OHDSI/OMOP Introduction

Bangkok, Thailand
April 24, 2024
Why Choose OHDSI/OMOP:
✓ Fast, reliable studies across a series of datasets and data types
✓ Reduced cost of ownership including understanding coding schemes, writing statistical programs across databases or developing software
✓ Expanded data access via the OHDSI network and remote multi-center database studies

What OHDSI is:
✓ Open Source
✓ Community
✓ Data

OHDSI Collaborators:
• 3,758 collaborators
• >1,100 organizations
• 83 countries from 6 continents

OHDSI Network:
• 534 data sources
• 49 countries
• 956M unique patient records

https://ohdsi.org/
OHDSI’s Mission

To improve health by empowering a community to collaboratively generate the evidence that promotes better health decisions and better care.
History of OMOP/OHDSI

- **End of OMOP Experiment**
  - Main findings in OMOP experiment
    - Heterogeneity in estimates due to choice of database
    - Heterogeneity in estimates due to analysis issues
    - Inconsistent results for the same outcome
    - Good performance in Cox PH model
    - Good performance in Cox PH model with a different outcome
    - Self-controlled methods perform best for all outcomes

- **2009**: OMOP Experiment #1
- **2013**: Launch of OHDSI
- **2014**: OHDSI COVID-19 Study-a-Thon
- **2015**: First Hackathon at Columbia University
- **2016**: First OHDSI Symposium/Network Study Published
- **2017**: EMA Adoption
  - Australia, Japan Chapters
- **2018**: FDA Adoption
  - FDA BEST Launch
  - EHDEN Initiation (Europe)
  - First European Symposium
- **2019**: International OHDSI COVID
- **2020**: OHDSI COVID-19 Study-a-Thon
- **2022**: Singapore, Taiwan Chapters
- **2023**: OMOP in Thailand

- **Global Acceptance**
- **Korea Chapter**
- **China Chapter**
- **India Chapter**
- **FDA Adoption**
- **FEEDER-NET Initiation (Korea)**
- **First Hackathon at Columbia University**
OMOP Common Data Model (CDM)

Ontologies are critical when designing data models

- 11,027,290 concepts
  - 3,598,454 standard concepts
  - 847,008 classification concepts
- 142 vocabularies
- 44 domains
- 82,142,038 concept relationships
- 87,967,689 ancestral relationships
- 4,673,156 concept synonyms
Data Standardization to OMOP Enables Systematic Research

- Reliant on partner capabilities
- Not scalable
- Not transparent
- Expensive
- Slow
- Prohibitive to non-expert routine use

One SAS or R script for each study

Analytical method: Adherence to Drug

OMOP CDM

- North America
- Southeast Asia
- China
- Europe
- UK
- Japan
- India
- South Africa
- Switzerland
- Italy
- Israel

OHDSI tools

- Adherence
- Mortality
- Prediction
- Safety
- Signals
To improve health by empowering a community to collaboratively generate the evidence that promotes better health decisions and better care.

**OHDSI data network**

- **Source data in local structure and vocabularies**
- **Standardized patient-level database (OMOP CDM)**
- **Standardized analytics (OHDSI tools)**
- **OHDSI Data partner 1**
- **ETL**
- **OHDSI Data partner 2**
- **Source data**
- **OMOP CDM**
- **OHDSI tools**
- **OHDSI Data partner 3**
- **Source data**
- **OMOP CDM**
- **OHDSI tools**
- **OHDSI Data partner n**
- **Source data**
- **OMOP CDM**
- **OHDSI tools**

**OHDSI collaborations**

- **Open community data standards (OMOP CDM)**
- **Open source development (OHDSI tools)**
- **Methodological research**
- **Clinical evidence generation**

**OHDSI Network studies**

- **Pre-specified protocol with analysis specification**
- **Standardized summary statistics results repository**

**Collaborative Interpretation**

- **Evidence dissemination**
Health Analytics Data-to-Evidence (HADES)

Overview

- R packages that can run against any OMOP database
  - Support R packages
    - DatabaseConnector
    - SqlRender
    - ROhdsiWebApi
    - CohortDiagnostics
  - Analytical R packages
    - PatientLevelPrediction
    - CohortMethod (comparative effectiveness)
    - FeatureExtraction (characterization)
    - SelfControlledCaseSeries

https://ohdsi.github.io/Hades/index.html
Data relevance across clinical domains

OMOP Workgroups & OHDSI Phenotype Collaborations

- Type 2 Diabetes Mellitus
- Type 1 Diabetes Mellitus
- Atrial Fibrillation
- Multiple Myeloma
- Alzheimer’s Disease
- Hemorrhagic Events
- Neutropenia
- Parkinson’s Disease and Parkinsonism
- Attention Deficit Hyperactivity Disorder
- Hypertension
- Acute Myocardial Infarction
- Heart Failure
- Cardiomyopathy
- Multiple Sclerosis
- hidradenitis suppurativa
- Anaphylaxis
- Depression
- Non-Small-Cell Lung Cancer
- Drug-Induced Liver Injury
- Severe Visual Impairment And Blindness
- Suicide Attempts
- Kidney Stones
- Delirium
- Systemic Lupus Erythematosus
- Triple Negative Breast Cancer
- Pulmonary Hypertension
- Prostate Cancer
- HIV
Global OHDSI Adoptions
Korean Government Initiatives

Seoul
Federated OMOP network of 62 hospitals and >76M patients

Incheon/Gyeonggi
Participation from secondary and tertiary hospitals nationwide

Chungcheong
Good representation of each of the provinces of South Korea

Gangwon
Funded by series of grants from the Korean government

Jeolla
Foster collaborative research and evidence-sharing ecosystem

Gyeongsang
China Government’s Guides on RWE & RWD

From Center for Drug Evaluation (CDE), National Medical Products Administration (NMPA)

- **1st guide** was released in Jan 2020, introducing the definition, data source requirement, design, and evaluation of using RWE for drug effectiveness study and safety monitoring.

- **2nd guide** was released in Aug 2020, focusing on the details and importance of the source, safety, curation, quality assurance and maintenance of RWD, so that reliable RWE could be produced.
China Government’s Guides on RWE & RWD

CDM & OHDSI Citations in the 2nd Guide, Section 4 – Real World Data Curation

CDM Introduction in Guide:
• Under multidisciplinary collaboration, CDM was created with standardized structure, format and vocabulary, to achieve multi-center data integration and collaboration.

References in Guide:
• EMA. A Common Data Model for Europe – Why? Which? How?
• OHDSI – Observational Health Data Sciences and Informatics, https://www.ohdsi.org

Fig. 2 in Guide – Diagram on Converting Source Data to CDM
Initiatives in Singapore

- Government building a data sharing platform using OMOP CDM (TRUST)
- OHDSI Singapore Chapter act as technical advisors

- Converted EMR data to OMOP CDM for over 300K patients between 2015 – 2018
- Participated in OHDSI APAC Hypertension study published in JAMA Network Open

- Integrate two type 2 diabetes cohorts
- First integrated research data asset for chronic disease with patients’ full EMR data, social status and -omics data
OHDSI APAC Formation
Expanding APAC Collaboration

- 7 regional chapters in APAC since 2014
- 104 OMOP data sources from 8 APAC countries
1st In-person APAC Symposium

2022 OHDSI APAC
亞太年會在北醫
2021台灣正式成為OHDSI亞洲第六國分部
並爭取到2022亞洲年會在台北的主辦權
讓我們一起用健康資料軟實力在世界舞台發光發熱！

2022 OHDSI APAC SYMPOSIUM
11.12 - 13
Cheng-Pu Conference Hall, Xing-Chun Building

現正熱烈報名中！！！
Expanding Community Outreach

2023 APAC Symposium

✓ 2-day in-person event hosted in Sydney, Australia
✓ 110 attendees from around the world represented by all stakeholder groups including consumer!

2023 China Symposium

✓ 4-day in-person event hosted in Shanghai, China consisting of main conference and tutorials
✓ China regional experts from all disciplinary areas
Expanding Community Outreach

- **April APAC**
  - Two in-person events hosted in Japan and Thailand
  - Targeted to familiarize new collaborators in the region with OHDSI/OMOP and understand local perspectives/considerations

**OHDSI one-day event in Tokyo, Japan**
- 2024年4月17日(水) 13:00～15:00
- Hands-on session is 15:30～19:30
- Target: 15 participants
- Aim: Help attendees understand OHDSI/OMOP and local perspectives
- Hosted by IQVIA and Soring Informatics and Data Innovation Center (SiData+)

**2024 APAC Symposium**
- 4-day in-person event hosted in Singapore consisting of lectures, tutorials and a datathon
- Co-hosted with Singapore Healthcare AI Datathon & Expo (SHADE) 2024

**Transforming Evidence Generation in Thailand with OHDSI/OMOP: An Introductory Tutorial**
- Hosted by IQVIA and Siring Informatics and Data Innovation Center (SiData+)
- IQVIA and SiData+ bring together medical and healthcare professionals in Thailand to familiarize with the process of transforming data into evidence using the OMOP Common Data Model, OHDSI tools, and scientific best practices.
- Learn about global Real World Evidence (RWE) trends, especially in the Asia-Pacific region
- Gain understanding of OHDSI/OMOP and its impact on medical research in Thailand
- Conduct hands-on experiences for deeper understanding of vocabulary mapping and Extract Transform Load (ETL)
- Network with like-minded fellow clinicians, researchers and developers in Thailand
- Wednesday, 24 April 2024 | Eastin Grand Hotel Phuket Phuket, Bangkok, Thailand
Total 41 publications from APAC in 2023, including 2 multi-center publications in JAMA, and 14 publications so far in 2024.
## Save Our Sisyphus (SOS) Challenge

### 35 Research Questions
Submitted by the OHDSI community

### 9 Weekly Tutorials
Taught by global subject matter experts in two time zones to accommodate the entire global community

### 4 Studies
Selected to be designed, implemented, executed and disseminated by the community as a whole

### 5 Months
From study conception to fruition, enabling presentation of preliminary study results at the APAC Symposium

### 1 Important Lesson
Panel discussion with regulator, clinician, researcher, and consumer representatives triggered a critical debate on how we as a research community should best convey our findings to the general public

### Study Led by APAC
*Is fluoroquinolone use really associated with the development of aortic aneurysms?* led by Korea and Australia
**LEGEND**: Large-scale Evidence Generation and Evaluation across a Network of Databases

**GOAL**: To generate real world evidence on the effects of medical interventions using observational healthcare data to support clinical decision making

**IMPACT**: LEGEND has produced a new model for generating reliable evidence and new opportunities for collaborative research
Analysis of Dual Combination Therapies Used in Treatment of Hypertension in a Multinational Cohort

Yuan Lu, ScD; Mui Van Zandt, BS; Yun Liu, PhD; Jing Li, MS; Xiaolin Wang, MS; Yong Chen, PhD; Zhengfeng Chen, MBBS, MMEd; Jaehyeong Cho, PhD; Sneemanee Raj Dorajoo, PhD; Mengling Feng, PhD; Min-Huei Hsu, MD, PhD; Jason C. Hsu, PhD; Usman Iqbal, PharmD, MBA, PhD; Jitendra Jonnagaddala, PhD; Yu-Chuan Li, MD, PhD; Slaw-Teng Liaw, MBBS, PhD; Hong-Seok Lim, MD, PhD; Kee Yuan Ngiam, MBBS, MMed, PhD; Phuong Anh Nguyen, PhD; Rae Woong Park, MD, PhD; Nicole Pratt, PhD; Christian Roich, MD, PhD; Sang Youl Rhee, MD; Selva Muthu Kumaran Sathappan, MSc; Seo Jeong Shin, PhD; Hui Xing Tan, MTech; Seng Chan You, MD, PhD; Xin Zhang, MS; Harlan M. Krumholz, MD, SM; Marc A. Suchard, MD, PhD; Hua Xu, PhD

Abstract

**Importance.** More than 1 billion adults have hypertension globally, of whom 70% cannot achieve their hypertension control goal with monotherapy alone. Data are lacking on clinical use patterns of dual combination therapies prescribed to patients who escalate from monotherapy.

**Objective.** To investigate the most common dual combinations prescribed for treatment escalation in different countries and how treatment use varies by age, sex, and history of cardiovascular disease.

Key Points

**Question.** What are the most common antihypertensive dual combinations prescribed to patients who escalate from monotherapy in clinical practice, and how do the combinations differ by country and patient demographic subgroup?
Hypertension: Dual Combination Therapy Patterns

11 electronic health record databases (4 from IQVIA, 7 from external contributors) were combined using the Observational Medical Outcomes Partnership (OMOP) standard data model.

DATA CONTRIBUTORS
- Ambulatory EMR
- France Longitudinal Patient Data
- Italy Longitudinal Patient Data
- Australia Longitudinal Patient Data
- ePBRN* 2019 (South Western Sydney Local Health District)
- Ajou University School of Medicine
- Kyung Hee University Hospital
- Khoo Teck Paut Hospital
- National University Hospital
- Jiangsu Province Hospital
- Taipei Medical University Clinical Research Database

REGIONS
- USA
- France
- Italy
- Australia
- South Korea
- Singapore
- China
- Taiwan
- East
- West

AREA

By standardizing real world data, 1 million patients from across the globe could be observed to answer critical treatment pattern questions.

8 regions

112 M patients

12 dual therapy combinations

- Male
- Female
- 18-64 y
- ≥ 64 y

1 M hypertension patients on dual therapy

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* Electronic Practice-Based Research Network

23
**Clinical Findings**

- Significant variations in antihypertensive prescribing patterns were observed between East and West regions
  - Both the initial antihypertensive treatment and preference for dual therapy combinations varied between regions
  - Despite real world evidence supporting CCBs having superior outcomes\(^2\), they are the least popular treatment worldwide
  - Variations were observed down to the patient subgroup level (age, gender), allowing for deeper insights

### Starting Therapy (% of Patients)

<table>
<thead>
<tr>
<th></th>
<th>West (%)</th>
<th>East (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACEi/ARB</td>
<td>36%</td>
<td>46%</td>
</tr>
<tr>
<td>CCB</td>
<td>15%</td>
<td>44%</td>
</tr>
<tr>
<td>β-blocker</td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>Diuretic</td>
<td>16%</td>
<td>3%</td>
</tr>
</tbody>
</table>

**West:** United States, France, Italy, Australia  
**East:** South Korea, Singapore, China, Taiwan

### Dual Therapy Combinations

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<td>46%</td>
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</tr>
<tr>
<td>ACEi/ARB → β-blocker</td>
<td>31%</td>
<td>17%</td>
</tr>
<tr>
<td>ACEi/ARB → Diuretic</td>
<td>38%</td>
<td>7%</td>
</tr>
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<td>20%</td>
<td>2%</td>
</tr>
<tr>
<td>β-blocker → Diuretic</td>
<td>20%</td>
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**Real World Implications**

By using real world data, prescribing patterns and patient outcomes can be observed and the underlying reasons explored:
- Adherence to prescribing guidelines
- Cost
- Patient outcomes
- Responsiveness to research

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Methodology

A standardized analytics pipeline for reliable and rapid development and validation of prediction models using observational health data.

Logistic regression models for patient-level prediction based on massive observational data: Do we need all data?

Learning patient-level prediction models across multiple healthcare databases: evaluation of ensembles for increasing model transportability

with patients who are lost to follow-up when developing prognostic models using a cohort design
Summary

1. **Open Source**
   CDM, tools, methods, and documentation all publicly available

2. **Standardization**
   Standard CDM, vocabulary/ontology, tools, methods, data quality, and documentation

3. **Research Community**
   Large research community with multiple stakeholders and disciplinaries

4. **Multi-country/multi-center research**
   Large scale research using standardized tools and methods
Join The Journey

As a community, we are collaborating towards improving health outcomes for patients around the world.

To achieve this goal, we are developing open-source analytic tools and generating high-quality evidence to inform medical decision making.

Whether you’re a software developer, physician or clinical researcher, there is a place for everyone in the OHDSI community.

Want to Join The Journey? Here are a few ways you can get started!

https://www.ohdsi.org/join-the-journey/
Thank you!

Mui Van Zandt & Sarah Seager

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