Applying the OMOP Common Data Model to Facilitate Benefit-Risk Assessments of Medicinal Products Using Real-World Data from Singapore and South Korea

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INTRODUCTION

The changing regulatory landscape of health products has led to an increasing interest in incorporating real-world evidence (RWE) for regulatory decision-making. Using a common data model (CDM) may address the challenges encountered in using multiple databases for evidence generation, such as those arising from the use of disparate data coding standards, database architectures, and vocabularies.

OBJECTIVES

- To characterize the benefits of converting Electronic Medical Records (EMRs) to a common data model (CDM).
- To assess the potential of using CDM-converted data to rapidly generate insights for benefit-risk assessments - based on a case study of atrial fibrillation patients newly started on oral anticoagulation from two databases in Singapore and South Korea - to enhance post-market regulatory evaluations and decisions.

METHODOLOGY

Mapping of EMRs to OMOP-CDM schema (Singapore), and use of existing OMOP-converted data (South Korea)

We used EMR data originating from a tertiary acute care hospital in Singapore, comprising information on 260,000 unique patients who visited the hospital between January 2013 and December 2016, and mapped it to the OMOP-CDM version 5.3.0 format.

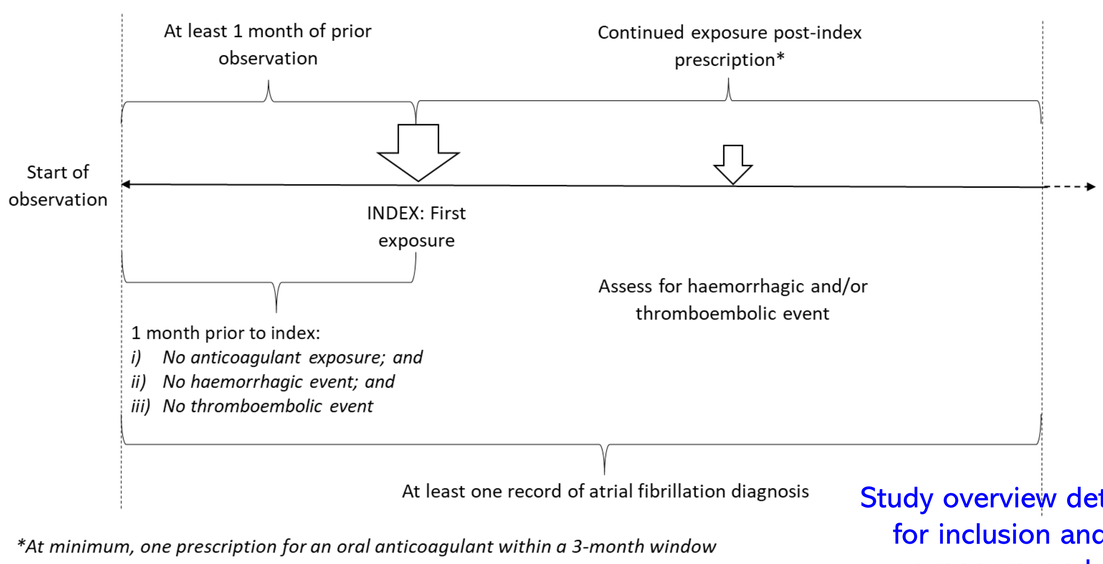
Existing OMOP-converted data from Ajou Medical Center (AUMC) containing information on about 2,700,000 unique patients who visited the hospital between January 1994 and December 2020 was enlisted for external validation of subsequent analyses of OMOP-converted data

Illustrative analysis following CDM Conversion

Sample cohort assembly
We identified patients diagnosed with atrial fibrillation (AF) who were newly started with oral anticoagulants (OAC). Patients must not have had any prior bleeding and/or thromboembolic events for at least 1 month before date of initiation of OAC, and must have had at least one OAC dispensing record in the 3 months following index exposure in an inpatient or outpatient setting to be included.

Patients were followed for at least three months after the date of first OAC exposure.

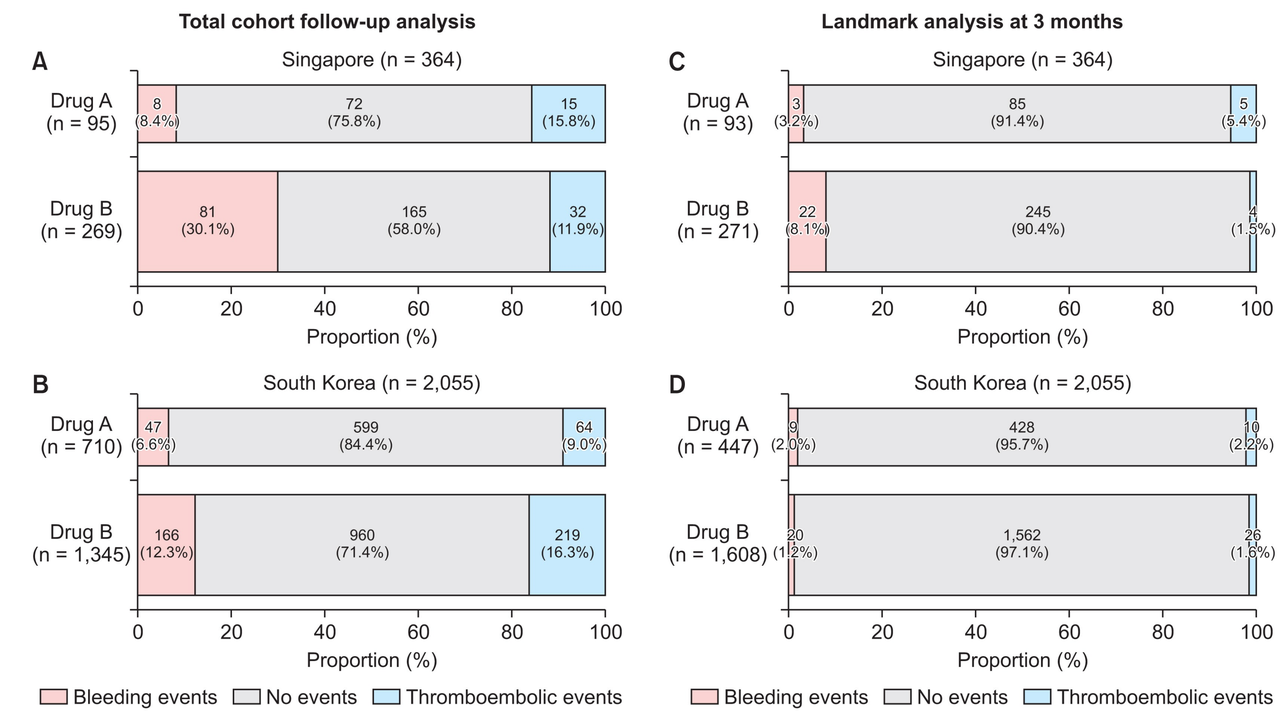
Visualizing comparative safety, effectiveness, and utilization for benefit-risk assessments
Existing analytic codes used in a prior OMOP-CDM study by Hripcsak et al [1] were modified to conduct an illustrative analysis of OAC used for AF in Singapore and South Korea, representing the comparative effectiveness, safety and utilization of the drug.



Study overview detailing criteria for inclusion and exclusion, exposure, and outcomes

RESULTS & DISCUSSION

Over 90% of records from the original tables in Singapore were mapped over to the CDM, except for dispensing records which included many non-drug items. There were 364 patients from Singapore and 2,055 patients from South Korea who fulfilled the inclusion/exclusion criteria for the illustrative analysis. Most patients were warfarin users (Singapore: n=269 [73.9%], South Korea: n=1,345 [65.4%])



Drug A: rivaroxaban. Drug B: warfarin
Denominator for percentages: number of patients in the cohort on the drug
Numerator for percentages: number of patients in the cohort on the drug who experienced the event (pink/blue), or were event free (grey)

Illustrative analysis
100%, horizontally stacked, bar charts for the total study period and at 3-month time-point. Bar thickness represents study sample size while the pink and blue regions represent safety and lack of effectiveness, respectively. The grey central region represents the event-free proportion not experiencing any undesirable events.

In both settings, the landmark analysis at 3 months reveals a fairer comparison of the drugs. (A => C, B => D) and show that the unadjusted differences between drugs are far less pronounced.

Baseline characteristics of cohorts

	Warfarin		Rivaroxaban	
	Singapore	South Korea	Singapore	South Korea
Number of patients	269 (73.9)	1,345 (65.5)	95 (26.1)	710 (34.5)
Age (yr)	70 (15)	63 (17)	71 (15)	69 (14)
Sex				
Male	142 (52.7)	854 (63.5)	44 (46.3)	398 (56.1)
Female	127 (47.2)	491 (36.5)	51 (53.7)	312 (43.9)
Race				
Korean	-	1,345 (100)		710 (100)
Chinese	163 (60.6)	-	66 (69.5)	-
Malay	66 (24.5)	-	20 (21.1)	-
Indian	20 (7.4)	-	5 (5.3)	-
Others	20 (7.4)	-	4 (4.2)	-

Values are presented as number(%); for age, the median (interquartile range) are used

Discussion

CDM conversion alters only the form, but not the substance of the data. This underscores the need to understand the provenance and processes that generated the data. Conversion can speed up analyses, although some modifications and extensions to previously written code are likely required for specific use cases.

The cohorts from the two countries used were demographically different, which could introduce alternative explanations for the study findings. The proposed bar graphs remain an unadjusted descriptive analysis of the rate of events in different populations exposed to comparator agents. Incorporating methods to adjust for confounders and visualize the adjusted event rates would be important areas of future research.

CONCLUSION

While the structure of the OMOP-CDM and its accessory tools facilitate real-world data analysis, extending them to fulfil regulatory analytic purposes in the post-market setting, such as benefit-risk assessments, may require layering on additional analytic tools and visualisation techniques.

ACKNOWLEDGEMENT

- Information Management Department, Health Sciences Authority
- A/Prof Cheng Leng Chan, Dr Dorothy Toh and Ms Jalene Poh for their support
- Dr Michael Winther for his valuable programmatic coordination of the SAPhIRE programme

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