Characterization of Antiepileptic Drug Treatment Pathways with the Common Data Model: Pilot Results from Columbia University Irving Medical Center

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Background

Efforts to characterize variability in epilepsy treatment pathways and conduct observational research are limited by the large number of possible antiepileptic drug (AED) regimens and sequences, heterogeneity of patients, and challenges of measuring confounding variables and outcomes across institutions. The Observational Medical Outcomes Partnership (OMOP) Common Data Model has been previously used to characterize treatment pathways for common diseases across the Observational Health Data Science and Informatics (OHDSI) collaborative(1) and for pediatric epilepsy at a single center(2). The goal of this study was to demonstrate the feasibility of characterizing adult epilepsy patients and AED treatment pathways using OHDSI's data standards in a United States electronic health record (EHR)-derived database.

Methods

We validated a phenotype algorithm for epilepsy using the CDM in an EHR-derived OMOP database from Columbia University Irving Medical Center (2001-2020) against chart review. Our epilepsy cohort consisted of patients who fulfilled one of the following 3 criteria: (i) a first occurrence of an epilepsy diagnosis during an inpatient hospitalization or emergency department (ED) visit; (ii) at least 2 outpatient seizure or epilepsy diagnoses within 5 years that are at least 30 days apart; (iii) at least 1 epilepsy or seizure diagnosis that first occurred within 2 years antecedent to a first AED exposure. We obtained the frequency of all antecedent conditions and procedures for this cohort and characterized AED exposure sequences over time and by age and sex for patients with a minimum 1 year of continuous pharmacotherapy exposure.

Results

The phenotype algorithm identified 22,486 patients with epilepsy with 83.0% positive predictive value. Patients frequently experienced neurologic conditions and diagnoses antecedent to meeting epilepsy criteria. For the analysis of treatment pathways, 3,183 patients had a minimum of 1 year of continuous pharmacotherapy exposure and were included. Levetiracetam incrementally replaced phenytoin as the most common first-line agent, increasing from 11.1% of cases in 2000-2005 to 42.8% in 2016-2020. Drug sequences included up to 8 unique ingredients and a total of 1,235 unique pathways were observed. There were 134 unique first- and second-line 2-drug sequences, with no ordered pair accounting for more than 7% of pathways. Among those with any drug exposure, 72.8% of patients had 2 or more unique exposures and 42.4% of patients had 3 or more drugs. Men and women under 45 had longer path depths and greater pathway heterogeneity.

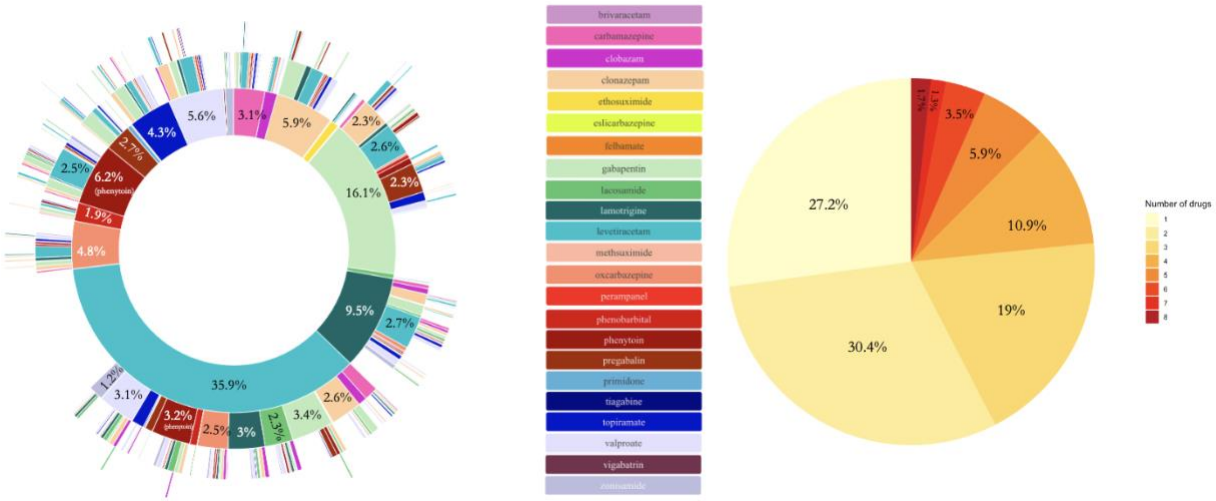

Figure 1. Sunburst diagram demonstrating pharmacotherapy treatment pathways for patients meeting the phenotypic definition of epilepsy (left). Rings from inside to out represent sequential drug exposures. Proportions represent the percentage of patients exposed to each drug at each stage in the sequence. Path depth diagram demonstrating the proportion of patients exposed to the total number of drugs (1-8) among all treatment pathways (right).

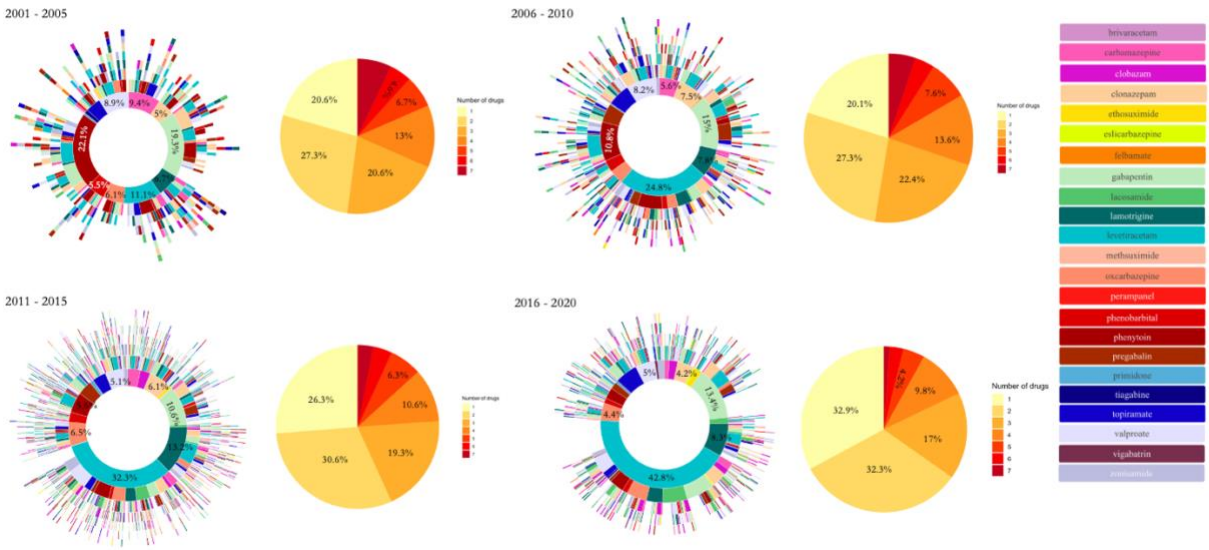

Figure 2. Treatment pathway sunburst diagrams and path depth diagrams stratified by study period.

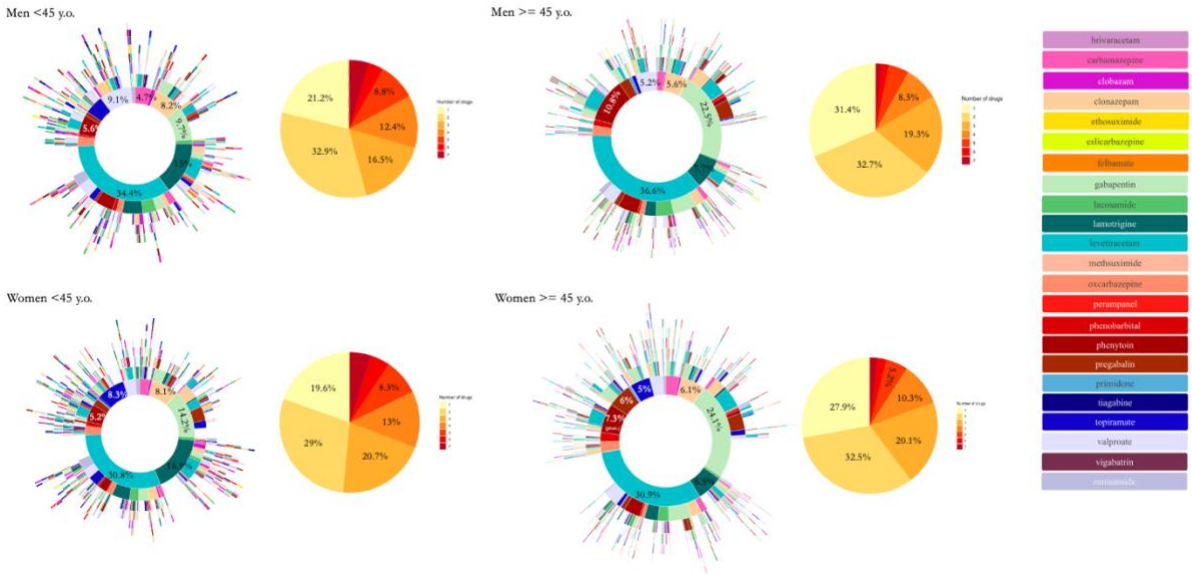

Figure 3. Treatment pathways sunburst diagrams and path depth diagrams stratified age and sex.

Conclusion

Despite the availability of new AEDs in the last 2 decades and accumulated guidelines and evidence(3,4) there remains significant heterogeneity in AED use in practice, particularly for second-line and subsequent agents. Multi-center OHDSI studies have the potential to better characterize the full extent of variability and support observational comparative effectiveness research but additional work is needed to validate co-variates and outcomes.

References/Citations

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