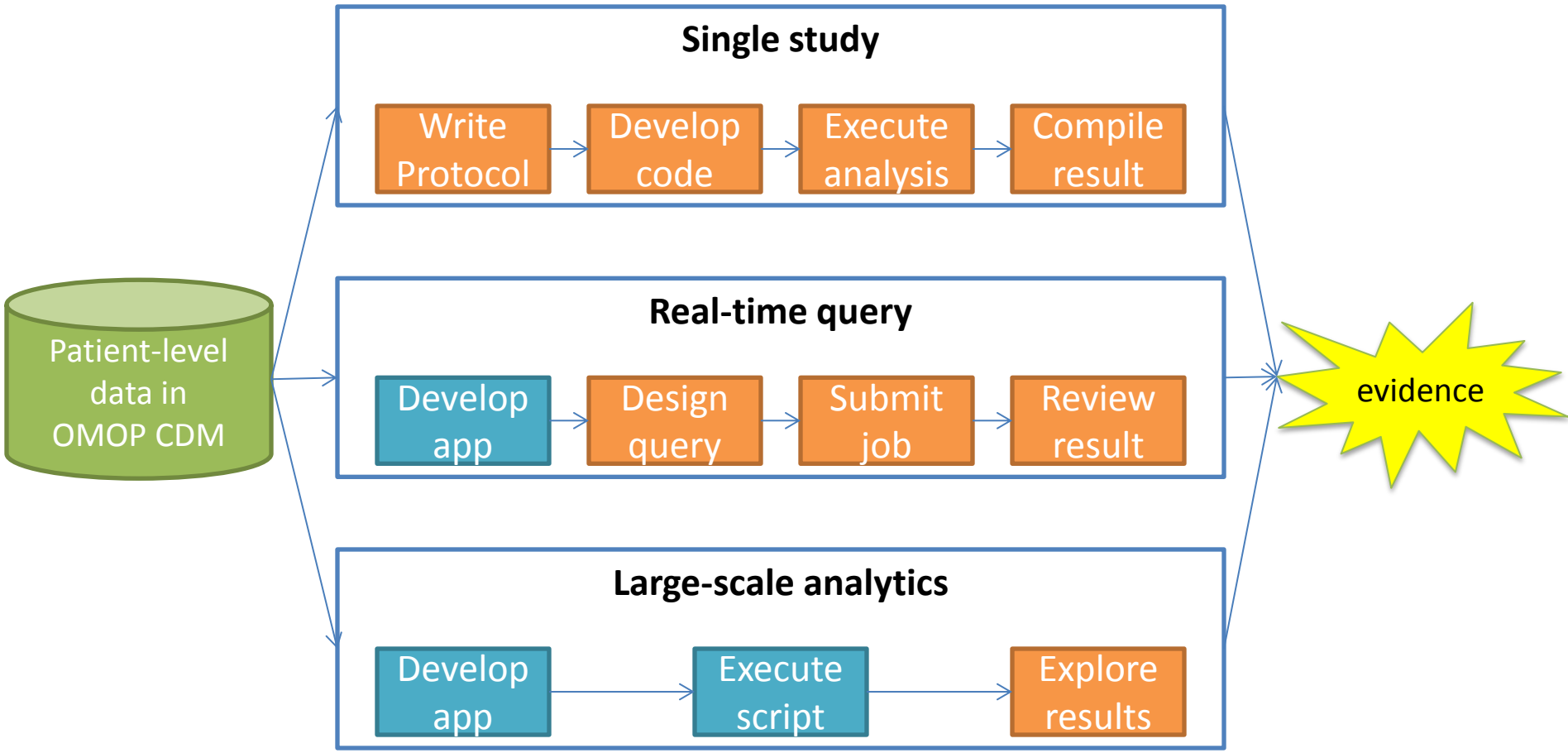
Usagi: map your source codes to CDM vocabulary

CDM: DDL, index, constraints for Oracle, SQL Server, PostgresQL; Vocabulary tables with loading scripts

ACHILLES: profile your CDM data; review data quality assessment; explore population-level summaries

OHDSI Forums: Public discussions for OMOP CDM Implementers/developers

~~Data~~ Evidence sharing paradigms



One-time Repeated

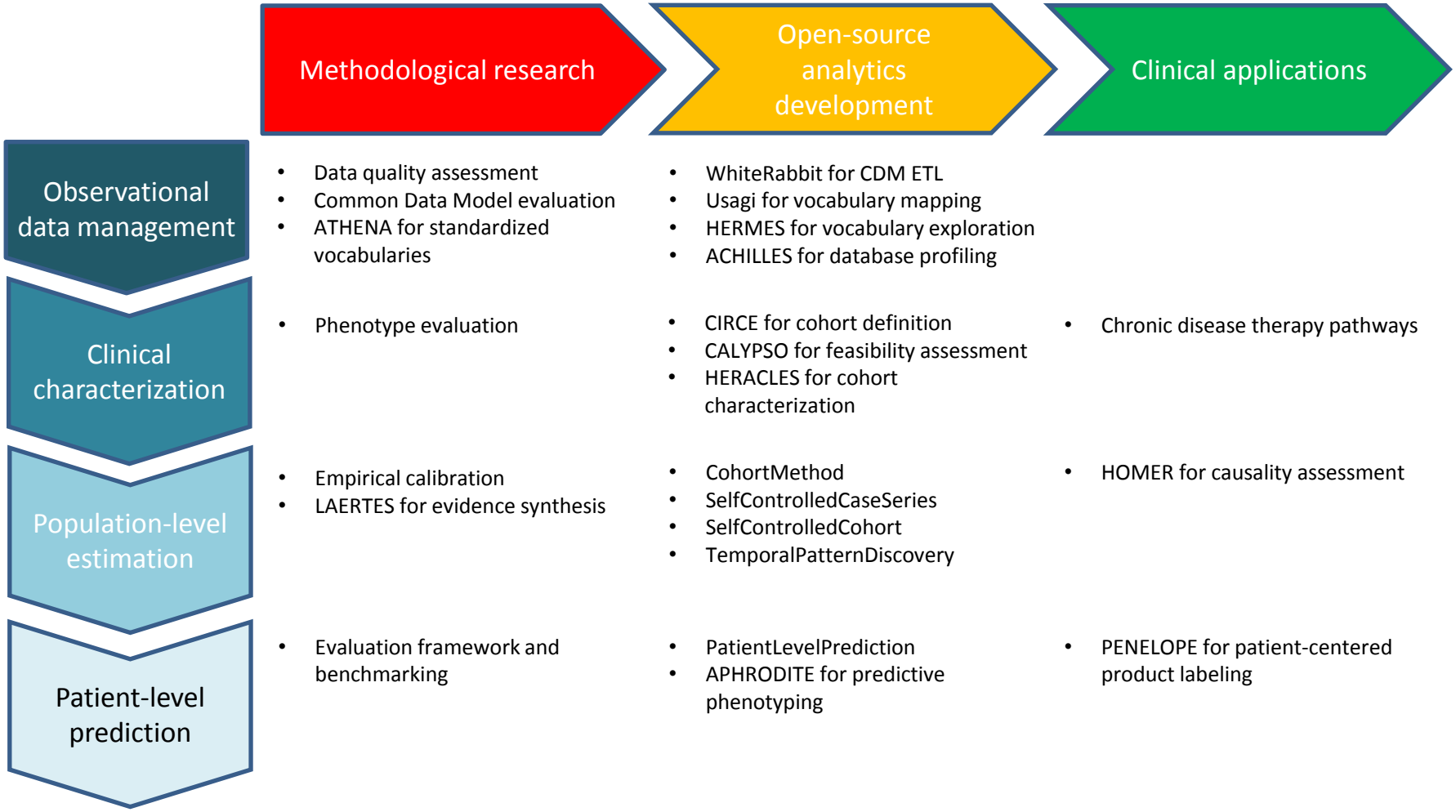
What evidence does OHDSI seek to generate from observational data?

- Clinical characterization
  - **Natural history:** Who are the patients who have diabetes? Among those patients, who takes metformin?
  - **Quality improvement:** what proportion of patients with diabetes experience disease-related complications?
- Population-level estimation
  - **Safety surveillance:** Does metformin cause lactic acidosis?
  - **Comparative effectiveness:** Does metformin cause lactic acidosis more than glyburide?
- Patient-level prediction
  - **Precision medicine:** Given everything you know about me and my medical history, if I start taking metformin, what is the chance that I am going to have lactic acidosis in the next year?
  - **Disease interception:** Given everything you know about me, what is the chance I will develop diabetes?

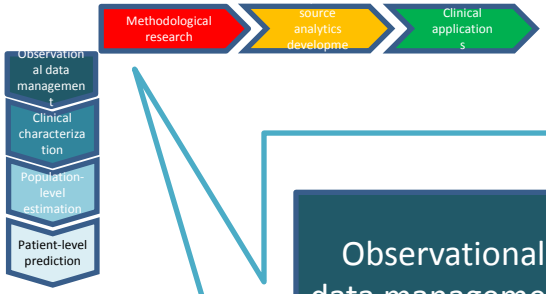
What is OHDSI's strategy to generate evidence?

- Methodological research
  - Develop new approaches to observational data analysis
  - Evaluate the performance of new and existing methods
  - Establish empirically-based scientific best practices
- Open-source analytics development
  - Design tools for data transformation and standardization
  - Implement statistical methods for large-scale analytics
  - Build interactive visualization for evidence exploration
- Clinical applications
  - Identify clinically-relevant questions that require real-world evidence
  - Execute research studies by applying scientific best practices through open-source tools across the OHDSI international data network
  - Promote open-science strategies for transparent study design and evidence dissemination

OHDSI ongoing collaborative activities



OHDSI ongoing collaborative activities



Observational data management

Methodological research

Poster:
Establishing Interoperability Standards between OMOP CDM v4, v5, and PCORnet CDM v1

PCORNet CDRNs:

- NYC CDRN
- PEDSNet
- pSCANNER

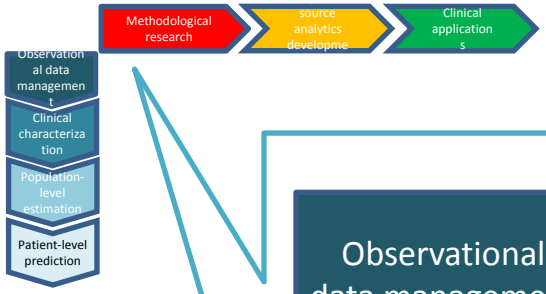
Common standard reference model:

OMOP CDM

Common ETL for project destination:

PCORNet CDM

OHDSI ongoing collaborative activities



Observational data management

Methodological research

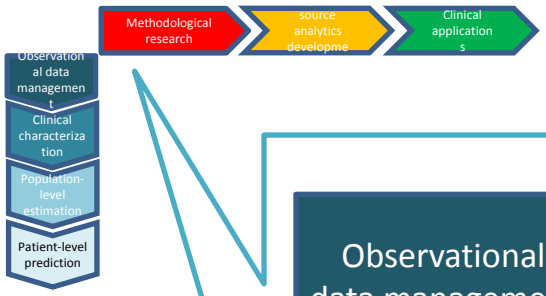
Poster:
Transforming the National Department of Veterans Affairs Data Warehouse to the OMOP Common Data Model

Case Report — Applied Clinical Informatics 536

Creating a Common Data Model for Comparative Effectiveness with the Observational Medical Outcomes Partnership

F. FitzHenry[1,2]; F.S. Resnic[3]; S.L. Robbins[3]; J. Denton[1,4]; L. Nookala[1,4]; D. Meeker[5]; L. Ohno-Machado[6]; M.E. Matheny[1,2,4,7]

OHDSI ongoing collaborative activities

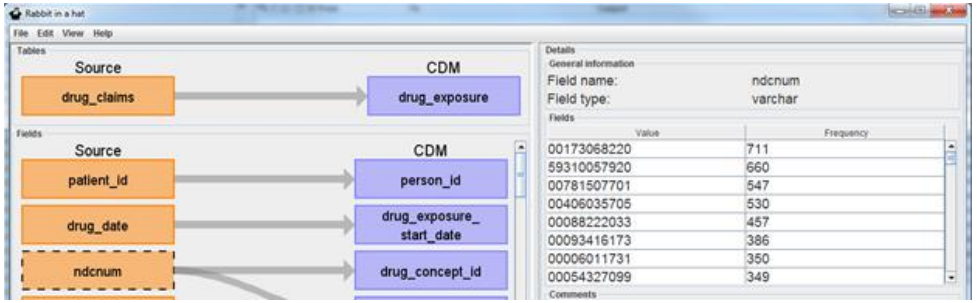


Observational data management

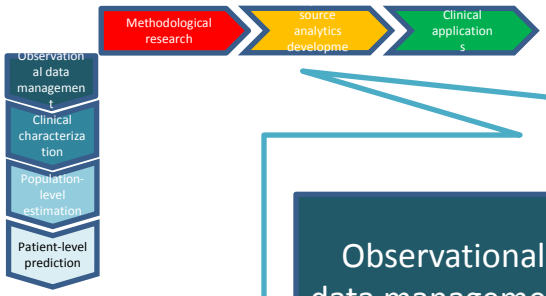
Methodological research

Open-source analytics development

OHDSI Community Booth:
ETL 101



OHDSI ongoing collaborative activities



Observational data management

Open-source analytics development

OHDSI Community Booth:
ATHENA for standardized vocabularies

ATHENA Download Page
Standardized Vocabularies for OMOP CDM

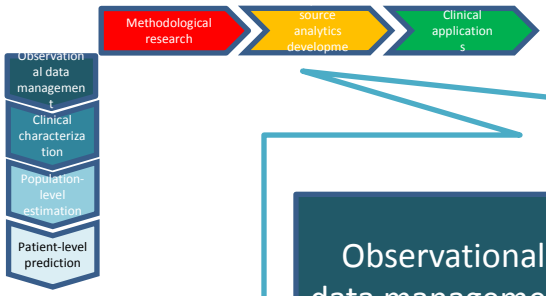
Fill out the form, pick the required vocabularies and select the right version

E-mail * :
Your name * :
Title:
Organization * :
Address * :
City * :
Country * : State: Zip:
Phone * :
CDM Version * : V4.5 V5

Select vocabularies * :

Vocabulary ID (CDM V4.5)	Vocabulary code (CDM V5)	VOCABULARY NAME	Available	Latest update
71	ABMS	Provider Specialty (American Board of Medical Specialties)		
1	SNOMED	Systematic Nomenclature of Medicine - Clinical Terms (IHDSTO)		31-JAN-15
2	ICD9CM	International Classification of Diseases, Ninth Revision, Clinical Modification, Volume 1 and 2 (NCHS)		01-OCT-14
3	ICD9Proc	International Classification of Diseases, Ninth Revision, Clinical Modification, Volume 3 (NCHS)		01-OCT-14
4	CPT4	Current Procedural Terminology version 4 (AMA)	EULA required	10-OCT-14
5	HCPCS	Healthcare Common Procedure Coding System (CMS)		12-NOV-14
6	LOINC	Logical Observation Identifiers Names and Codes (Regenstrief Institute)		29-JUN-15
7	NDFRT	National Drug File - Reference Terminology (VA)		06-JUL-15

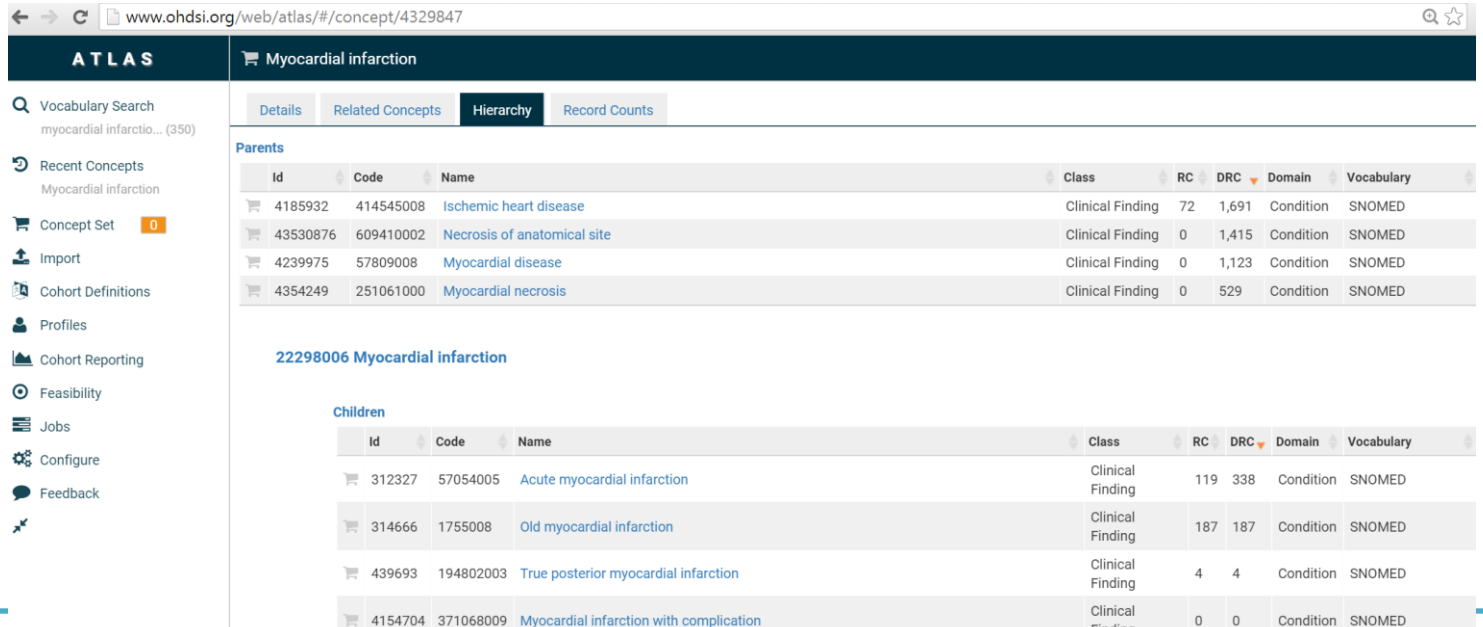
OHDSI ongoing collaborative activities



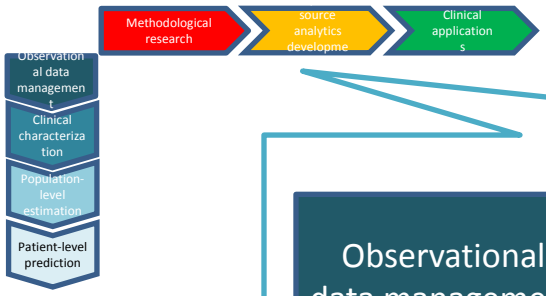
Observational data management

Open-source analytics development

Open-source analytic demo:
HERMES for vocabulary exploration



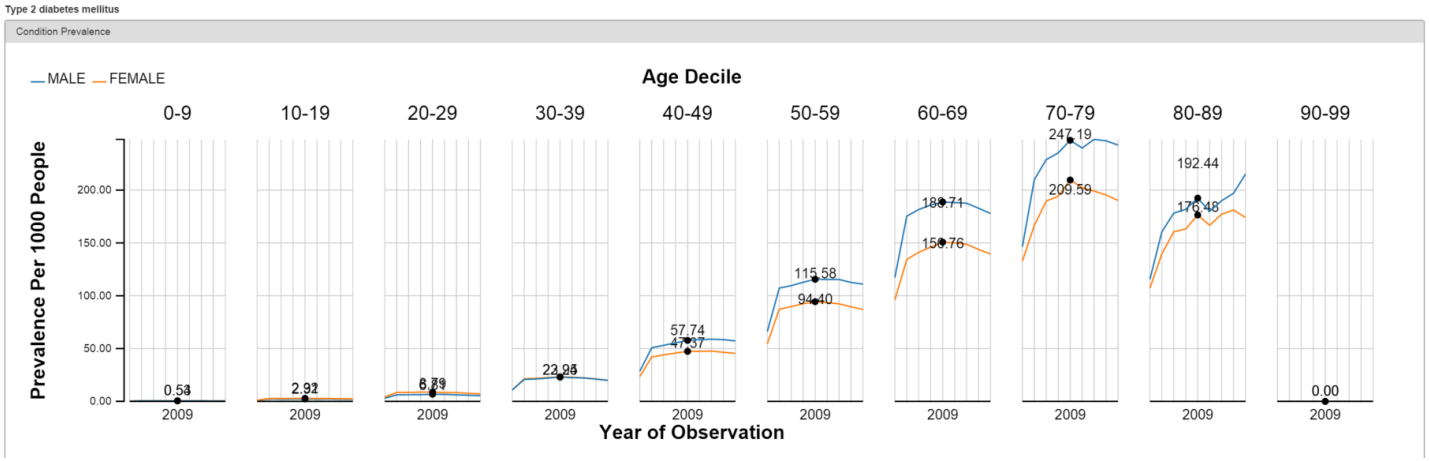
OHDSI ongoing collaborative activities



Observational data management

Open-source analytics development

Open-source analytic demo: ACHILLES for database profiling



OHDSI ongoing collaborative activities

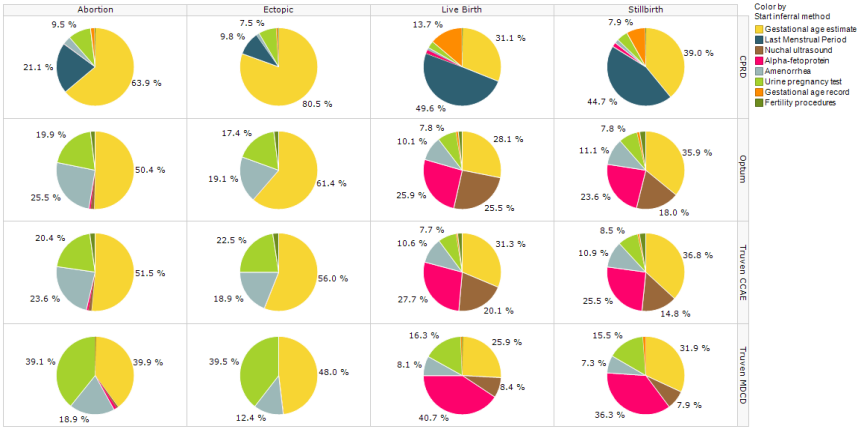
Observational data management

Clinical applications

Poster:

Determination of Pregnancy Episodes and Outcomes within a Distributed Network of Observational Databases

Figure 1: Distribution of pregnancy start inferral method utilization by data source and pregnancy outcome



OHDSI ongoing collaborative activities

Clinical characterization

Methodological research

Poster:
Size comparison of 17 CDM datasets using IRIS tool

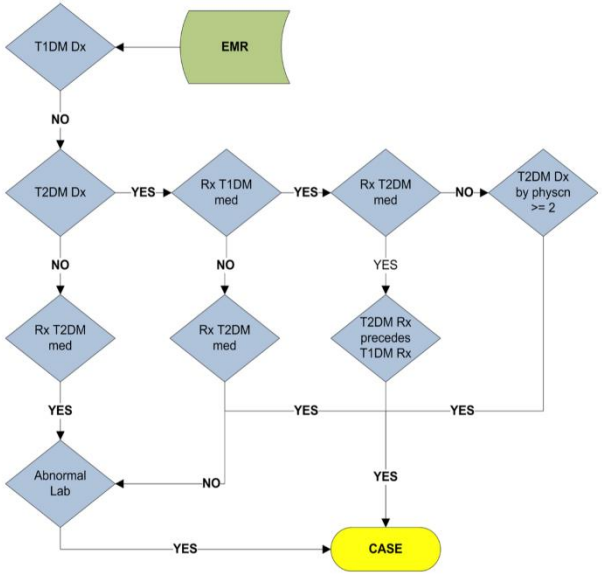
MEASURE	RESULT	EXPLANATION
G1	141,805,491	count of patients
G2	20,328,289,601	count of events
D2	90,024,522	count of patients with at least 1 Dx and 1 Rx
D3	112,148,500	count of patients with at least 1 Dx and 1 Proc
D4	5,939,621	count of patients with at least 1 Obs, 1 Dx and 1 Rx
D5	277,975	count of deceased patients

OHDSI ongoing collaborative activities

Clinical characterization

Methodological research

Poster:
Lessons from CIRCE implementation of eMERGE phenotype definitions into actionable CDM v5 SQL queries

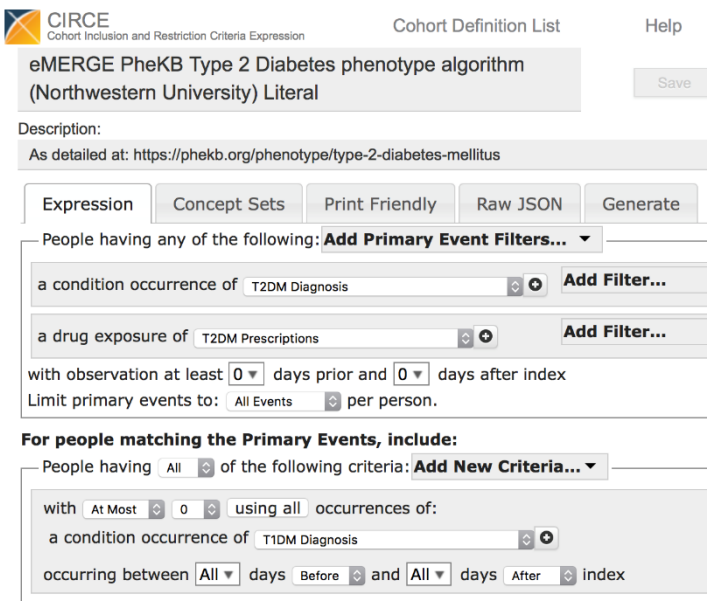


OHDSI ongoing collaborative activities

Clinical characterization

Open-source analytics development

Open-source analytics demos:
CIRCE for cohort definition
CALYPSO for feasibility assessment

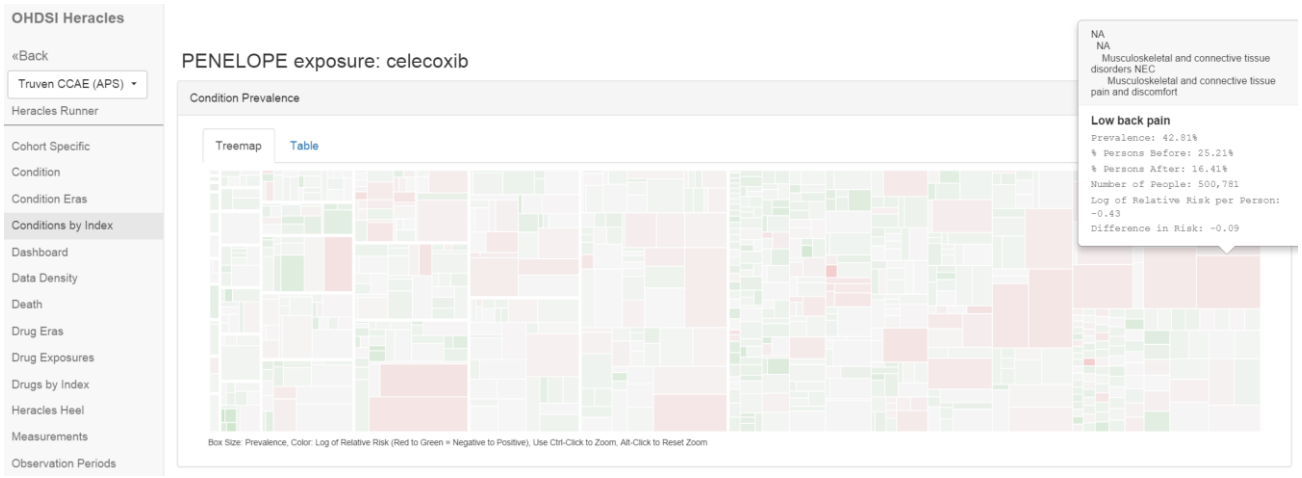


OHDSI ongoing collaborative activities

Clinical characterization

Open-source analytics development

Open-source analytics demos: HERACLES for cohort characterization



OHDSI ongoing collaborative activities

Clinical characterization

Clinical applications

Poster:
Exploration of the Epidemiology of Endometriosis

Endometriosis

A disorder in which tissue that normally lines the uterus grows outside the uterus.

Very common

More than 3 million US cases per year

- Treatable by a medical professional
- Requires a medical diagnosis
- Lab tests or imaging often required
- Chronic: can last for years or be lifelong

With endometriosis, the tissue can be found on the ovaries, fallopian tubes or the intestines.

The most common symptoms are pain and menstrual irregularities.

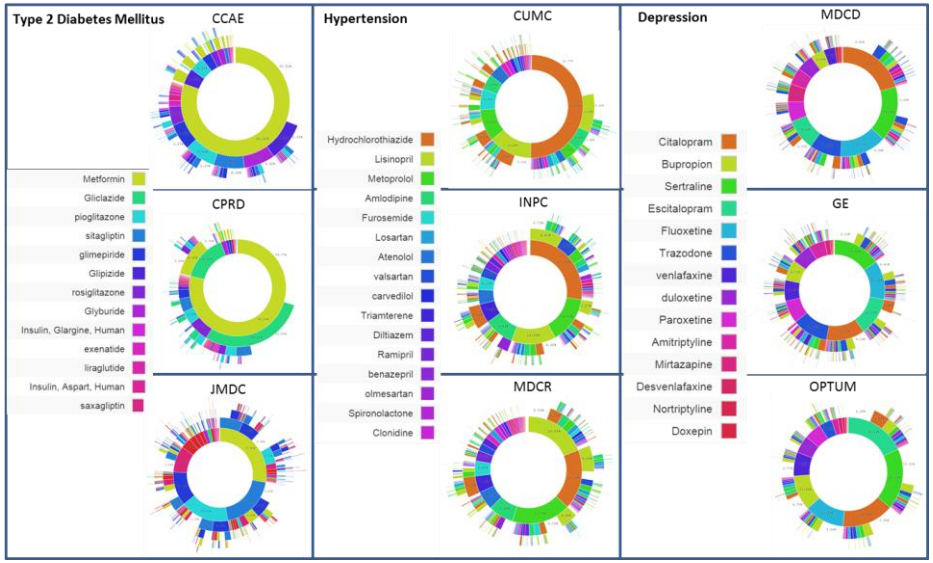
Effective treatments, such as hormones and excision surgery, are available.

OHDSI ongoing collaborative activities

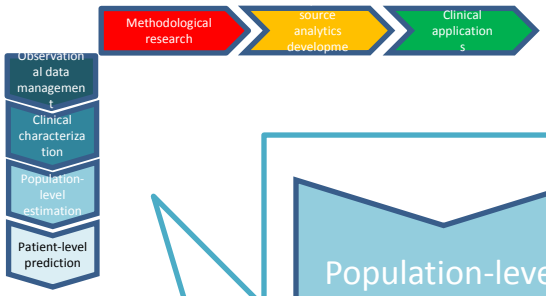
Clinical characterization

Clinical applications

Presentation:
Treatment pathways in chronic disease



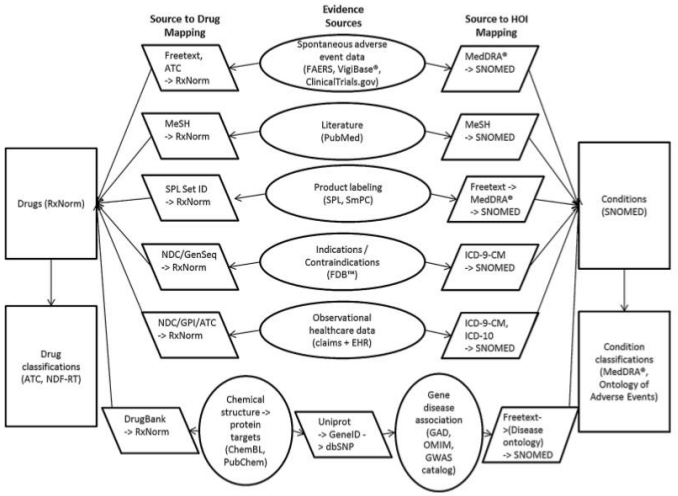
OHDSI ongoing collaborative activities



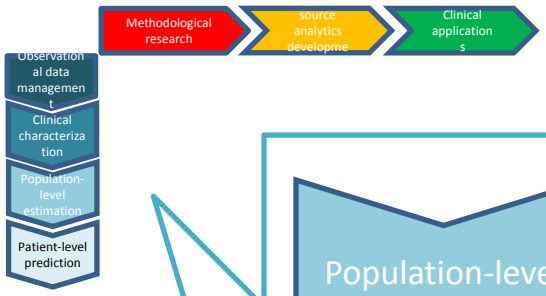
Population-level estimation

Methodological research

Open-source analytic demo:
LAERTES for evidence integration



OHDSI ongoing collaborative activities

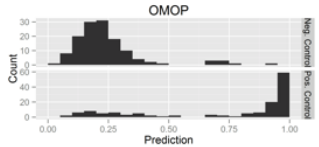


Population-level estimation

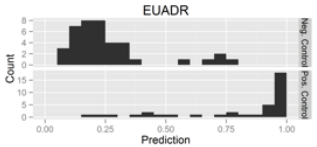
Methodological research

Poster:
Accuracy of an Automated Knowledgebase for Identifying Adverse Drug Reactions

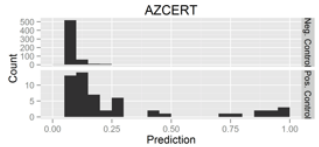
Figure 1. Histograms of predicted probabilities with AUCs for positive/negative controls in the various reference sets, using the model trained on both OMOP and EU-ADR ref. set.



AUC = 0.87 (0.83-0.92)



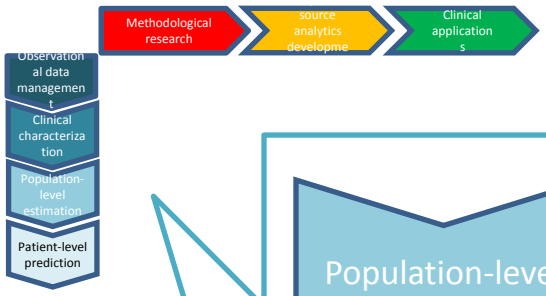
AUC = 0.95 (0.90-0.99)



AUC = 0.86 (0.79-0.93)

OMOP: Observational Medical Outcomes Partnership, EU-ADR: Exploring and Understanding Adverse Drug Reactions, AUC: area under the curve

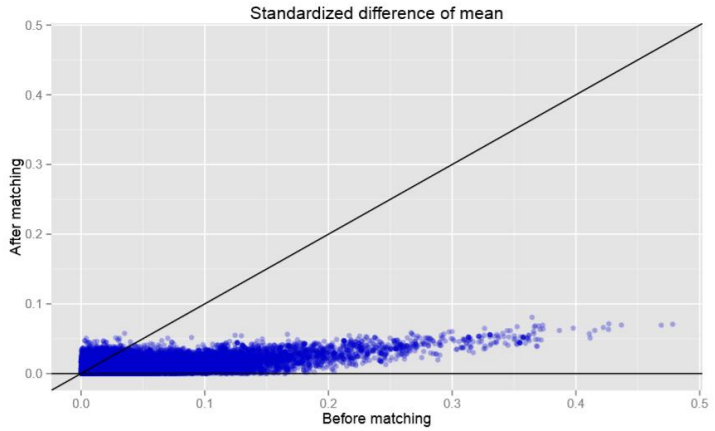
OHDSI ongoing collaborative activities



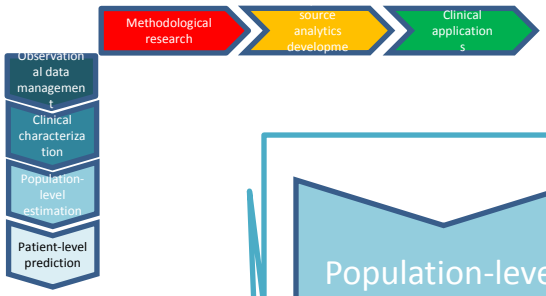
Population-level estimation

Methodological research

Poster:
How high can we go? Evaluating massively high-dimensional propensity score and outcome models in large-scale observational studies

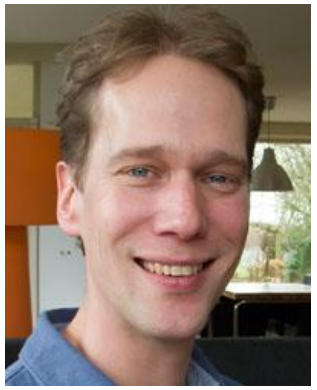


OHDSI ongoing collaborative activities



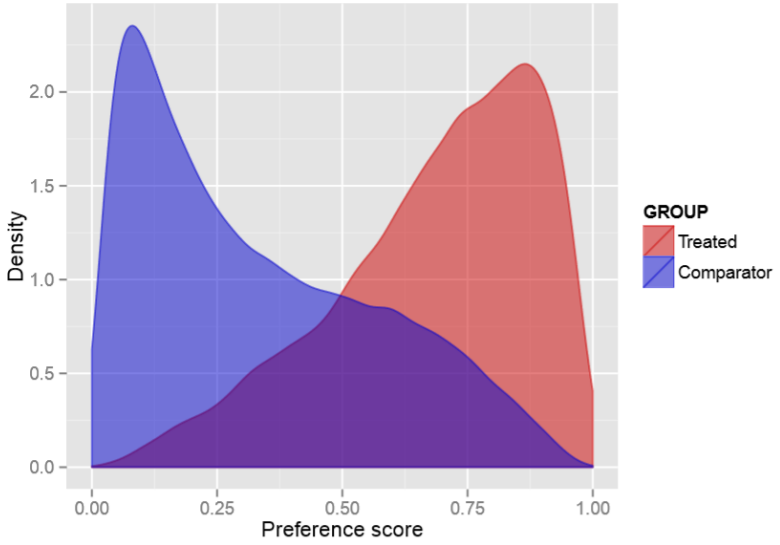
Population-level estimation

Open-source analytics development

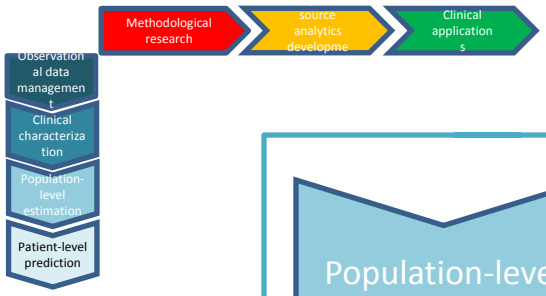


Open-source analytics demos:

Cohort Method
Self-controlled case series
Empirical calibration



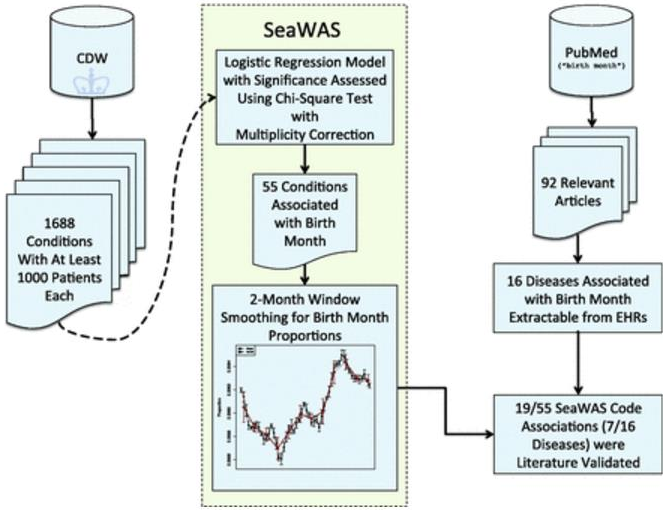
OHDSI ongoing collaborative activities



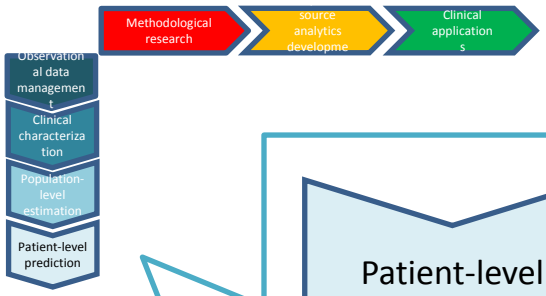
Population-level estimation

Clinical applications

Poster:
A Climate-Wide Journey to Explore Mechanisms Underlying Birth Month Disease Risk Associations



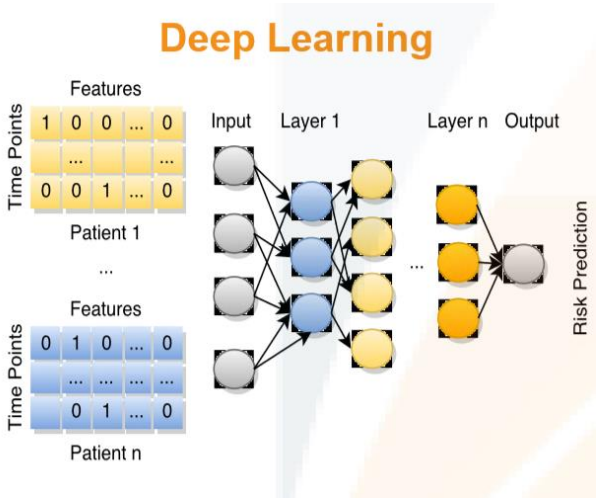
OHDSI ongoing collaborative activities



Patient-level prediction

Methodological research

Poster:
Discovering the hidden risk factors: An empirical evaluation of incorporating feature-learning methods into a risk model framework using the OMOP CDM



OHDSI ongoing collaborative activities

Patient-level prediction

Open-source analytics development

Open-source analytic demo: APHRODITE for predictive phenotyping

Package 'Aphrodite'

October 15, 2015

Type Package

Title Automated PHenotype Routine for Observational Definition Identification Training and Evaluation (APHRODITE) - Phenotype building tool using Fuzzy labels

Version 1.2

Date 2015-09-21

Author Juan M. Banda [aut, cre],
Kate Niehaus [aut],
Marc A. Suchard [aut],
Martijn J. Schuemie [aut]

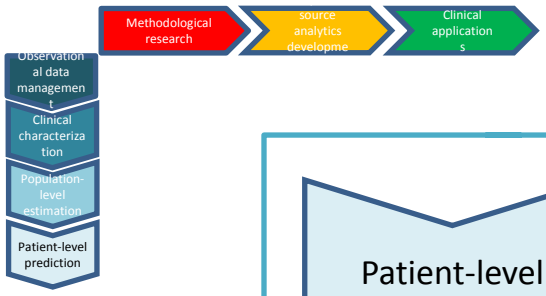
Maintainer Juan M. Banda <jmbanda@stanford.edu>

Description Aphrodite uses noisy class labels to create silver standard training corpora to construct phenotype models in conjunction with expert knowledge codified in existing ontologies and a comprehensive representation of the patient clinical record to learn phenotype models.

License Apache License 2.0 | file LICENSE

Depends R (>= 3.1.0),
data.table

OHDSI ongoing collaborative activities



Patient-level prediction

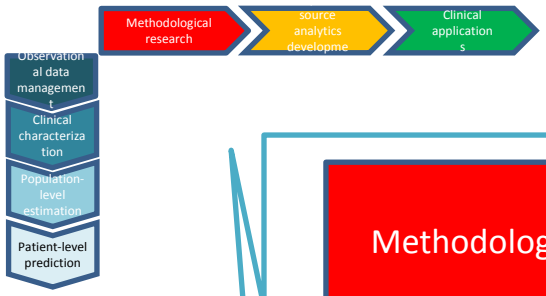
Clinical applications

Poster:
Lift your Anchors and Begin the OHDSI with APHRODITE

Abdominal pain	Cerebrovascular accident	Kidney stone
Alcoholism	Diabetes	Laceration
Allergic reaction	Deep vein thrombosis	Liver (history)
Ankle fracture	Employee exposure	Motor Vehicle Accident
Anticoagulated	Epistaxis	From nursing home
asthma/copd	Gastroenteritis	Pancreatitis
Back pain	Gastrointestinal bleed	Pneumonia
Bicycle accident	Geriatric fall	Psych
Cancer	Headache	Obstruction
Cardiac etiology	Hematuria	Septic shock
Cellulitis	Hiv+	Severe sepsis
Chest pain	Intracerebral hemorrhage	Sexual assault
Congestive heart failure	Immunosuppressed	Suicidal ideation
Cholecystitis	Infection	Syncope
		Urinary tract infection

Figure 1: (Left) Phenotypes currently being identified in real-time at BIDMC. (Right) Display screen where one of the phenotypes has been used to recommend a pathway of care.

OHDSI ongoing collaborative activities



Methodological research

Open-source analytics development

Clinical applications

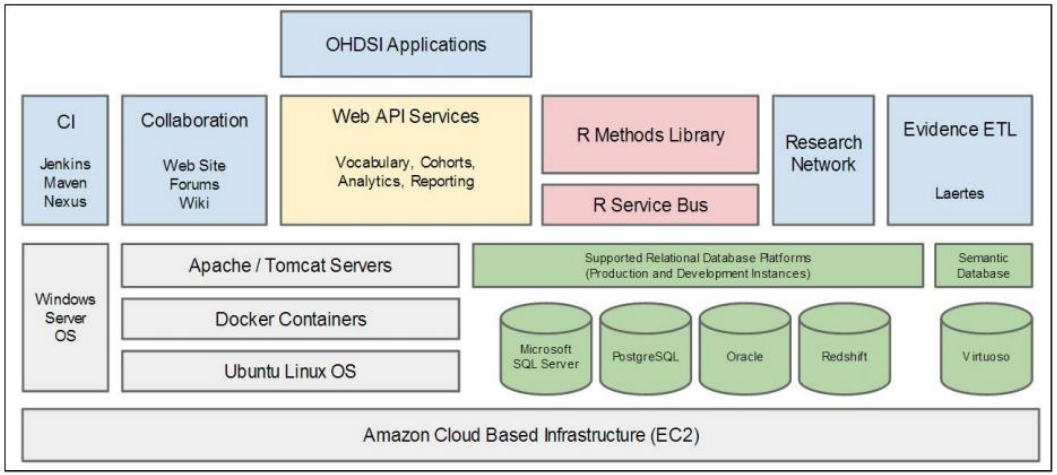
Observational data management

Clinical characterization

Population-level estimation

Patient-level prediction

Poster:
OHDSI Cloud Architecture



OHDSI commercial ecosystem

OutcomesInsights

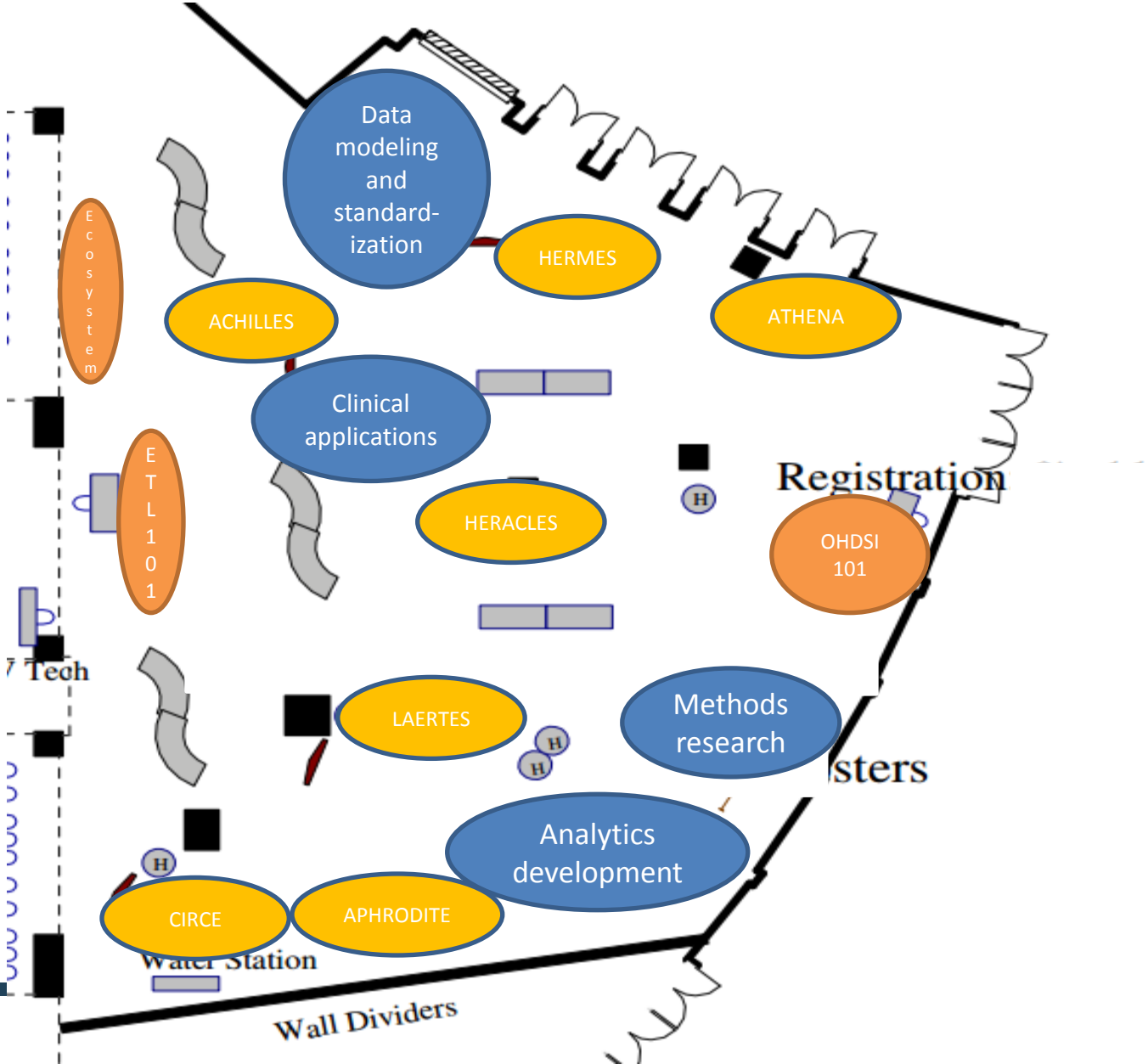
Signet Accel
True interoperability
realized in healthcare.

Ephir Inc.
Insights from Data

B2i

LTS Computing LLC

Journey through the OHDSI collaborator showcase



Panel Discussion – Experiences from the OHDSI international data network

Panel Discussion – The Value and Challenges of Evidence from Observational Data: A Multi-Stakeholder Perspective

- Moderator: David Madigan, PhD, Executive Vice President and Dean of the Faculty of Arts and Sciences at Columbia University
- Robert Ball, MD, MPH, ScM, Deputy Director – Office of Surveillance and Epidemiology, CDER, US Food and Drug Administration
- Invited: Robert Califf, MD, Deputy Commissioner of Medical Products and Tobacco, US Food and Drug Administration
- Nareesa Mohammed-Rajput, MD, Medical Director of Clinical Informatics, Suburban Hospital part of Johns Hopkins Medicine
- Maryan Zirkle MD, MS, MA, Program Officer – CER Methods and Infrastructure Program, PCORI
- Lesley Wise, Vice President of PV Risk Management and Pharmacoepidemiology, Takeda Pharmaceuticals

Future of OHDSI

This is your journey….

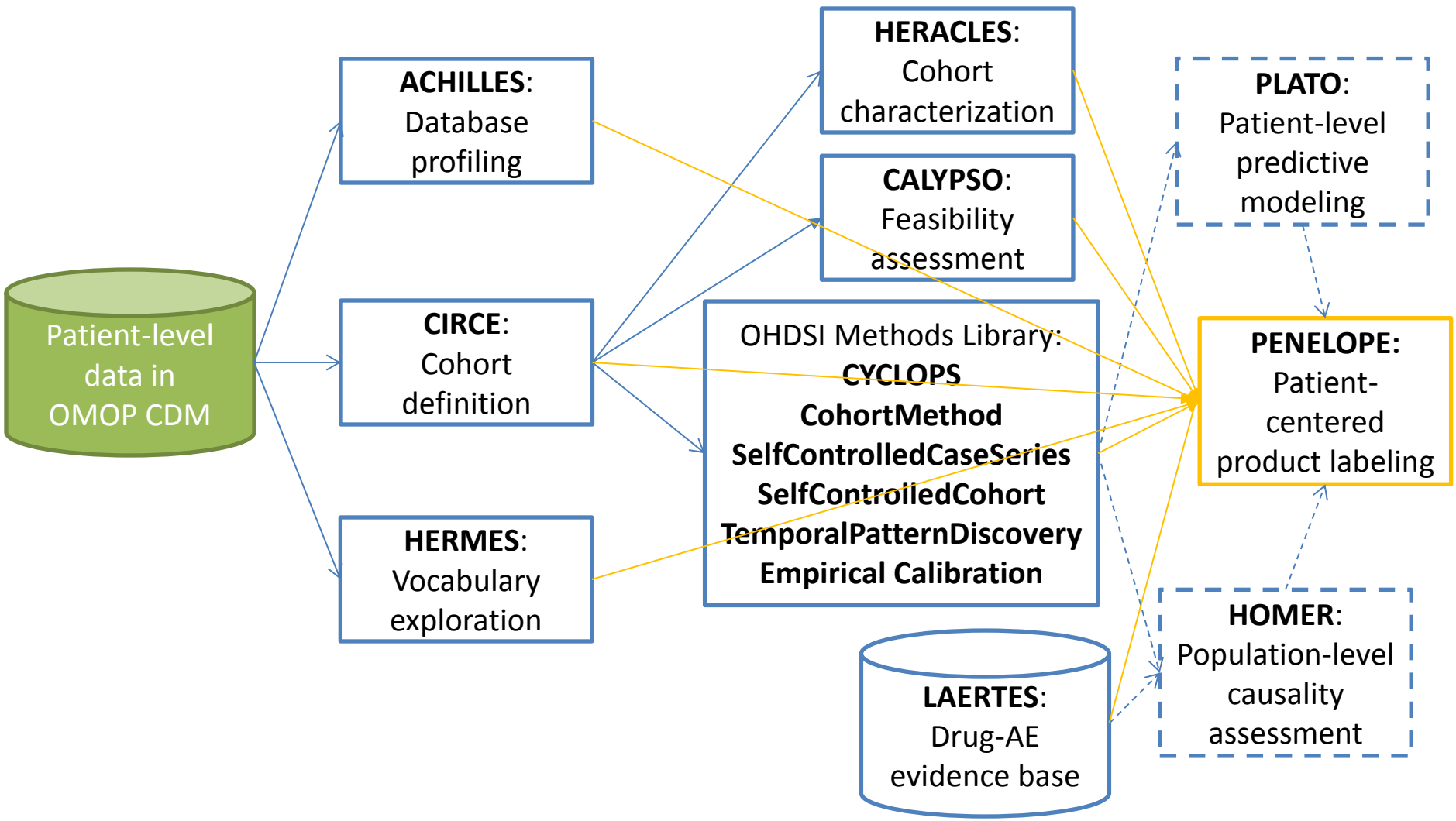
….where do we go from here?

I asked you to participate…

https://www.surveymonkey.com/r/59GTY6X

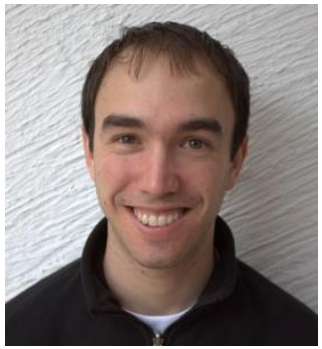
Let’s generate some evidence…

Standardized large-scale analytics tools under development within OHDSI



http://github.com/OHDSI

Thank you OHDSI Symposium Organizing Committee



David Sontag
NYU

Chunhua Weng
Columbia University

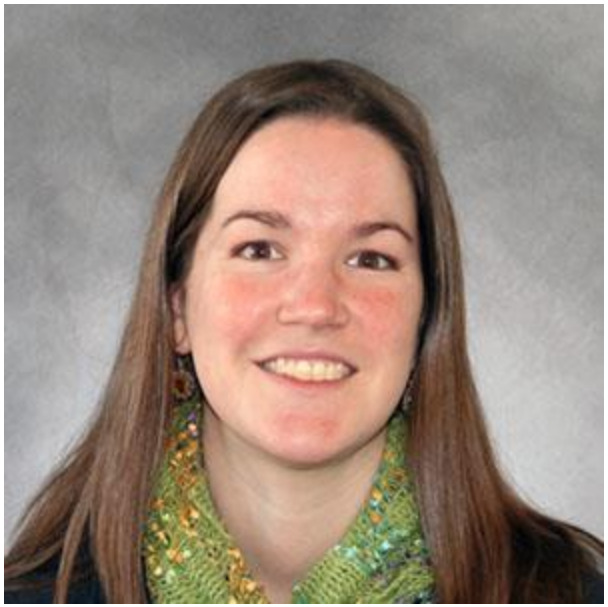
Jon Duke
Regenstrief

Ana Szarfman
FDA

Charlie Bailey
CHOP

Gregory Fusco
Takeda

Thank you Maura Beaton



Join the journey

Interested in OHDSI?

Questions or comments?

Contact:

ryan@ohdsi.org