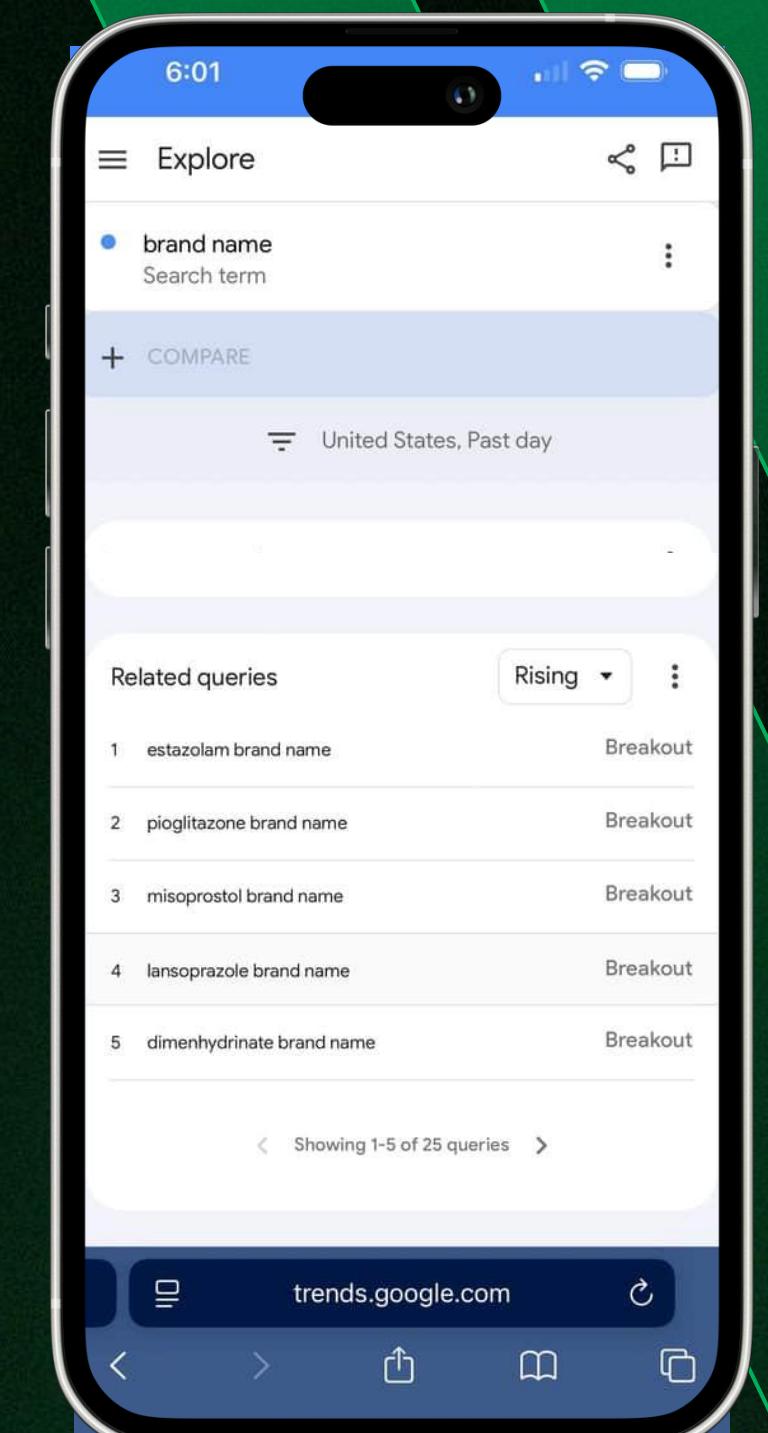
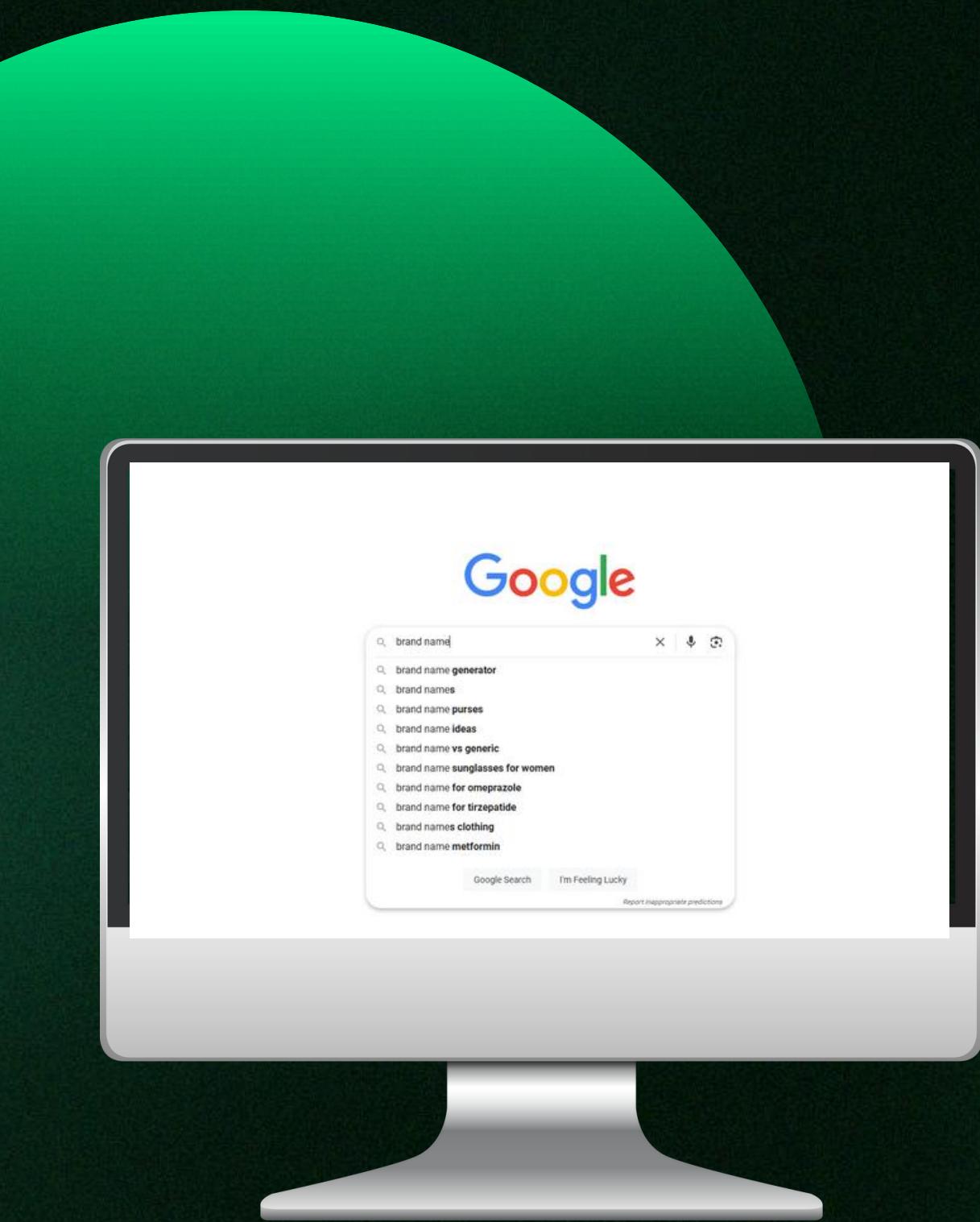


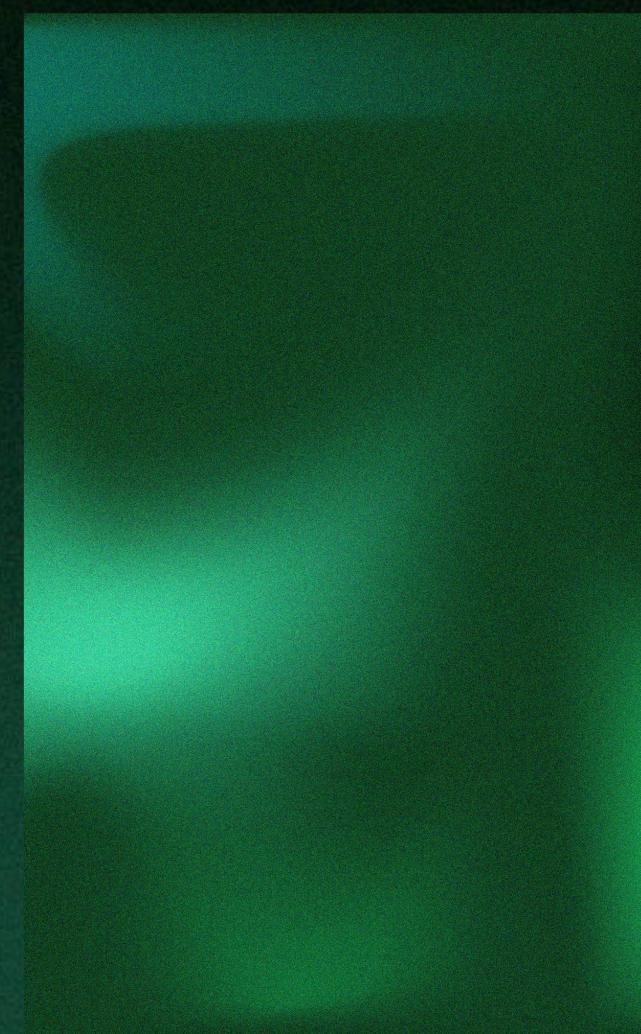
MedTech Insight: Uncovering Drug Trends, Risks, and Regional Health Patterns

MSIS 680 P 1 01 Adv Machine Learning and AI Spring 2025

Introduction



Contents



Risk Scoring



**Cluster
Analysis**



Forecasting

Why score risk ?

Los Angeles Times

Alzheimer's drug's potentially fatal side effect, ARIA, obscured by 'soothing acronym,' doctors say



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Health

• This article is more than 1 year old

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Campaigners call for more warnings on montelukast, after reports of night terrors, depression and other mental health events

Jon Ungoed-Thomas

Sun 3 Mar 2024 02.00 EST

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A registered physician s



Graham and Alison Miller, whose son Harry, 14, took his own life in 2018 while on montelukast at their home in southwest London. Photograph: Sophia Evans/The Observer

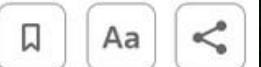
Reuters

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EU drugs regulator confirms suicidal thoughts as side effect of hair loss drug

By Reuters

May 8, 2025 4:05 PM EDT · Updated 4 days ago



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JAB HAPPY Fat jabs slash risk of silent killer which affects thousands of Brits a year by HALF, incredible study finds

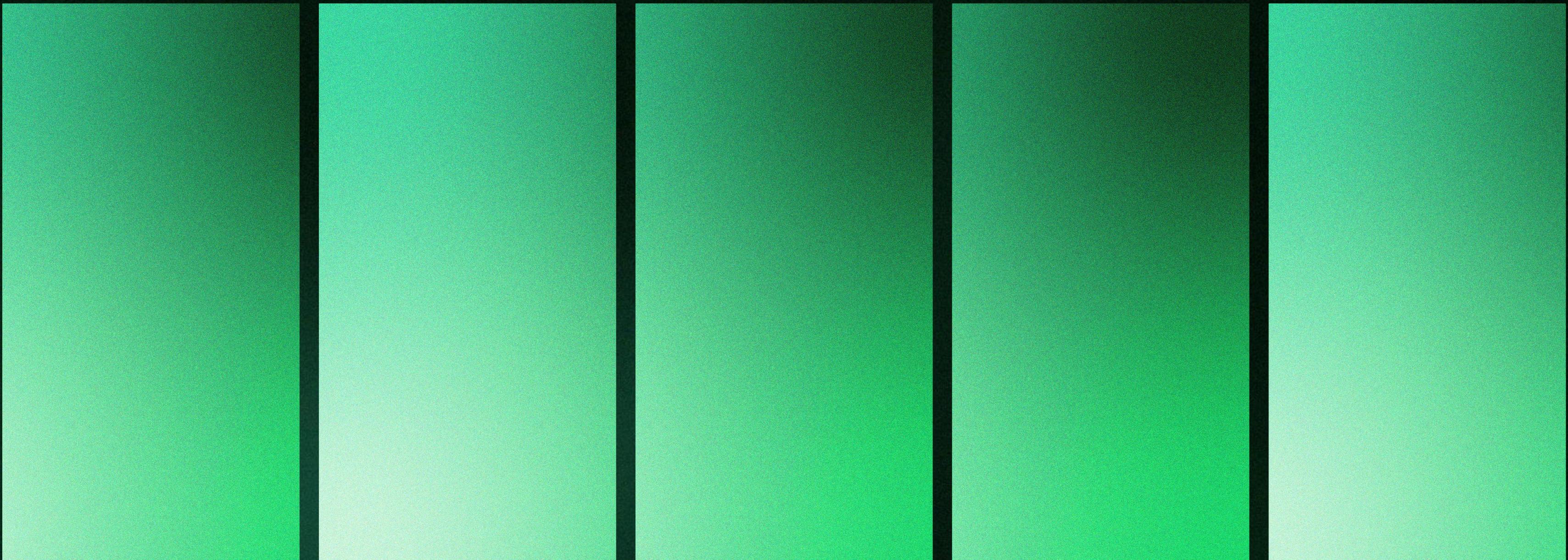
Boffins now want to test tens of thousands of Brits in a crucial clinical trial

Sam Blanchard, Health Correspondent

Published: 23:01, 11 May 2025 | Updated: 23:21, 11 May 2025



Side Effect Risk Scoring



Model Type

Rule-based Scoring

Input

Drug
Condition
Side Effect mapping

Output

Risk Score (Weighted
Average severity per
condition)

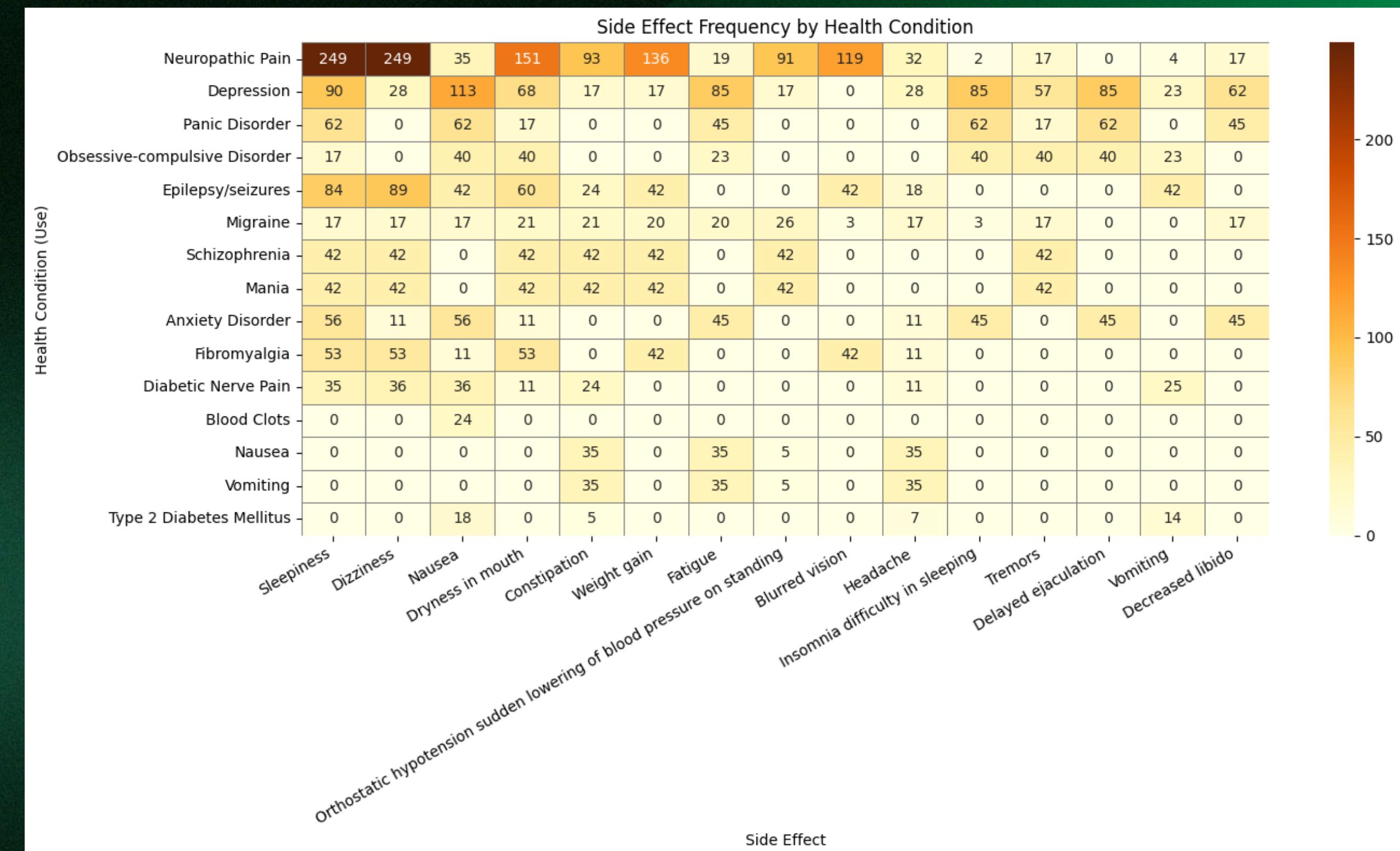
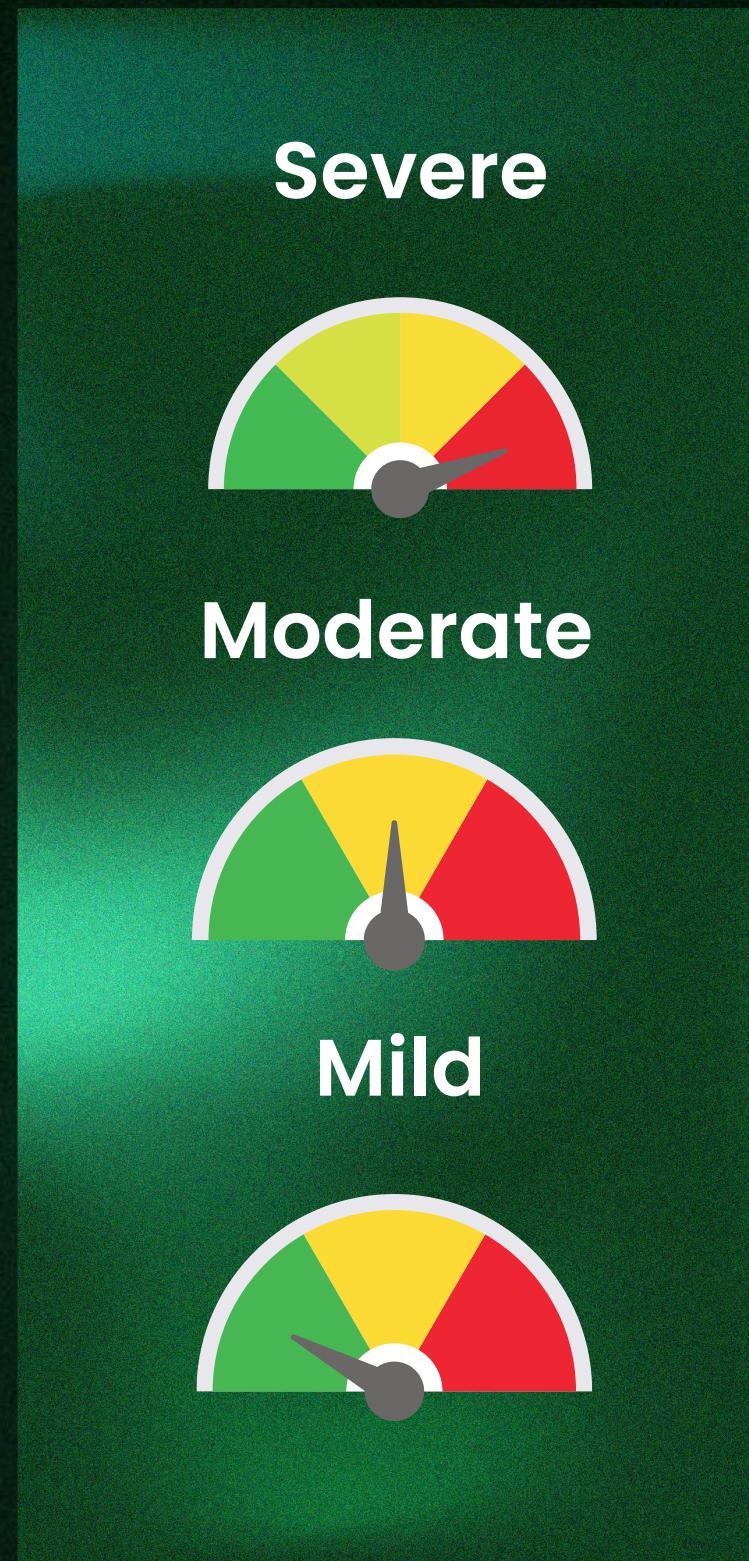
Impact

Safe prescribing
Targeted Patient Messaging

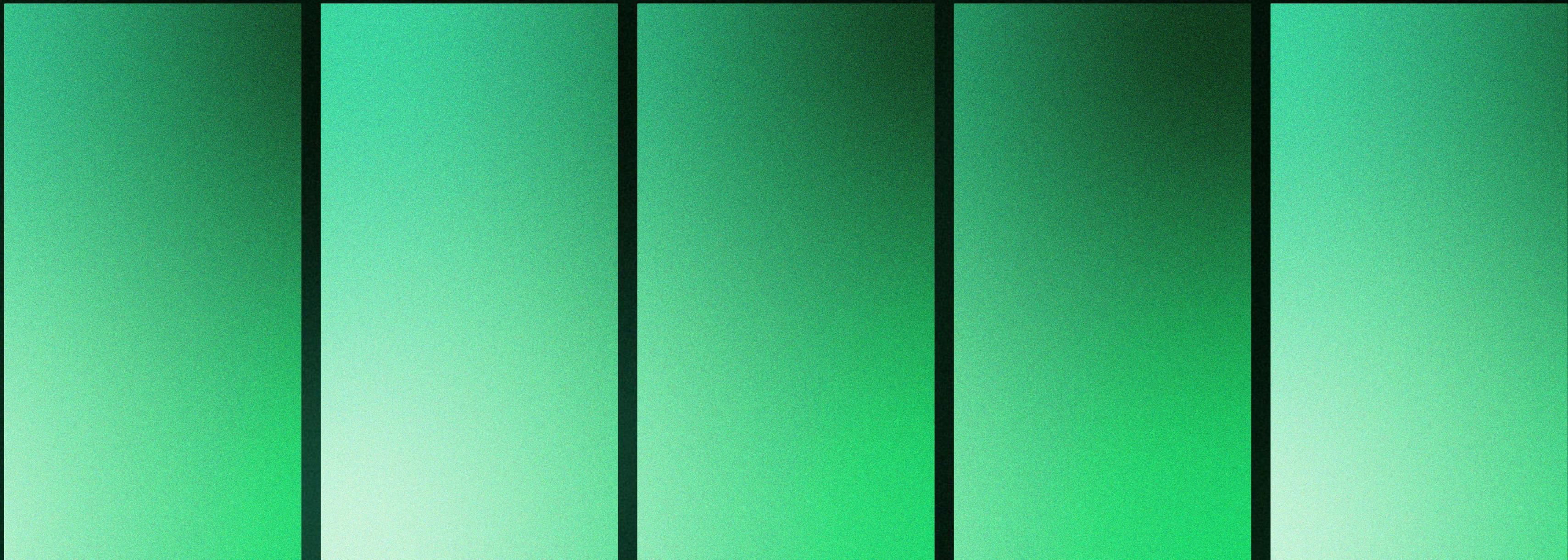
Stakeholders

Pharmaceutical Companies

Which health conditions are associated with the riskiest side effect profiles based on search-linked drugs?



Cluster Analysis



Model Type

KMeans Clustering

Input

State-level drug search popularity

Output

Regions grouped by health priorities for better outreach

Impact

Understand area-specific patient concerns

Stakeholders

Pharmaceutical Marketers
Healthcare Providers

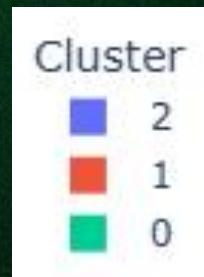
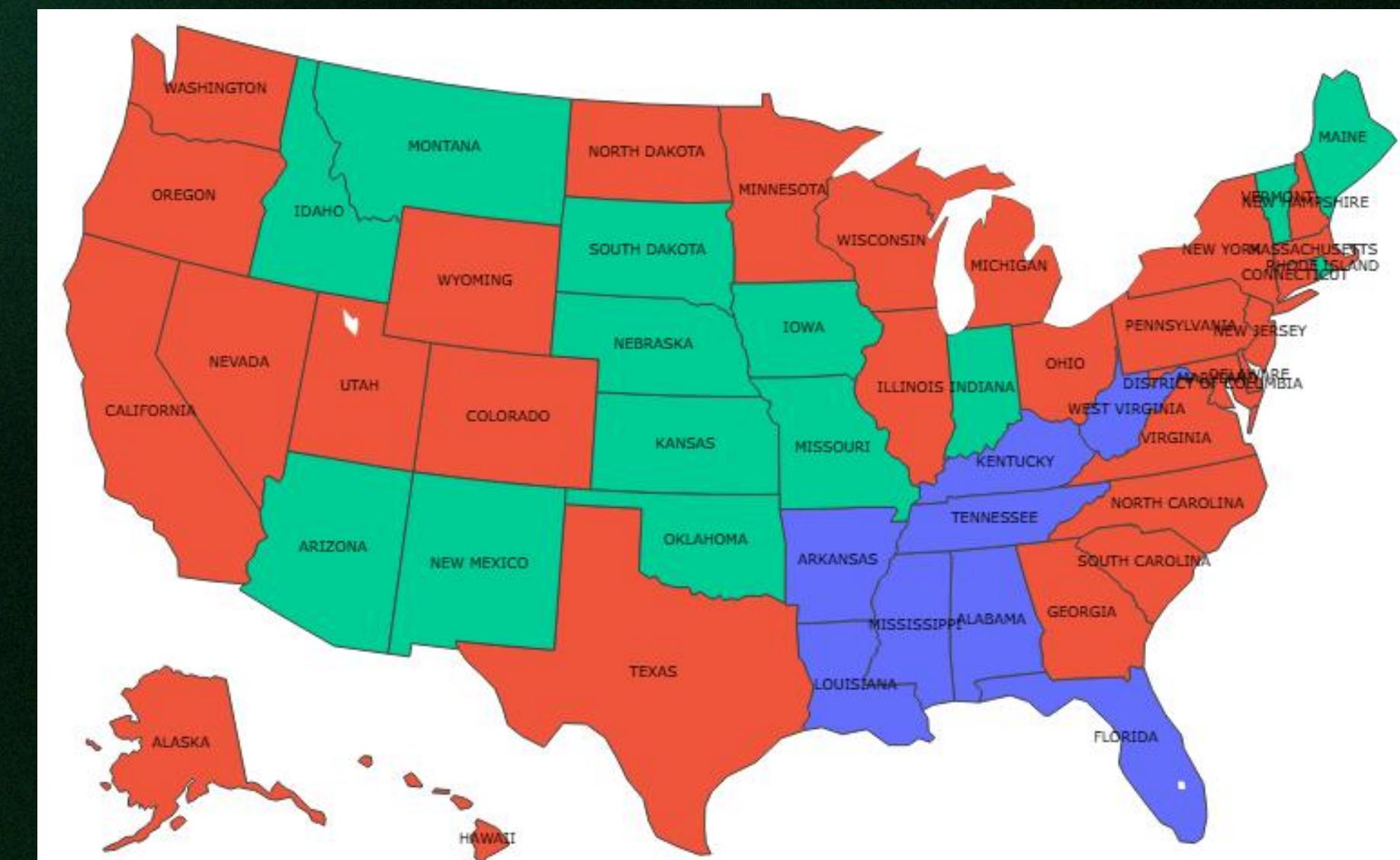
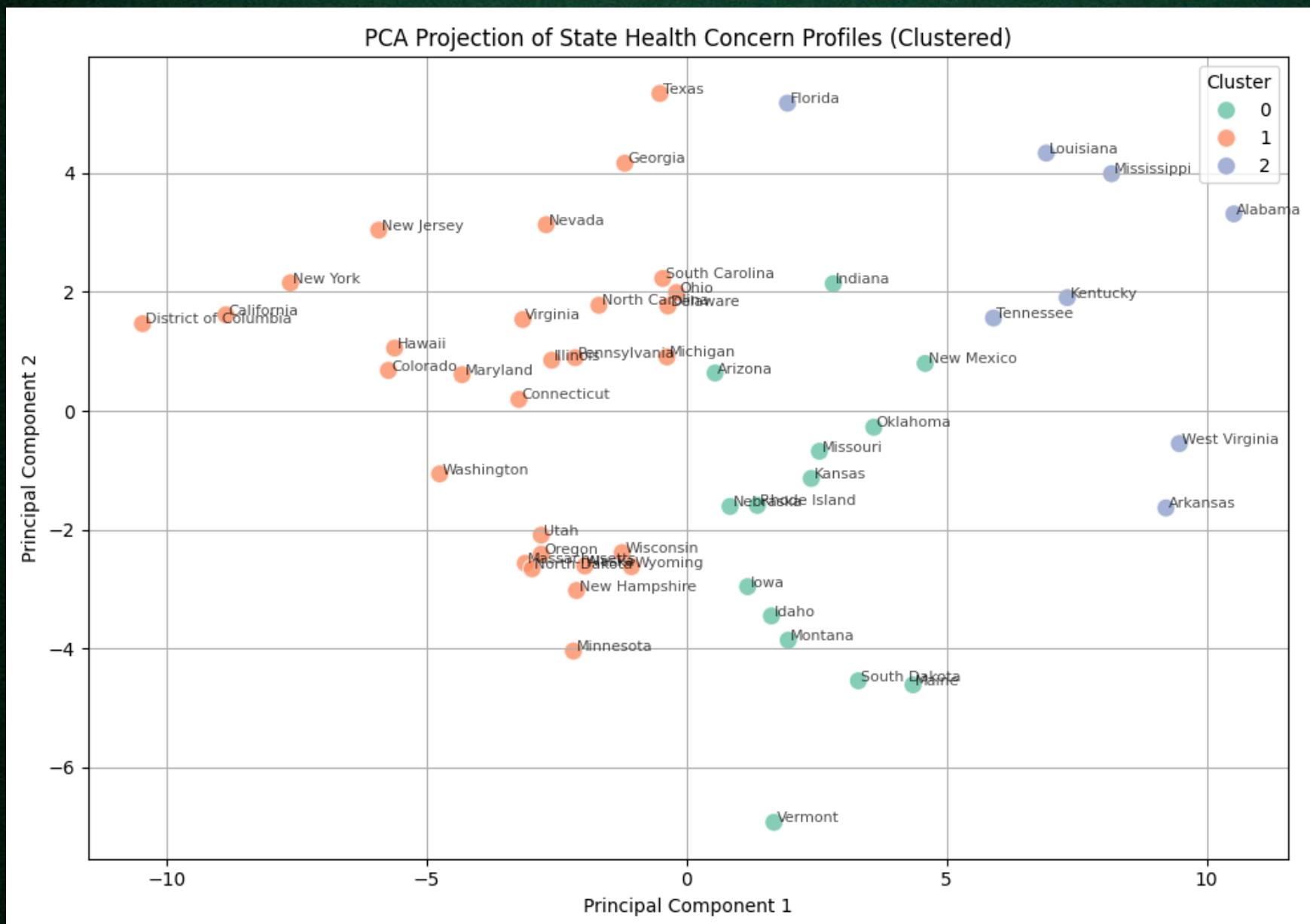
Do U.S. states exhibit similar public health concerns based on drug search data?

0
Condition-Focused or
Specialist Health
Regions

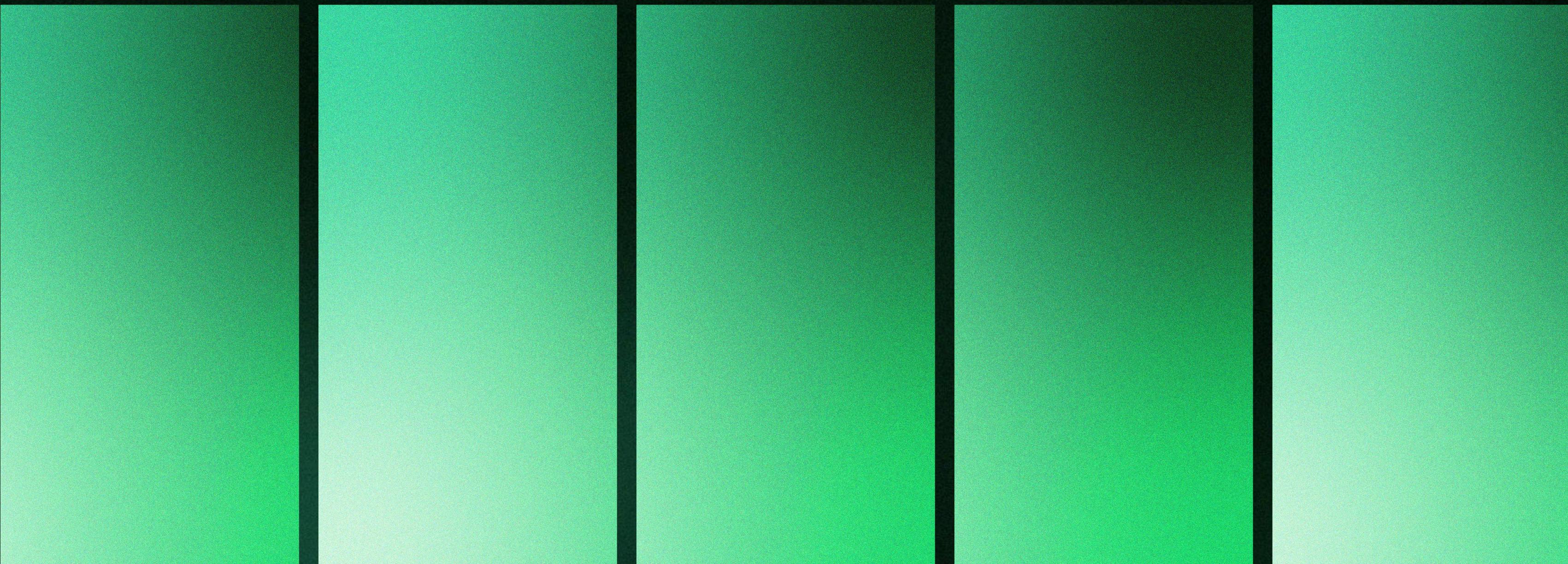
1
Diverse, High-Access,
Preventive-Oriented
States

2
Chronic Condition & High
Dependency States

U.S States Clustered Based on Health Priorities



Time Series Forecasting for Competitive Analysis



Model Type

Holt-Winters
Random Forest
Prophet

Input

Weekly national, state usage data (2021–2024)

Output

Manufacturer-level forecast curves

Impact

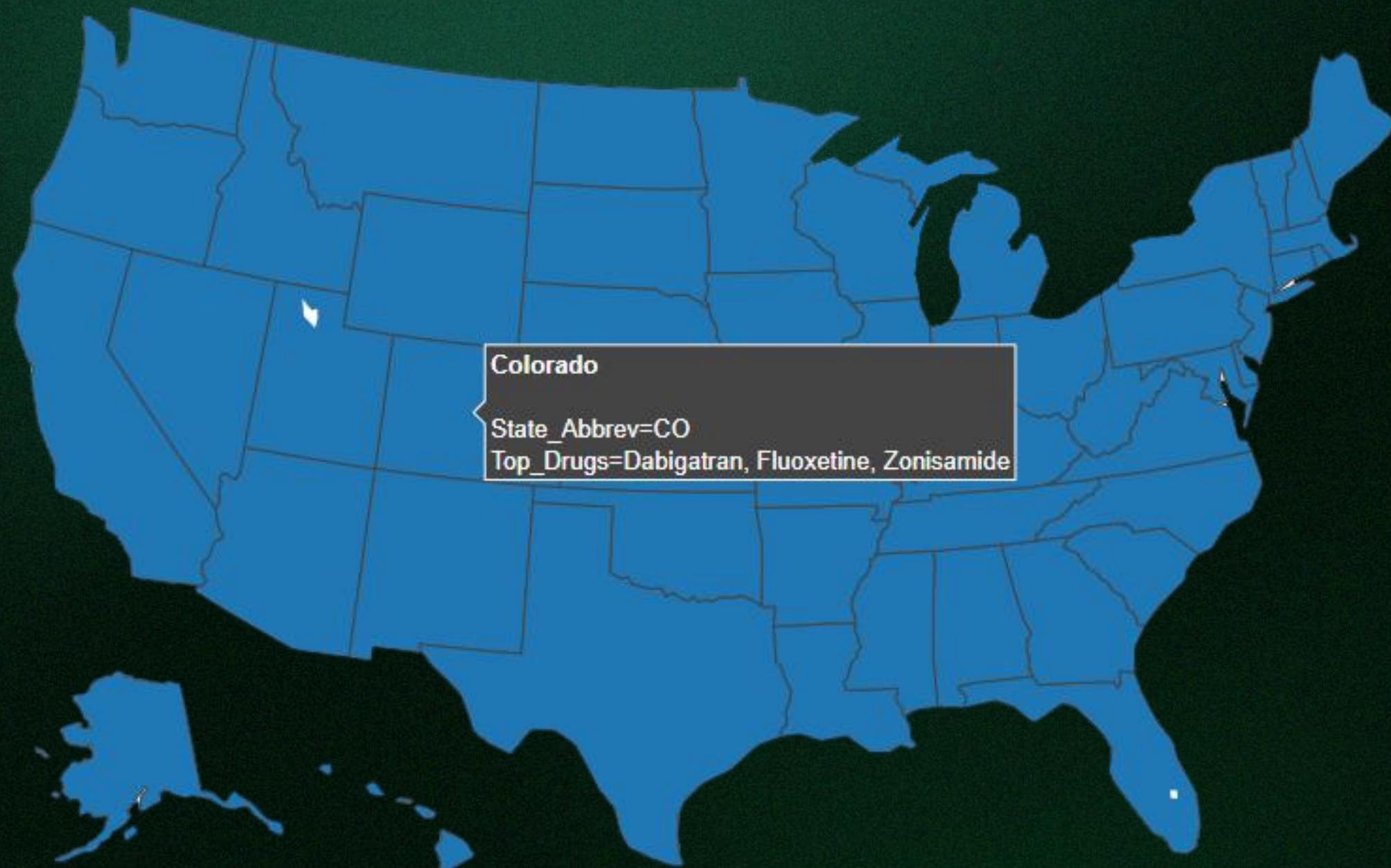
Strategic planning
Market timing for pharma firms

Stakeholders

Pharmaceutical Marketers
Healthcare Providers

U.S. Healthcare Market Leaders Per State (2021-2024)

(Based on Drug Search Popularity)



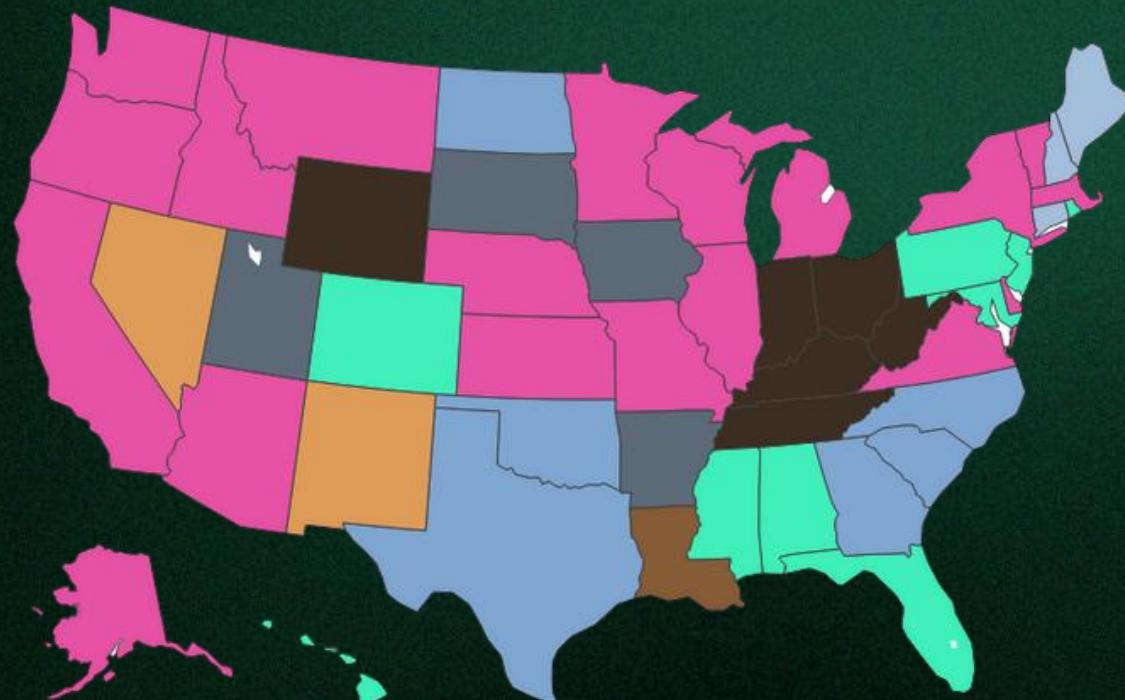
Market Leaders

- Alkem Laboratories Ltd
- Anthem Biopharma
- Aristo Pharmaceuticals Pvt Ltd
- Bayer Zydus Pharma Pvt Ltd
- Blue Cross Laboratories Ltd
- Cipla Ltd
- Dios Lifesciences Pvt Ltd
- Goddres Pharmaceuticals Pvt Ltd
- Health N U Therapeutics Pvt Ltd
- Icon Life Sciences
- Intas Pharmaceuticals Ltd
- Ipcia Laboratories Ltd
- Kivonyx Healthcare
- Knoll Pharmaceuticals Ltd
- Linux Laboratories
- Lupin Ltd
- Matias Healthcare Pvt Ltd
- Natco Pharma Ltd
- Quince Lifesciences Pvt Ltd
- Sparsh Remedies Pvt Ltd
- Sun Pharmaceutical Industries Ltd
- Talent India
- Torrent Pharmaceuticals Ltd
- UCB India Pvt Ltd
- Wallace Pharmaceuticals Pvt Ltd

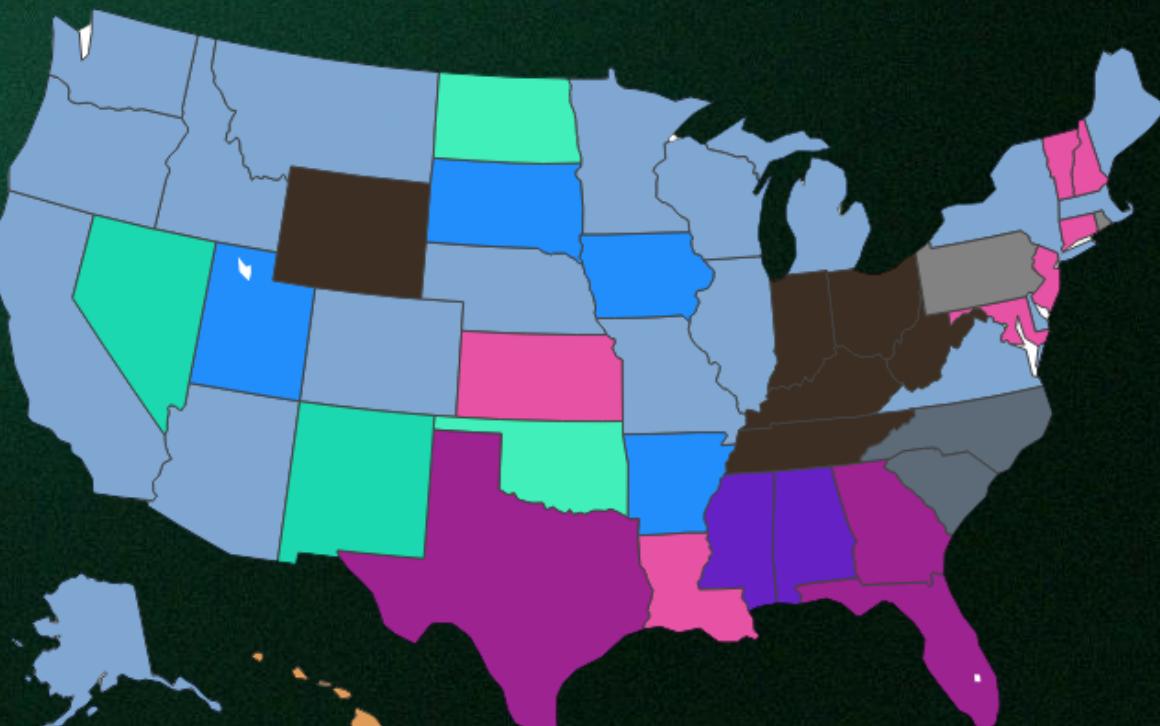
U.S. Healthcare Market Leaders Per State (2021-2024)

(Based on Drug Search Popularity)

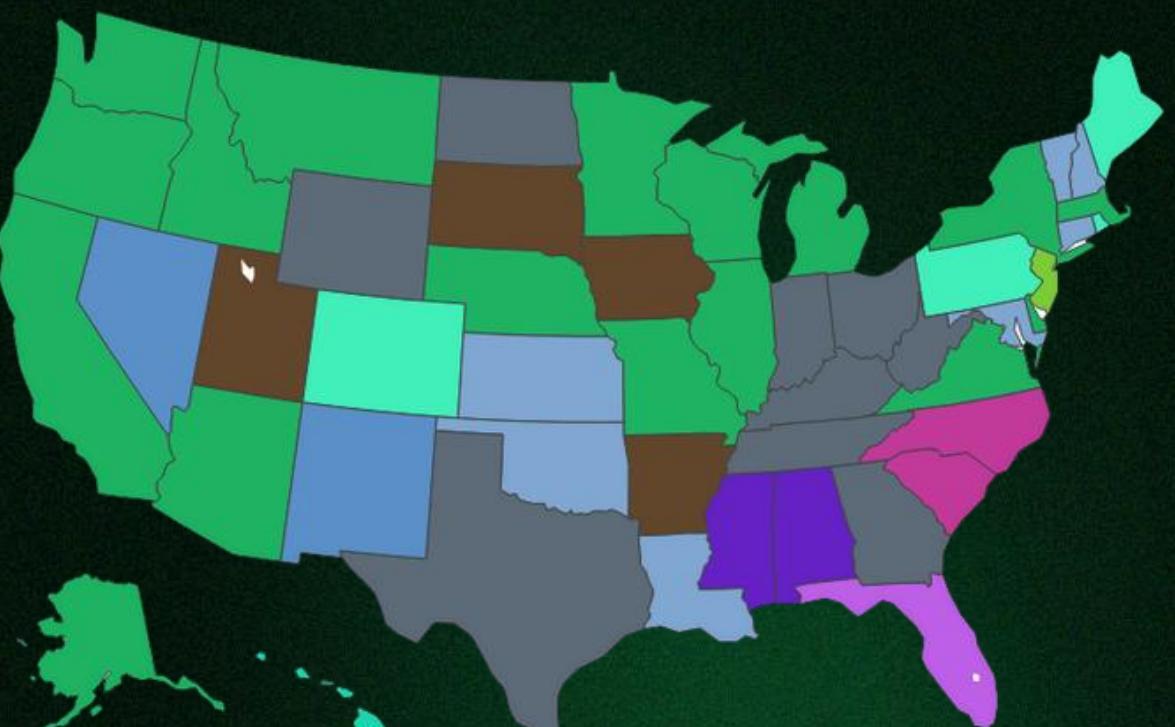
Tier 1



Tier 2



Tier 3



Manufacturer

- Lupin Ltd
- Sun Pharmaceutical Industries Ltd
- Icon Life Sciences
- Quince Lifesciences Pvt Ltd
- Intas Pharmaceuticals Ltd
- Health N U Therapeutics Pvt Ltd
- Wallace Pharmaceuticals Pvt Ltd
- Dios Lifesciences Pvt Ltd

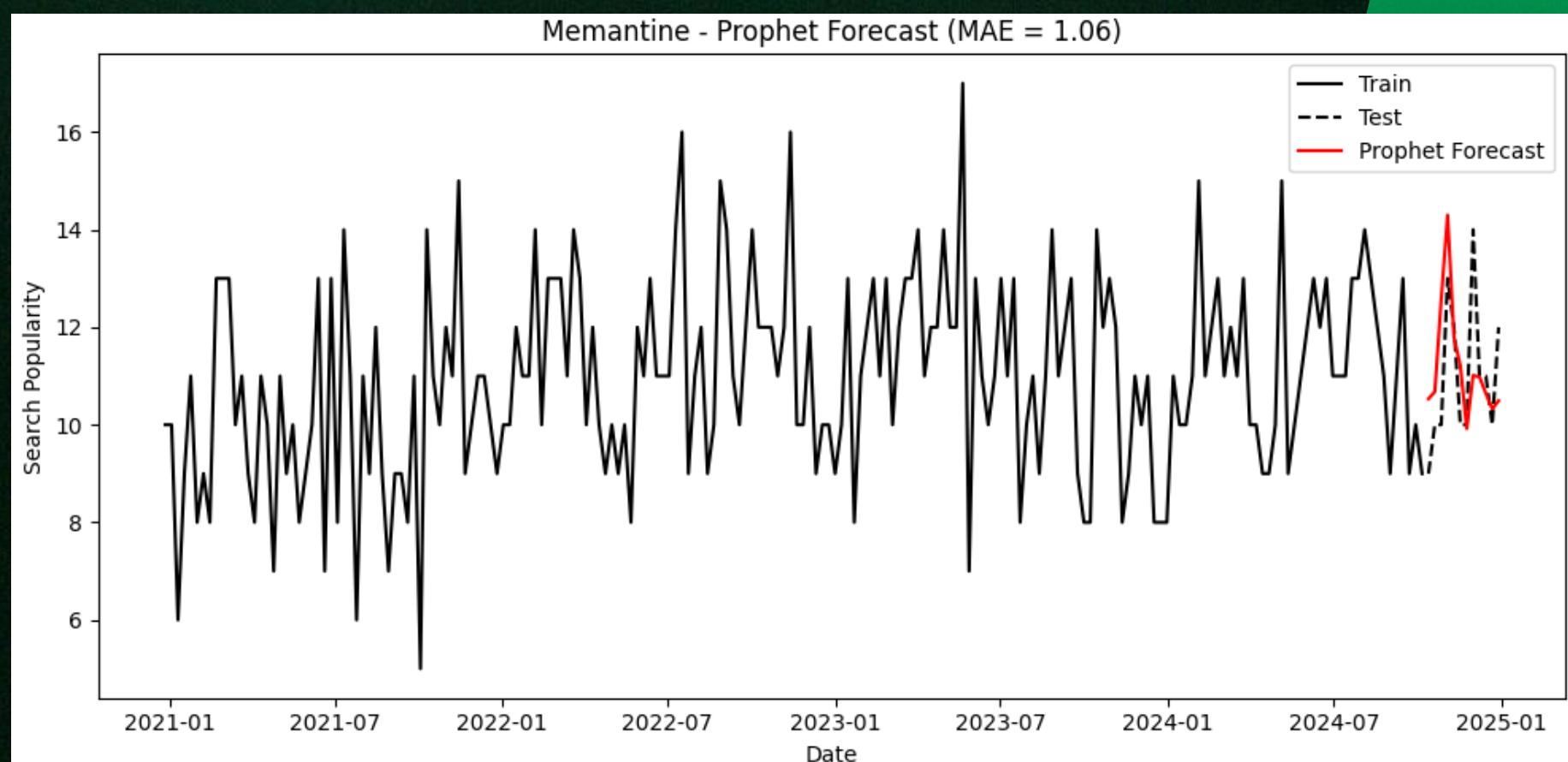
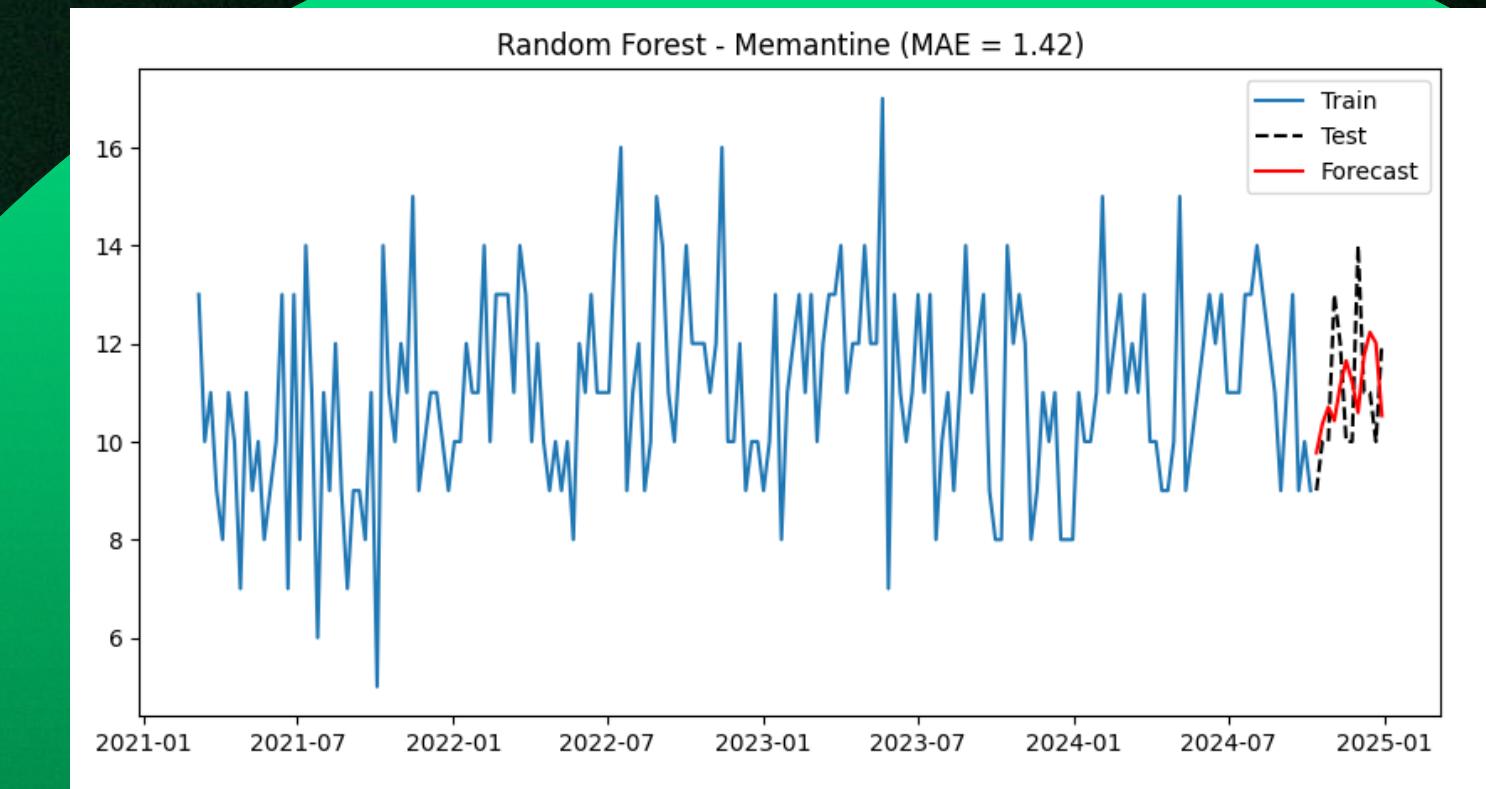
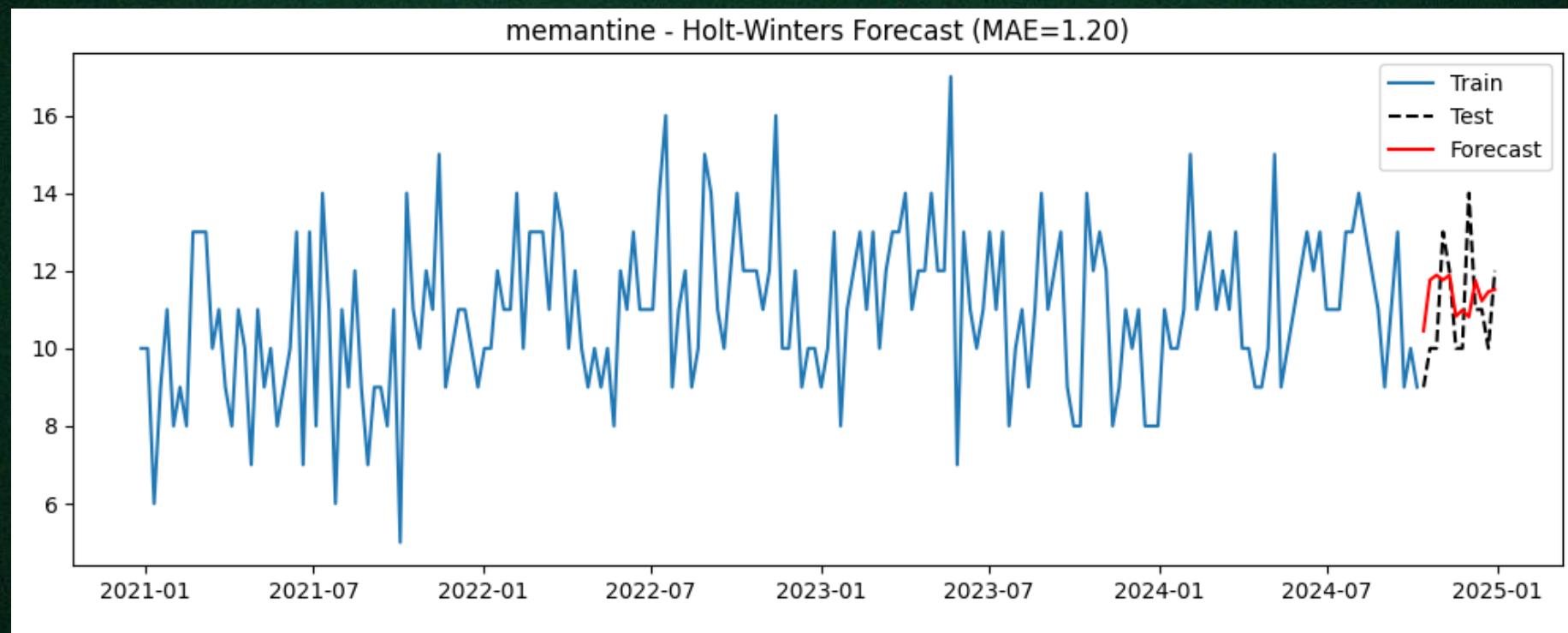
Manufacturer

- Ucb India Pvt Ltd
- Intas Pharmaceuticals Ltd
- Talent India
- Sun Pharmaceutical Industries Ltd
- Lupin Ltd
- Blue Cross Laboratories Ltd
- Dios Lifesciences Pvt Ltd
- Health N U Therapeutics Pvt Ltd
- Goddres Pharmaceuticals Pvt Ltd
- Icon Life Sciences
- Natco Pharma Ltd

Manufacturer

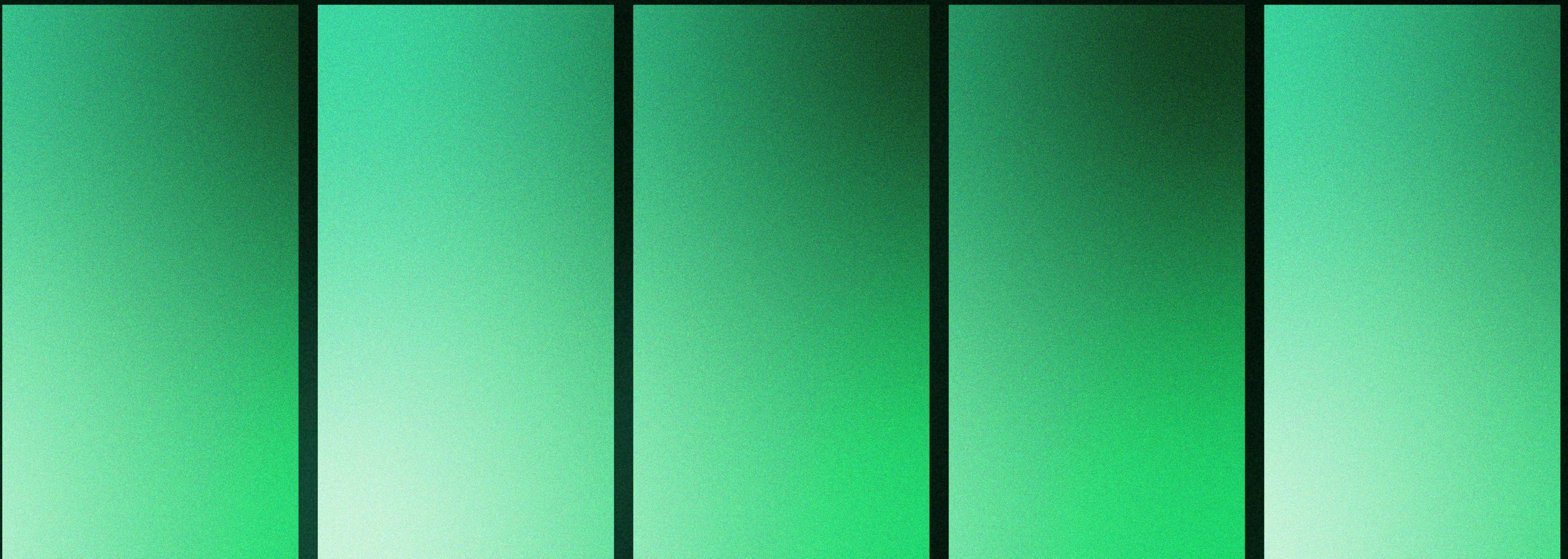
- Ucb India Pvt Ltd
- Linux Laboratories
- Matias Healthcare Pvt Ltd
- Lupin Ltd
- Intas Pharmaceuticals Ltd
- Bayer Zydus Pharma Pvt Ltd
- Cipla Ltd
- Icon Life Sciences
- Goddres Pharmaceuticals Pvt Ltd
- Aristo Pharmaceuticals Pvt Ltd
- Kivonyx Healthcare

Time Series Forecasting (Texas, USA - Drug - Memantine)



Model	Mean Absolute Error (MAE)
Holt-Winters	1.20 ✗
Random Forest	1.42 ✗
Prophet	1.06 ✓

Future Proofing



Model Type

Fine-tuned BERT

BioBERT (NLP Transform
model)

Input

Reviews
Uses
Side Effects

Output

Medical Tags
Classified Entities
Cross-verified side effects

Impact

Boosting model integrity
Foundation for
Automation

Stakeholders

Internal

Strengths

- Data-Driven Health Profiling
- Multi-Modal ML Approach
- Visual Interpretability
- Public & Commercial Use Cases
- Scalable Framework

Limitations

- Proxy Data Limitations
- Side Effect Labeling is Approximate
- Clustering Simplifies Complex Health Landscapes
- Time Series Assumptions
- Lack of Demographic Context

References

- Shiju A, He Z. **Classifying Drug Ratings Using User Reviews with Transformer-Based Language Models.** Proc (IEEE Int Conf Healthc Inform). 2022 Jun;2022:163-169. doi: 10.1109/ichi54592.2022.00035. Epub 2022 Sep 8. PMID: 36518748; PMCID: PMC9744636.
- <https://openprescribing.net/>
- <https://www.fda.gov/drugs/development-approval-process-drugs/drug-approvals-and-databases>
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- <https://www.kaggle.com/datasets/singhnavjot2062001/11000-medicine-details>



Google Trends

kaggle