Characterization, Healthcare Resource Utilization, and Costs of Health Equity Clusters of Medicaid-Insured Patients With Epilepsy: An Exploratory Machine Learning Approach

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Background

- The treatment of epilepsy requires frequent drug changes; therefore, formulary restrictions may lead to poorer outcomes, and differences in the intensity of formulary restrictions between plans may lead to health inequities and disparities among patients.
- Claims data from adults with newly diagnosed and treated epilepsy were previously used to describe the effects of formulary restrictions on antiseizure medication (ASM) use, healthcare resource utilization (HCRU), and costs across payer channels.[1]

Objective

- To describe health equity segments among Medicaid enrollees by identifying clusters and describing their characteristics, formulary restrictions, and economic burden.

Methods

STUDY DESIGN

- Retrospective, longitudinal, observational study using de-identified administrative claims data from an all-payers claims database (RWD Insights) and formulary data from Managed Markets Insights & Technology.
- The study population comprised Medicaid-insured adults (aged ≥18 years on the index date) with newly diagnosed epilepsy and ≥1 ASM prescription on or after the initial diagnosis date and within the identification period of January 1, 2015, through June 30, 2021 (date of first ASM prescription=index date), who had continuous medical and pharmacy benefits for ≥12 months pre-/post-index.
  - Epilepsy diagnosis was based on ≥1 diagnosis claim for epilepsy (*International Classification of Diseases [ICD]-9-Clinical Modification [CM]* codes: 345.4, 345.40, 345.41, 345.5, 345.50, 345.51, 345.7, 345.70, 345.71; *ICD-10-CM* codes: G40.0, G40.1, G40.2, G40.5) or ≥2 diagnosis claims for unspecified convulsions (*ICD-9-CM* code: 780.39; *ICD-10-CM* code: R56.9) on different days within 12 months of each other during the study period.
- Patients with any ASM prescriptions in the baseline period before the index date were excluded.
- Baseline and follow-up periods were 12 months pre- and post-index date, respectively.
- A statistical model machine learning approach (K-prototype) was used to assign patients to health equity clusters based on the number of third-generation ASMs a patient had access to and the number of steps before brivaracetam (BRV) could be prescribed.
- Patient characteristics on the index date, and formulary restrictions (ASM access policies as of January 2022), ASM use, HCRU, and costs (per patient per year; 2021 US dollars) over follow-up were examined in each health equity cluster.

Results

STUDY POPULATION

- Of 24,722 Medicaid enrollees, five health equity clusters were identified:
  1. Mostly White, easy access to BRV and third-generation ASMs, low HCRU (44.1%);
  2. Mostly Black/African American, easy access to BRV and third-generation ASMs, low HCRU (12.7%);
  3. High BRV and some third-generation ASM access barriers, high HCRU (19.1%);
  4. High access barriers to third-generation ASMs (6.7%); and
  5. Intermediate access barriers to third-generation ASMs, low HCRU (17.3%).
- Clusters 1 and 2 were considered 'average'; clusters 3 and 4 were 'higher access barriers and burden' patients.

Patient characteristics on the index date

	CLUSTER 1 (n=10,912)	CLUSTER 2 (n=3152)	CLUSTER 3 (n=4726)	CLUSTER 4 (n=1661)	CLUSTER 5 (n=4271)
Age, n (%), years					
18-34	3242 (29.7)	874 (27.7)	1306 (27.6)	407 (24.5)	1575 (36.9)
35-44	2454 (22.5)	706 (22.4)	1028 (21.8)	361 (21.7)	980 (22.9)
45-64	4983 (45.7)	1479 (46.9)	2243 (47.5)	840 (50.6)	1636 (38.3)
65-74	183 (1.7)	73 (2.3)	108 (2.3)	41 (2.5)	64 (1.5)
≥75	50 (0.5)	20 (0.6)	41 (0.9)	12 (0.7)	16 (0.4)
Female, n (%)	6811 (62.4)	2054 (65.2)	2872 (60.8)	1027 (61.8)	2655 (62.2)
Geographic region, n (%)					
South	4693 (43.0)	1715 (54.4)	838 (17.7)	302 (18.2)	889 (20.8)
North Central	2754 (25.2)	930 (29.5)	2224 (47.1)	280 (16.9)	1316 (30.8)
Northeast	1314 (12.0)	326 (10.3)	553 (11.7)	970 (58.4)	1309 (30.6)
West	2151 (19.7)	181 (5.7)	1111 (23.5)	109 (6.6)	757 (17.7)
Race, n (%)					
White	10,788 (98.9)	0 (0)	4423 (93.6)	601 (36.2)	4052 (94.9)
Asian	124 (1.1)	46 (1.5)	69 (1.5)	57 (3.4)	33 (0.8)
Black/African American	0 (0)	3106 (98.5)	234 (5.0)	1003 (60.4)	186 (4.4)
Ethnicity, n (%)					
Non-Hispanic	6836 (62.7)	2449 (77.7)	3430 (72.6)	1226 (73.8)	2804 (65.7)
Hispanic	1985 (18.2)	211 (6.7)	479 (10.1)	166 (10.0)	568 (13.3)
Unknown	2091 (19.2)	492 (15.6)	817 (17.3)	269 (16.2)	899 (21.0)

Overview

QUESTION

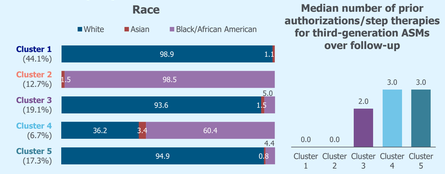
What are the characteristics, formulary restrictions, and economic burden of health equity segments among Medicaid-insured adults with newly diagnosed and treated epilepsy?

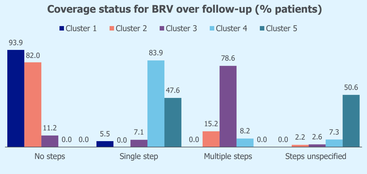
INVESTIGATION

Retrospective, longitudinal, observational study using de-identified administrative claims data and formulary data. A statistical model machine learning approach was used to assign patients to health equity clusters based on the number of third-generation antiseizure medications (ASMs) a patient had access to and the number of steps before brivaracetam (BRV) could be prescribed. Cluster 1: n=10,912; cluster 2: n=3152; cluster 3: n=4726; cluster 4: n=1661; cluster 5: n=4271.

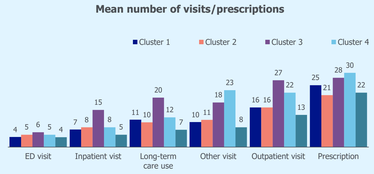
RESULTS

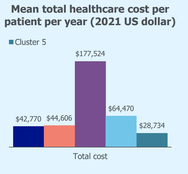
Health equity clusters: characteristics and formulary restrictions





All-cause healthcare resource utilization and costs over follow-up





ED, emergency department.

Conclusions

Two of the five health equity clusters (3 and 4) had higher access barriers/burden and comprised 19.1% and 6.7% of Medicaid enrollees, respectively. Results suggest a direct relationship between formulary restrictions and economic burden, which was not explained by patient characteristics or ASM use. Because managing epilepsy may require frequent ASM changes, patients with access restrictions may experience poorer economic outcomes than those with easier access to newer, more effective ASMs.

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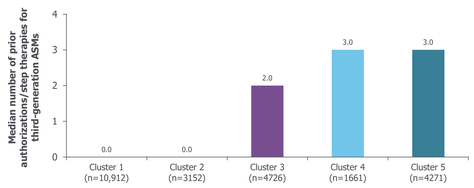
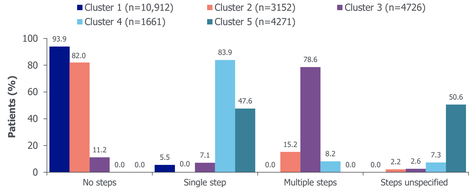
FORMULARY RESTRICTIONS

Prior authorizations/step therapies for third-generation ASMs over follow-up



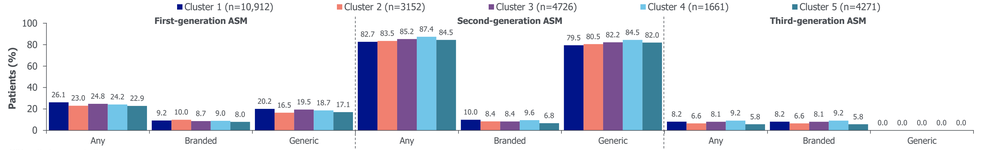
ASM, antiseizure medication.

Coverage status for BRV over follow-up



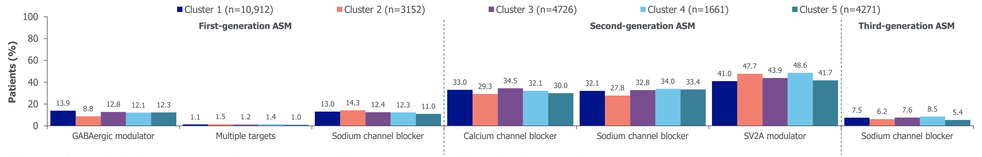
ASM USE

ASM use over follow-up, by generation and branded/generic



ASM, antiseizure medication.

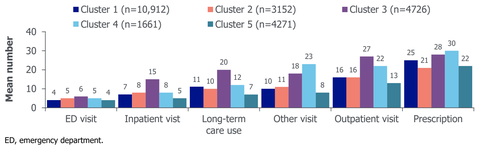
ASM use over follow-up, by generation and class (≥1% of patients)



AMPA, α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid; ASM, antiseizure medication; GABA, gamma-aminobutyric acid; SV2A, synaptic vesicle glycoprotein 2A.

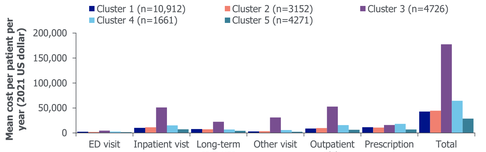
HCRU AND COSTS

All-cause HCRU over follow-up



ED, emergency department.

All-cause healthcare costs over follow-up



	ED visit	Inpatient vist	Long-term care use	Other visit	Outpatient visit	Prescription	Total
Cluster 1:	$2059	$9907	$7576	$2949	$8821	$11,458	$42,770
Cluster 2:	$2018	$11,316	$7260	$3452	$9729	$10,831	$44,606
Cluster 3:	$4548	$51,010	$22,368	$30,913	$52,845	$15,840	$177,524
Cluster 4:	$2814	$15,158	$6959	$5692	$15,626	$18,221	$64,470
Cluster 5:	$1620	$7317	$4190	$2354	$6306	$6947	$28,734

ED, emergency department.

- Over follow-up, cluster 3 had the highest inpatient and outpatient HCRU and total costs.
- The mean number and cost of prescriptions were highest in cluster 4, followed by cluster 3.

Limitations

- Claims data carry the possibility of missing and misclassified clinical information.
- The presence of a claim for a filled prescription does not indicate whether the medication was consumed or that it was taken as prescribed.
- Formulary restrictions were based on the formulary as reported by Managed Markets Insights & Technology for the plan in which the patient was enrolled and not specific rejections they may have experienced when filling a specific prescription.
- The findings may be generalized to only adult Medicaid enrollees with epilepsy and cannot be extrapolated to patients enrolled under other plans or those without insurance.
- Sensitivity analyses, which may examine how using different weights for model inputs or categorizing all variables may influence the observed relationships, were not performed.

Conclusions

- Two of the five health equity clusters (3 and 4) had higher access barriers/burden and comprised 19.1% and 6.7% of Medicaid enrollees, respectively.
- In general, patients with higher access restrictions had higher prescriptions, emergency department visits, other visits, long-term care use, and costs.
- This suggests a direct relationship between formulary restrictions and economic burden, which was not explained by patient characteristics or ASM use.
- Because managing epilepsy may require frequent ASM changes, patients with access restrictions may experience poorer economic outcomes than those with easier access to newer, more effective ASMs.
- Further research could describe access restrictions to ASMs at the state level; or examine the association between formulary restrictions and ASM treatment status, delay, and persistence; or examine the relationship between treatment initiation, delay, and persistence and clinical outcomes.

Reference

1.Peeples H, et al. Academy of Managed Care Pharmacy Annual Congress 2024; Abstract G23.

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