Investigating treatment pathways

History of OHDSI and OMOP

- The Observational Medical Outcomes Partnership (OMOP) started in 2008
- Planned to be a five-year public/private partnership
- Created a framework for collaborative study in the growing set of EHR, federal, and commercial databases
- The primary goal for OMOP was to improve surveillance for adverse events related to drugs
- The primary barriers were related to the disparate data sources

History of OHDSI and OMOP

- The Observational Health Data Sciences and Informatics (OHDSI) program started in 2014
- Continuation of the mission of OMOP
- Updated the OMOP Common Data Model (CDM)
- Continues and expands OMOP's work
  - Updating terminology mappings
  - Supporting groups interested in research in observational health data
  - Creating new techniques and tools to assist in analysis of such data
  - Working together to study areas of interest
- OHDSI provides a suite of open source analytic tools designed to operate on the OMOP CDM

Role of the CDM

- In this study, the CDM allowed for easier collaboration among sites
- Code only had to be created once and can be run anywhere
- Sites did need to check performance locally to ensure comparable coding

Understanding treatment pathways

- Treatment for a particular condition can vary significantly over time
  - New drugs on the market
  - Discovery of biomarkers
  - Changing costs
- And at different institutions:
  - What is reimbursable?
  - Population differences
  - Institutional policies
  - Personal preferences

Who was involved?

- Ajou University School of Medicine
- MarketScan Commercial Claims and Encounters
- UK Clinical Practice Research Datalink
- Columbia University Medical Center
- General Electric Centricity
- Regenstrief Institute, Indiana Network for Patient Care
- Japan Medical Data Center
- MarketScan Medicaid Multi-State
- MarketScan Medicare Supplemental and Coordination of Benefits
- Optum Clinformatics
- Stanford Translational Research Integrated Database Environment

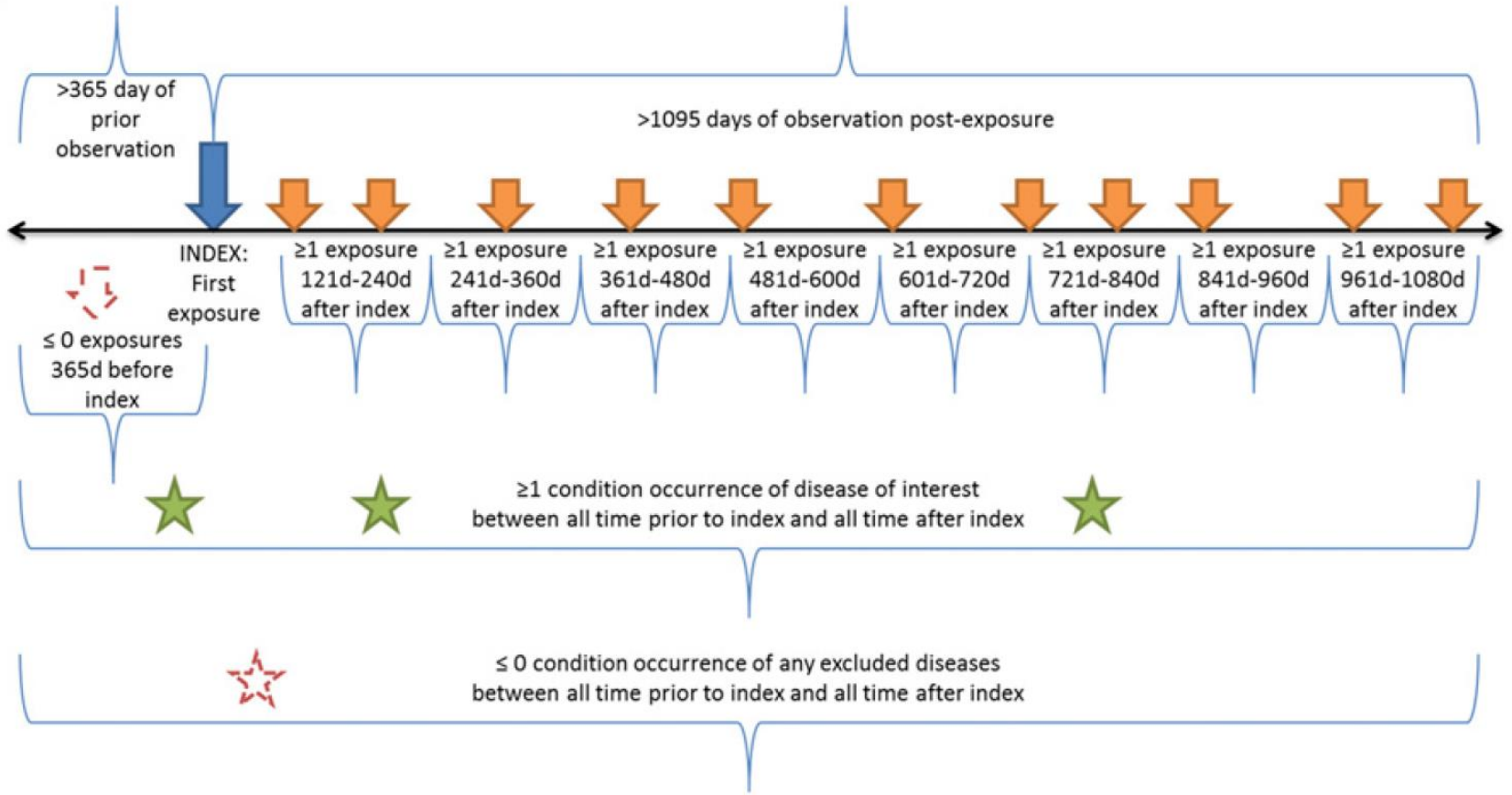
Diseases and Medications

- Studied three diseases, defined by SNOMED CT terms:
  - Hypertension
  - Type 2 Diabetes
  - Depression
- Each disease had an associated medication class as defined by the Anatomical Therapeutic Chemical (ATC) Classification System or First Databank (FDB):
  - Antihypertensives, diuretics, peripheral vasodilators, beta blocking agents, calcium channel blockers, agents acting on the renin-angiotensin system (ATC)
  - Drugs used in diabetes (ATC) or diabetic therapy (FDB)
  - Antidepresents (ATR or FDB)
- Some exclusions applied

Identifying individuals

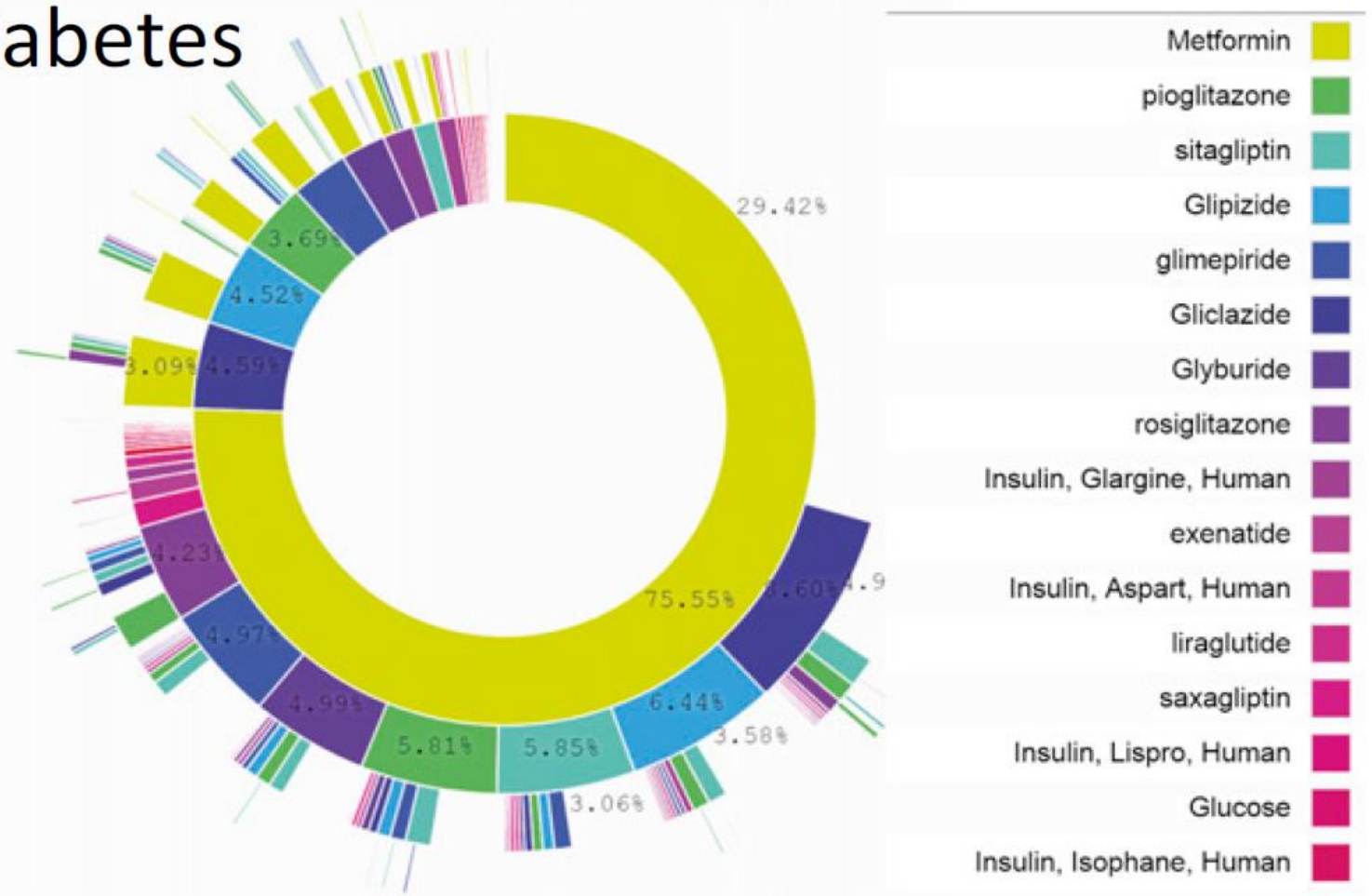
- Must have at least one disease and at least one matching medication.
- Must have at least 1 year of history before the first medication date
  - To increase the likelihood that this was a first treatment of the disease by any medication
- Must have at least 3 years of continuous treatment after the index date with some medication targeted to the disease
  - To ensure sufficient time to characterize a pathway

Identifying individuals

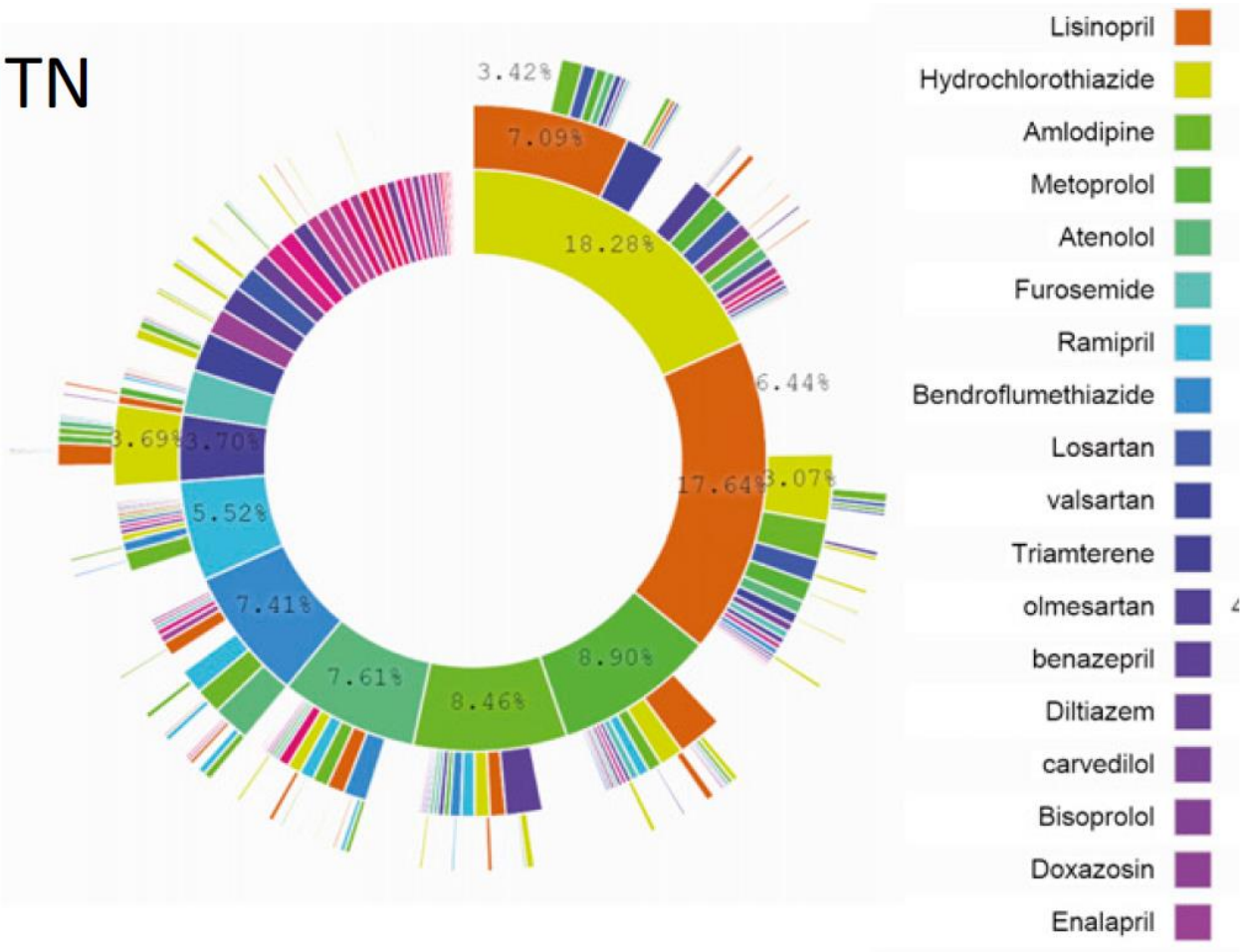


Overall treatment pathways

A Diabetes



B HTN


3.42%
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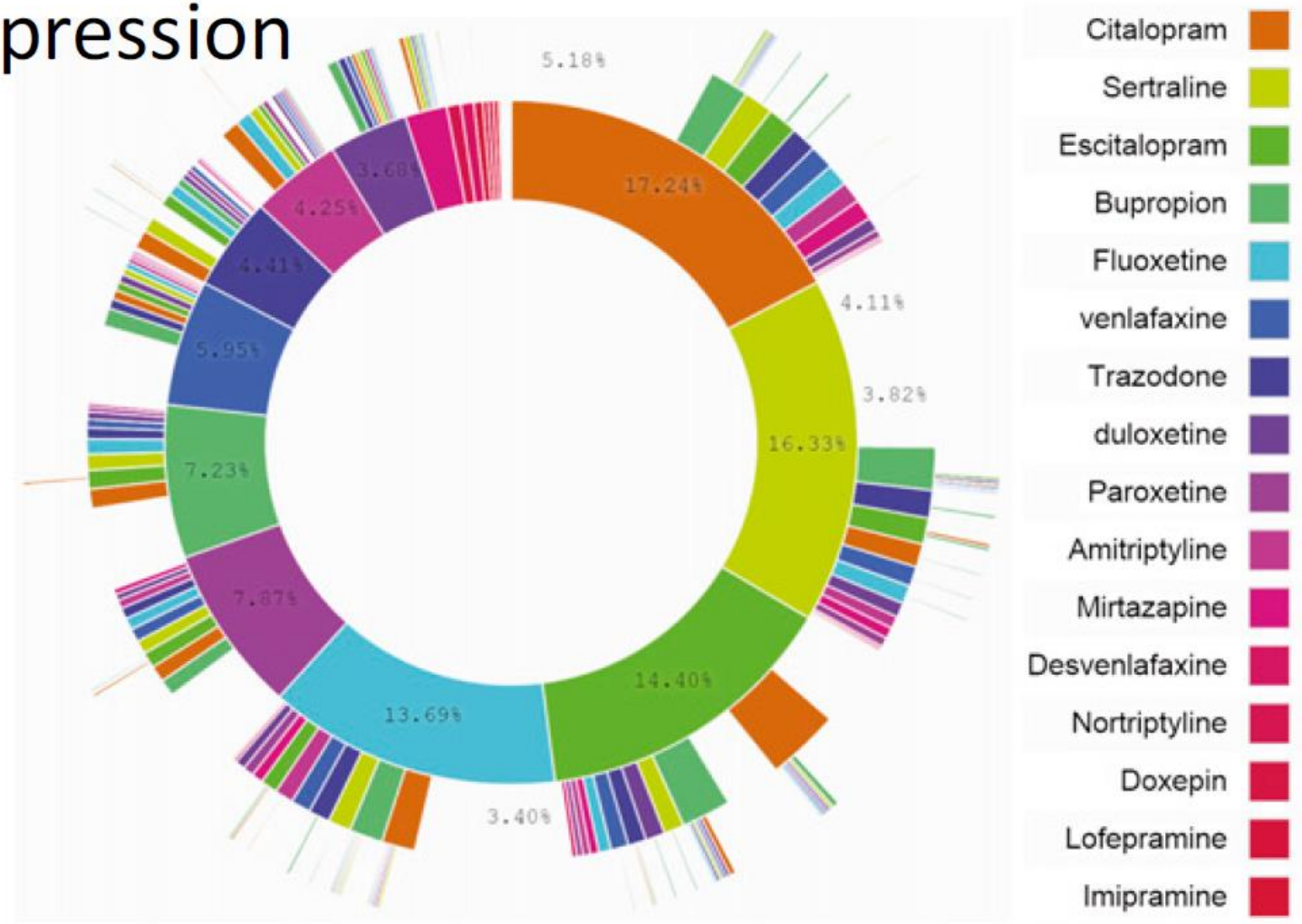
Lisinopril
Hydrochlorothiazide
Amlodipine
Metoprolol
Atenolol
Furosemide
Ramipril
Bendroflumethiazide
Losartan
valsartan
Triamterene
olmesartan
benazepril
Diltiazem
carvedilol
Bisoprolol
Doxazosin
Enalapril

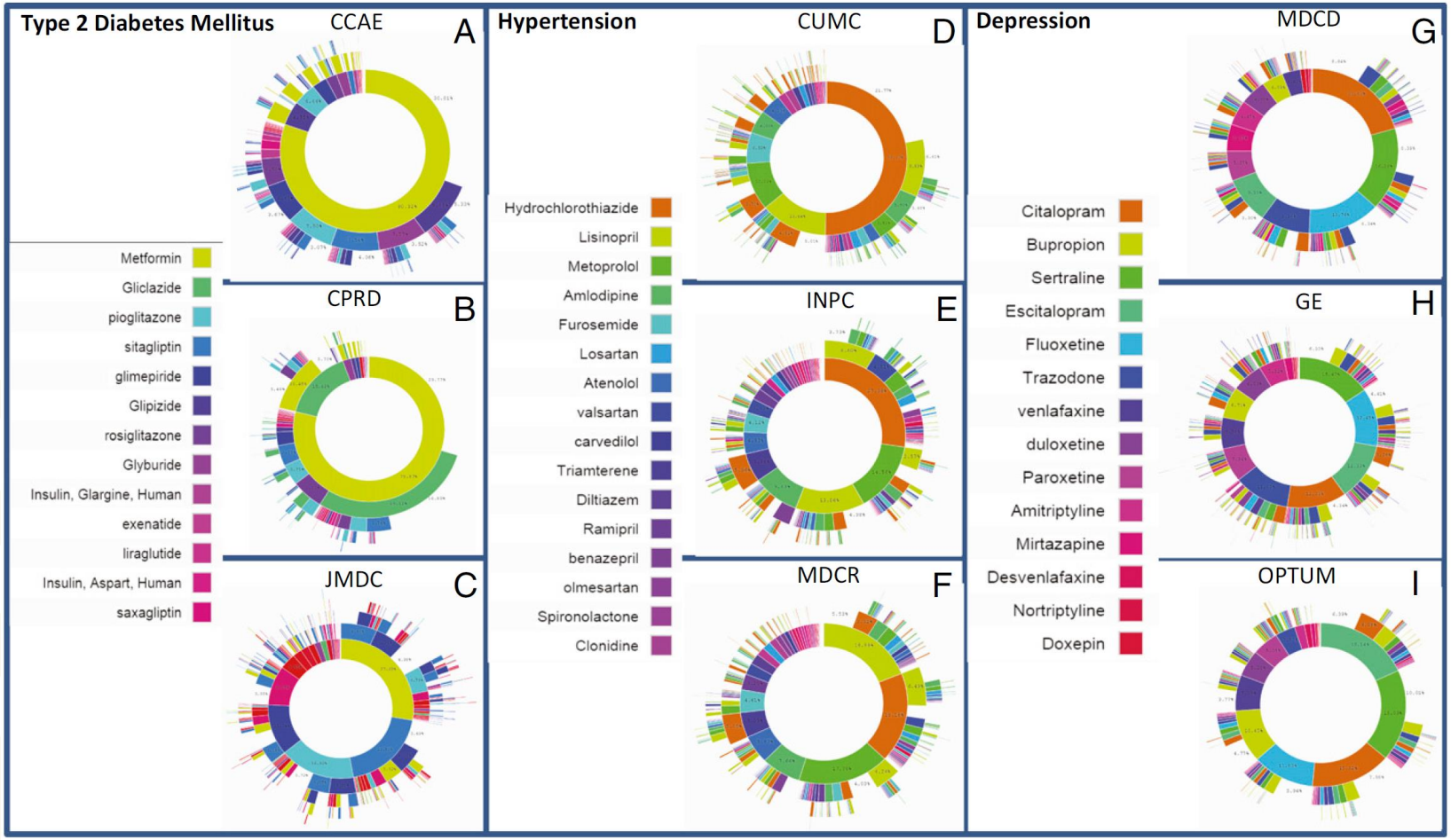
C Depression



Distinct treatment pathways

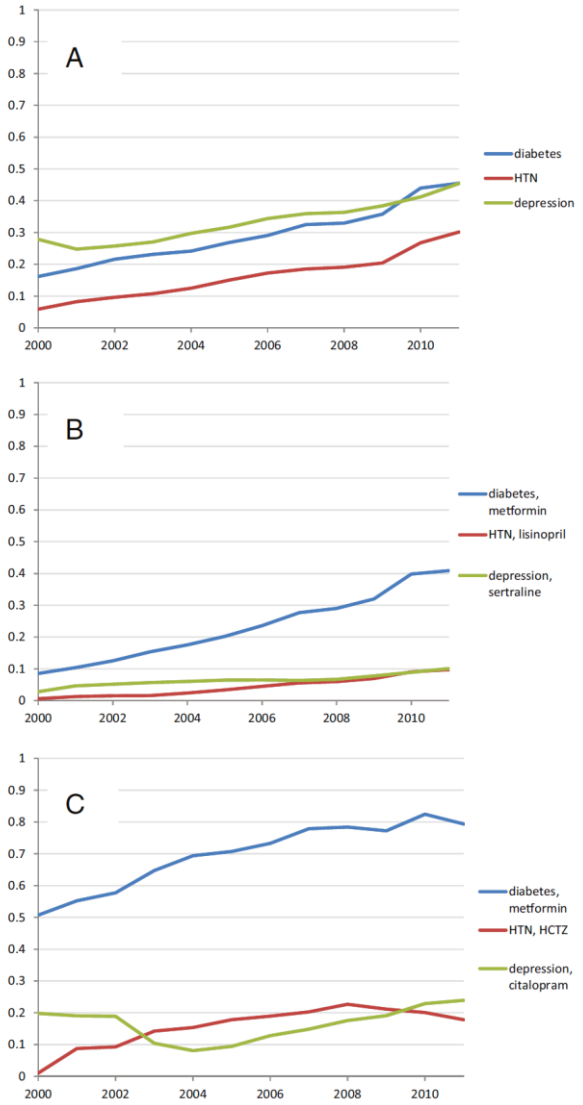
- Many individuals had a “unique” treatment pathway, ie, no one else had the same sequence of treatments
  - 10% of diabetes patients
  - 24% of hypertension patients
  - 11% of depression patients
- The response to the question, “In an underlying population of 250 million, based on my 3-year treatment pathway, what patients are like me?” would be “No one.”

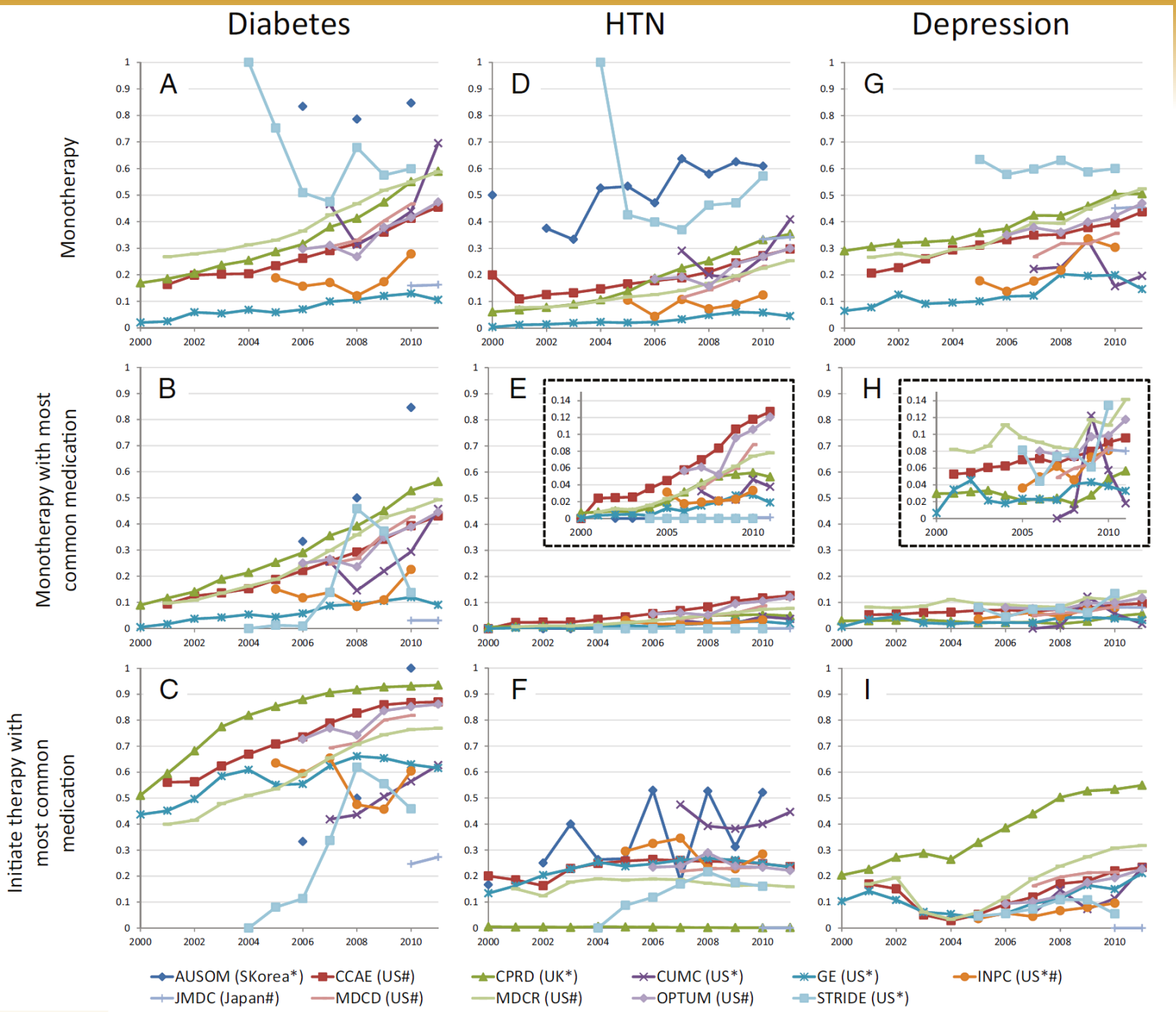
Differences among sources



Monotherapy trends

- (A) Shows a trend of increasing use of monotherapy (use of a single medication in the entire 3-year window)
- (B) Displays cases in which the sequence contains only the most common monotherapy
- Illustrates that for hypertension and depression, unlike diabetes, the monotherapy trend is not driven by a single medication
- (C) shows cases in which a sequence begins with the most common starting medication for that disease
- It demonstrates the degree to which a single medication dominates as a starting medication for the disease; more variation for hypertension and depression.




Diabetes
HTN
Depression
Monotherapy
Monotherapy with most common medication
Initiate therapy with most common medication
A
B
C
D
E
F
G
H
I
AUSOM (SKorea*)
CCAE (US#)
CPRD (UK*)
CUMC (US*)
GE (US*)
INPC (US*#)
JMDC (Japan#)
MDCD (US#)
MDCR (US#)
OPTUM (US#)
STRIDE (US*)

ATC to compare switching drug classes

- They used the World Health Organization's Anatomical Therapeutic Chemical (ATC) classification to group medications into classes
- This allowed them to compare the extent to which medications were changed or added
  - Within the same medication class
  - Across medication classes
- They did not note a large change
  - Depression shows a stronger tendency to stay within class than diabetes or hypertension
  - However, depression has fewer classes (6) than diabetes (23 classes) or hypertension (29 classes).

General stability of results

- One might expect a lot of variability given the very different data sources
- Despite this, the results seemed reasonable across sites (eg, trends in figure 5)
- The world is moving toward more consistent therapy over time across diseases and across locations
- There are some large outliers, which is concerning for single site/country studies

Converging on a therapy?

- The proportion of patients with a unique treatment pathway is notable (almost 25% for hypertension)
- There may not be a consistently most effective treatment
- Lack of indications for WHY a particular medication is chosen first
- Very much trial an error currently
- Drug therapies for depression are notable
- Treatment resistant hypertension