Observational Health Data Sciences and Informatics (OHDSI): An International Network for Open Science and Data Analytics in Healthcare

Patrick Ryan, PhD
Janssen Research and Development
Columbia University Medical Center
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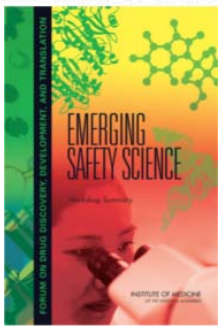
Odyssey (*noun*): \oh-d-si\

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

A journey to OHDSI

INSTITUTE OF MEDICINE



eu-adr

edmforum
knowledge inspiring health

OBSERVATIONAL
MEDICAL
OUTCOMES
PARTNERSHIP

AHRQ

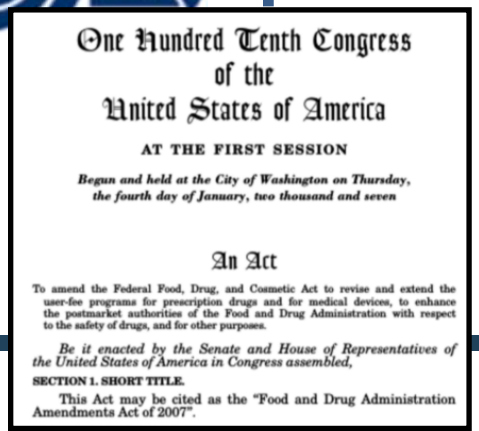
SAFTINet
Informing Practice Improving Care

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

What's the core problem?

We have lots of DATA we'd like to learn from…

….and very little EVIDENCE we can actually trust

Why large-scale analysis is needed in healthcare

All health outcomes of interest

All drugs

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

OHDSI's mission

To improve health, by empowering a community to collaboratively generate the evidence that promotes better health decisions and better care.

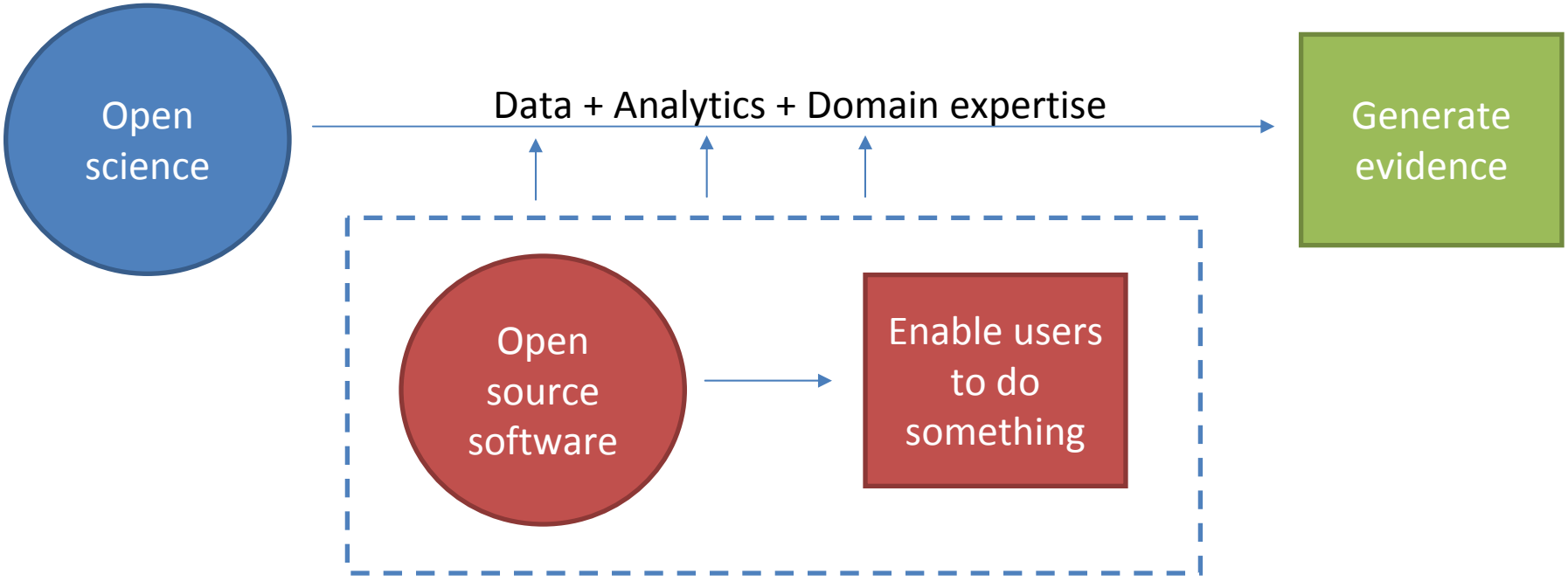
What evidence does OHDSI seek to generate from observational data?

- 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's approach to open science



- Open science is about sharing the journey to evidence generation
- Open-source software can be part of the journey, but it's not a final destination
- Open processes can enhance the journey through improved reproducibility of research and expanded adoption of scientific best practices

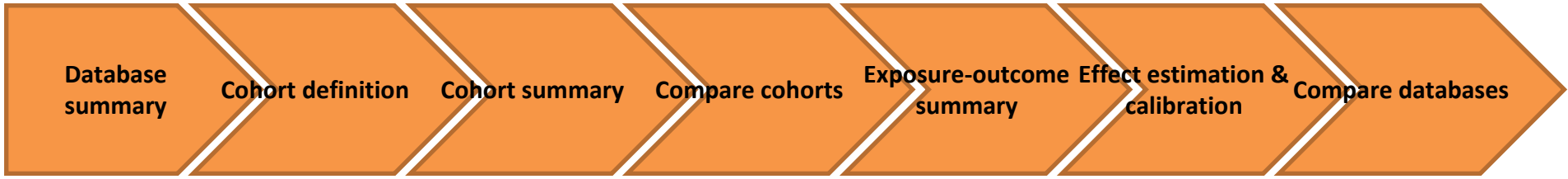
Standardizing workflows to enable reproducible research

Open science

Population-level estimation for comparative effectiveness research:

Is <intervention X> better than <intervention Y> in reducing the risk of <condition Z>?

Generate evidence



Defined inputs:

- Target exposure
- Comparator group
- Outcome
- Time-at-risk
- Model specification

Consistent outputs:

- analysis specifications for transparency and reproducibility (protocol + source code)
- only aggregate summary statistics (no patient-level data)
- model diagnostics to evaluate accuracy
- results as evidence to be disseminated
  - static for reporting (e.g. via publication)
  - interactive for exploration (e.g. via app)

OHDSI community in action

OHDSI Collaborators:

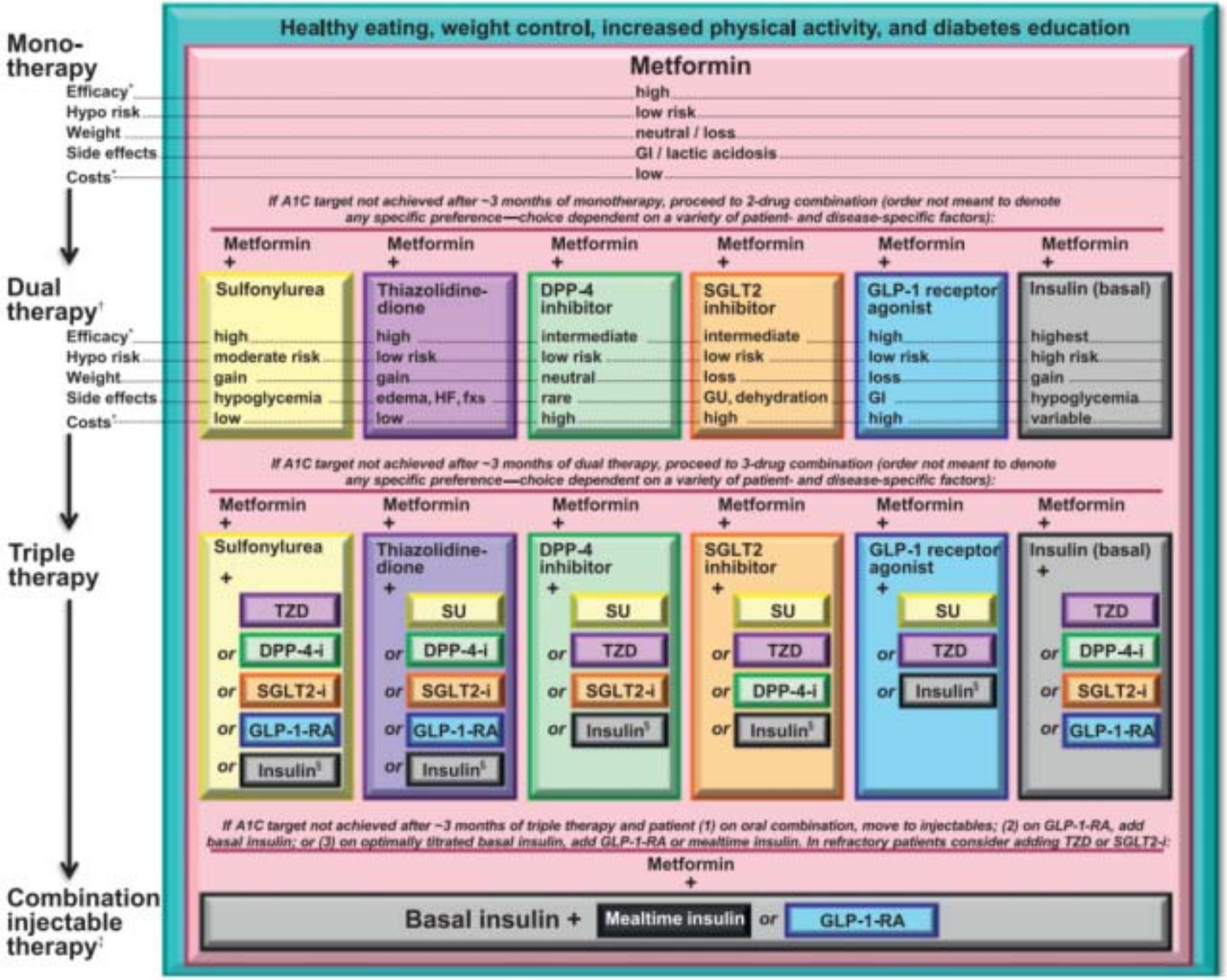
- >140 researchers in academia, industry, government, health systems
- >20 countries
- Multi-disciplinary expertise: epidemiology, statistics, medical informatics, computer science, machine learning, clinical sciences

Standardized process for network analyses:

Community:

Ask clinical question → Design protocol → Develop standardized analytics → Generate and disseminate evidence

ADA T2DM Guidelines, 2015



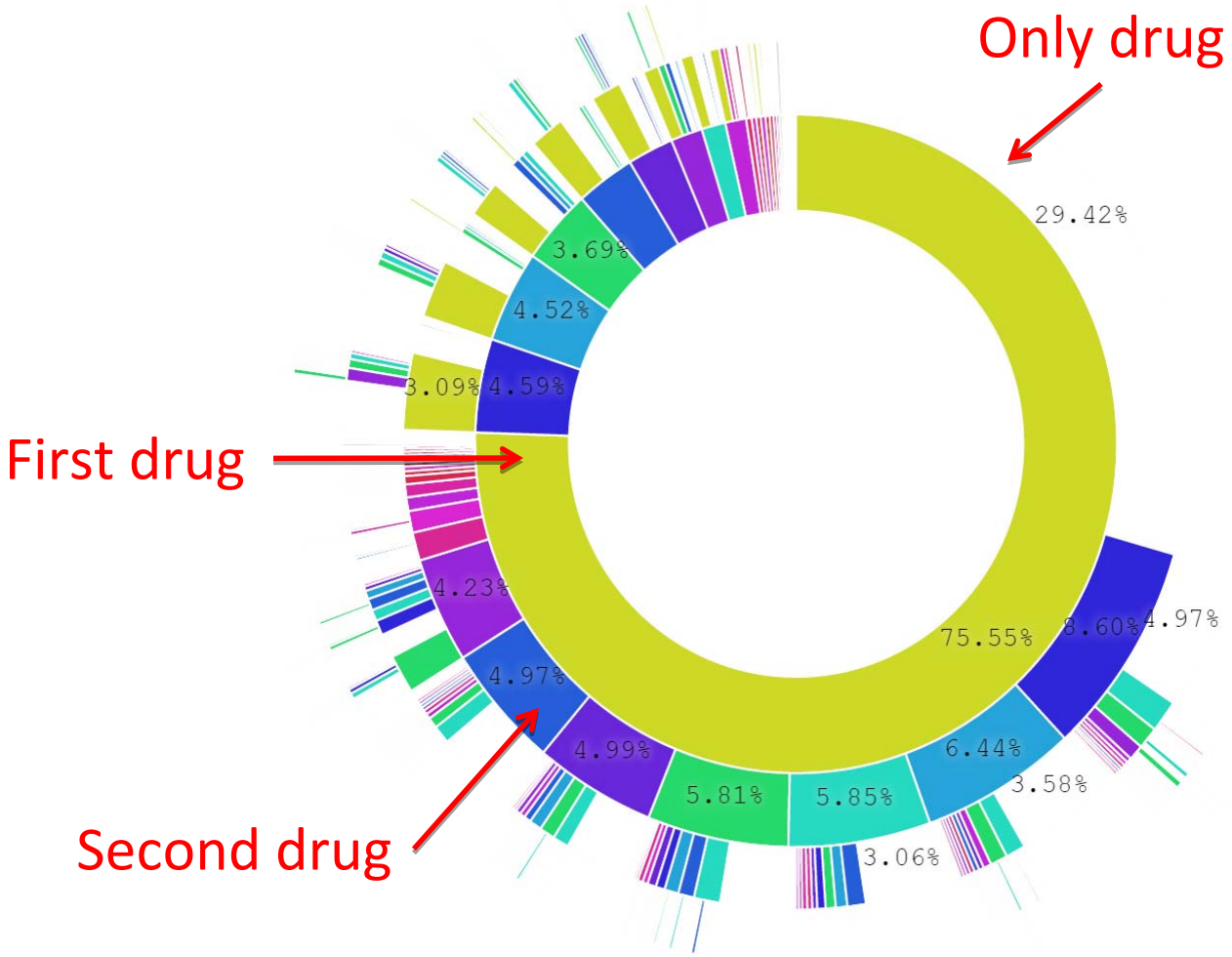
OHDSI participating data partners

Code	Name	Description	Size (M)
AUSOM	Ajou University School of Medicine	South Korea; inpatient hospital EHR	2
CCAE	MarketScan Commercial Claims and Encounters	US private-payer claims	119
CPRD	UK Clinical Practice Research Datalink	UK; EHR from general practice	11
CUMC	Columbia University Medical Center	US; inpatient EHR	4
GE	GE Centricity	US; outpatient EHR	33
INPC	Regenstrief Institute, Indiana Network for Patient Care	US; integrated health exchange	15
JMDC	Japan Medical Data Center	Japan; private-payer claims	3
MDCD	MarketScan Medicaid Multi-State	US; public-payer claims	17
MDCR	MarketScan Medicare Supplemental and Coordination of Benefits	US; private and public-payer claims	9
OPTUM	Optum ClinFormatics	US; private-payer claims	40
STRIDE	Stanford Translational Research Integrated Database Environment	US; inpatient EHR	2
HKU	Hong Kong University	Hong Kong; EHR	1

Hripcsak et al, PNAS, in press

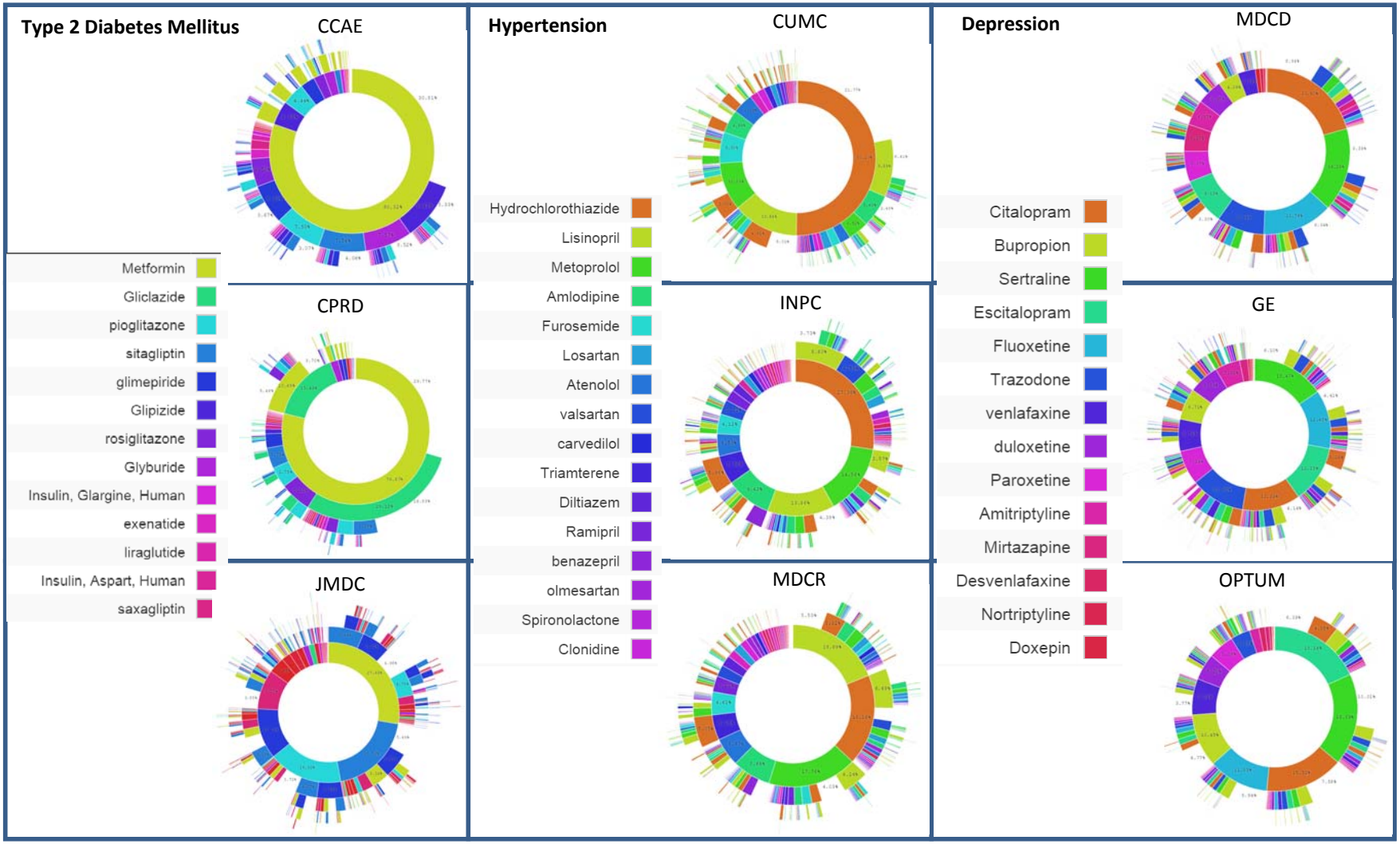
Treatment pathways for diabetes

T2DM : All databases



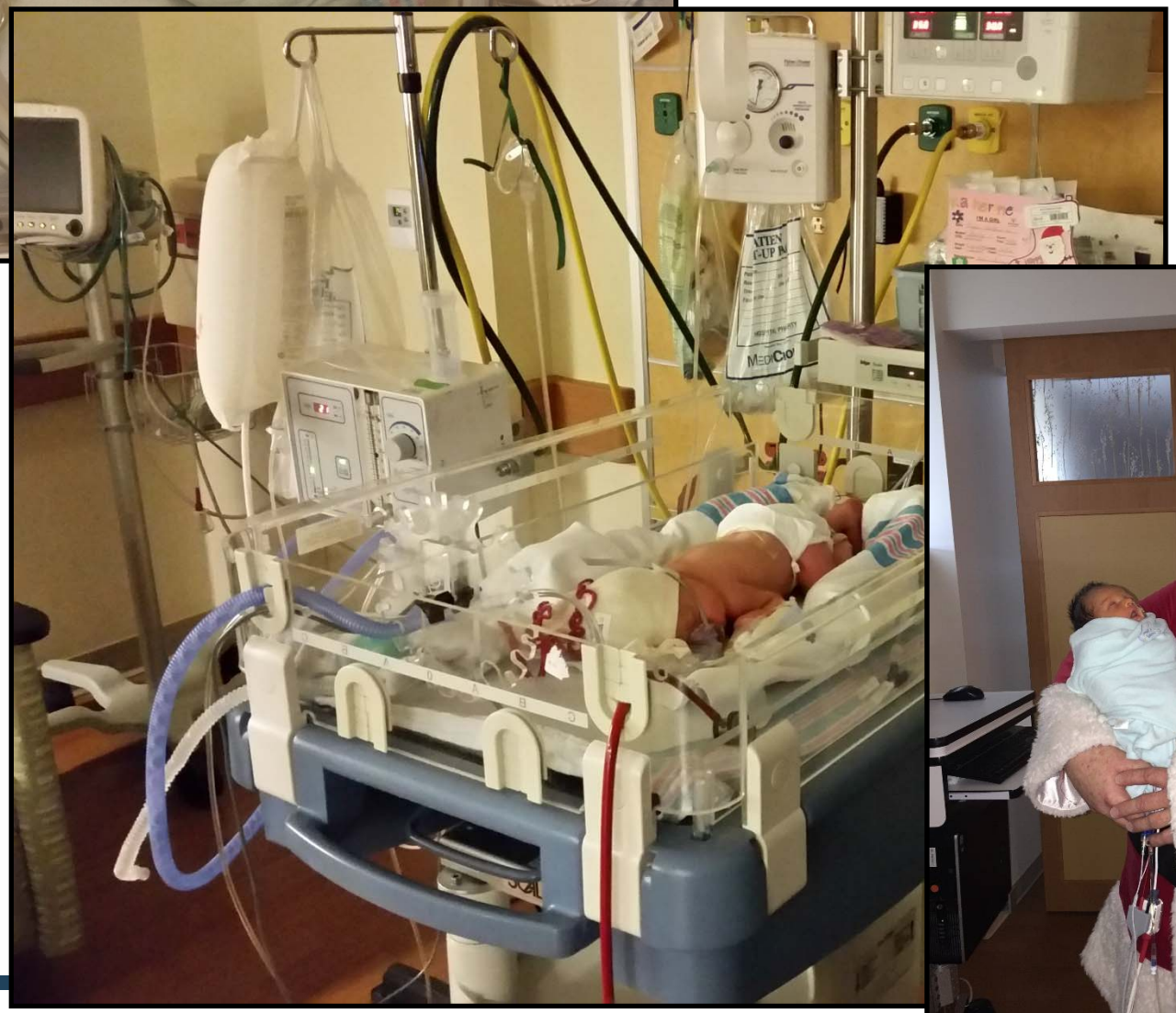
Hripcsak et al, PNAS, in press

Population-level heterogeneity



Hripcsak et al, PNAS, in press


PUSH



Indication
Synagis® (palivizumab) is a prescription medication that is used to help prevent a serious lung disease caused by respiratory syncytial virus (RSV) in children at high risk for severe lung disease from RSV.

Select Safety Information
Common side effects of Synagis include fever and rash. Other possible side effects include skin reactions around the area where the shot was given (like redness, swelling, warmth, or discomfort).

Please see complete Important Safety Information on pages 22-24 and accompanying full Prescribing Information, including Patient Information.

Doctor X: “This paper says there’s side effects, but I’ve never seen them happen”

SYNAGIS- palivizumab injection, solution
MedImmune, LLC

HIGHLIGHTS OF PRESCRIBING INFORMATION
These highlights do not include all the information needed to use SYNAGIS safely and effectively. See full prescribing information for SYNAGIS.
SYNAGIS® (palivizumab) injection, for intramuscular use
Initial U.S. Approval: 1998

INDICATIONS AND USAGE

Synagis is a respiratory syncytial virus (RSV) F protein inhibitor monoclonal antibody indicated for the prevention of serious lower respiratory tract disease caused by RSV in children at high risk of RSV disease.

- Safety and efficacy were established in children with bronchopulmonary dysplasia (BPD), infants with a history of premature birth (less than or equal to 35 weeks gestational age), and children with hemodynamically significant congenital heart disease (CHD).
- The safety and efficacy of Synagis have not been established for treatment of RSV disease. (1)

DOSAGE AND ADMINISTRATION

15 mg per kg of body weight, administered intramuscularly prior to commencement of the RSV season and remaining doses administered monthly throughout the RSV season. (2.1)
Children undergoing cardio-pulmonary bypass should receive an additional dose of Synagis as soon as possible after the cardio-pulmonary bypass procedure (even if sooner than a month from the previous dose). Thereafter, doses should be administered monthly as scheduled. (2.1, 12.3)

DOSAGE FORMS AND STRENGTHS

Single-dose liquid solution vials: 50 mg per 0.5 mL and 100 mg per 1 mL. (3)

CONTRAINDICATIONS

Previous significant hypersensitivity reaction to Synagis. (4)

WARNINGS AND PRECAUTIONS

- Anaphylaxis and anaphylactic shock (including fatal cases), and other severe acute hypersensitivity reactions have been reported. Permanently discontinue Synagis and administer appropriate medications if such reactions occur. (5.1)
- As with any intramuscular injection, Synagis should be given with caution to children with thrombocytopenia or any coagulation disorder. (5.2)
- Palivizumab may interfere with immunological-based RSV diagnostic tests such as some antigen detection-based assays. (5.3, 12.4)

ADVERSE REACTIONS

Adverse reactions occurring greater than or equal to 10% and at least 1% more frequently than placebo are fever and rash. (6.1)

Pediatric patients across US observational databases

source	age group (at database entry)	persons	avg years of observation
CCAE	1. newborn 0 to 27d	3,360,896	2.23
MDCD	1. newborn 0 to 27d	1,862,651	1.74
Optum	1. newborn 0 to 27d	1,473,940	1.82
CCAE	2. infant and toddler 28d to 23mo	3,275,604	2.34
MDCD	2. infant and toddler 28d to 23mo	1,379,760	1.70
Optum	2. infant and toddler 28d to 23mo	963,770	1.97
CCAE	3. children 2 to 11 yo	14,904,293	2.46
MDCD	3. children 2 to 11 yo	4,037,836	1.77
Optum	3. children 2 to 11 yo	4,951,888	2.18
CCAE	4. adolescants 12 to 18 yo	12,218,224	2.41
MDCD	4. adolescants 12 to 18 yo	2,565,515	1.57
Optum	4. adolescants 12 to 18 yo	3,805,609	2.23

Exploring palivizumab exposure and hypersensitivity in observational data

data source	age group (at time of exposure)	persons exposed	follow-up time (yrs)	persons with outcome	risk (events / 1000 persons); 95%CI
CCAE	1. newborn 0 to 27d	1839	4829	0	0 (0 - 2.59)
MDCD	1. newborn 0 to 27d	381	760	0	0 (0 - 12.41)
OPTUM	1. newborn 0 to 27d	2610	5916	1	0.38 (0 - 2.45)
CCAE	2. infant and toddler 28d to 23mo	42843	106320	27	0.63 (0.43 - 0.92)
MDCD	2. infant and toddler 28d to 23mo	19910	41196	17	0.85 (0.53 - 1.38)
OPTUM	2. infant and toddler 28d to 23mo	22365	48632	11	0.49 (0.27 - 0.9)
CCAE	3. children 2 to 11 yo	544	1525	1	1.84 (0 - 11.68)
MDCD	3. children 2 to 11 yo	265	706	0	0 (0 - 17.78)
OPTUM	3. children 2 to 11 yo	204	574	0	0 (0 - 23.01)
CCAE	4. adolescants 12 to 18 yo	38	93	0	0 (0 - 115.33)
MDCD	4. adolescants 12 to 18 yo	33	28	0	0 (0 - 131.21)
OPTUM	4. adolescants 12 to 18 yo	11	44	0	0 (0 - 334.22)

Back of the envelope:
Assuming CCAE+MDCD+OPTUM represents 10% of US and exposures are evenly distributed across ~1000 NICUs, doctor would have seen ~50 newborns with exposure... even if the true event rate was 1%, there's >60% chance they'd never see one case

OHDSI: what does it mean to me?

Where is there reliable data about the health of children?

Who are the children who are exposed to palivizumab?

Does palivizumab cause anaphylaxis in newborns?

Will my daughter be the one to develop anaphylaxis?

Concluding thoughts

- Observational databases can be a useful tool for generating evidence to important clinical questions in…
  - Clinical characterization
  - Population-level estimation
  - Patient-level prediction
- …but ensuring that evidence is reliable requires developing scientific best practices, and transparent and reproducible processes to conduct analyses across the research enterprise
- An open science community allows all stakeholders to contribute to and benefit from a shared solution…anyone can get involved…that mean's YOU!
- Every patient, caregiver, parent and child deserves to know what is known (and what remains uncertain) from the real-world experience of others in order to inform their medical decision-making

Join the journey

Interested in OHDSI?

Questions or comments?

ryan@ohdsi.org