

Capstone 2: Population Drug Demand

Introduction/Background

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- Aging population causing a strain on the healthcare industry [1]
- Challenges:
 - Chronic disease
 - Disabilities/ dependencies
 - Caregiving gaps
 - System deficiencies



Introduction/ Background

- Chronic illness
- Increased drug demand, exacerbating drug shortage [2]
- Urgent public health crisis



Proposed Solution Using Data Science

Proposed Solution

- Predict drug demand from population trends
 - Forecast demand
 - Mitigate supply chain bottlenecks



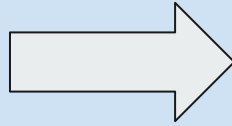


Scope of Solution Space

- Location
- Provide an initial guiding direction towards mitigation
 - Other factors:
 - Physical capacity of manufacturing plants
 - Economic viability.
- Date ranges of publicly available data

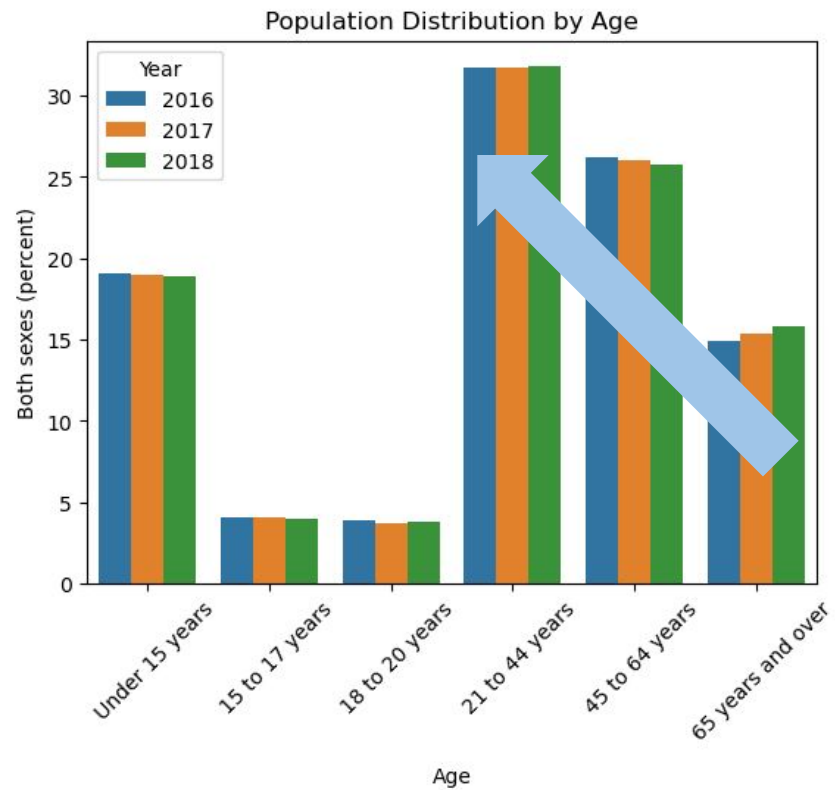
Data Sources

Population Data +
Prescription Usage (%)
per Age Group
=
Population per Age Group
Using Prescriptions

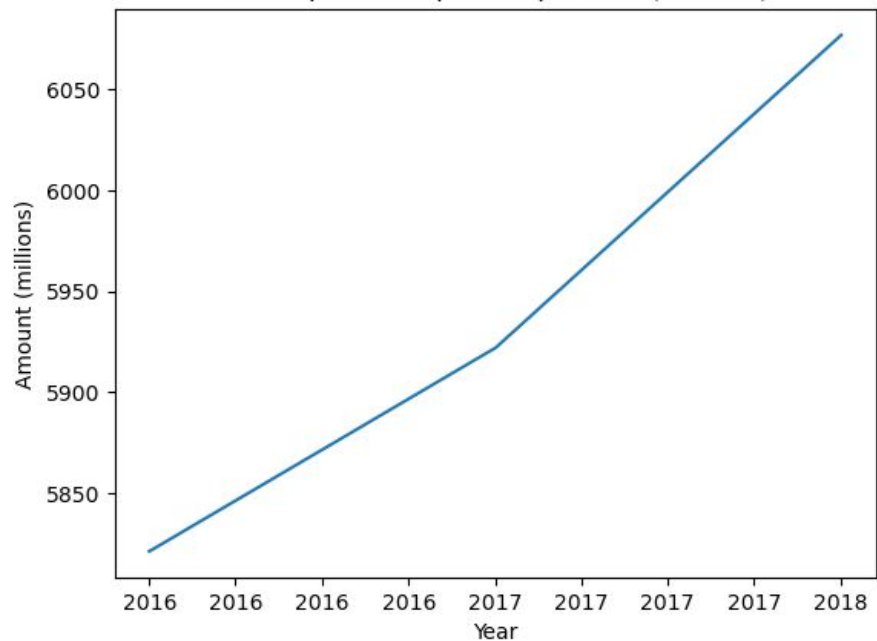


Train model on:
Population per Age Group
Using Prescriptions +
Prescriptions Dispensed per
Year

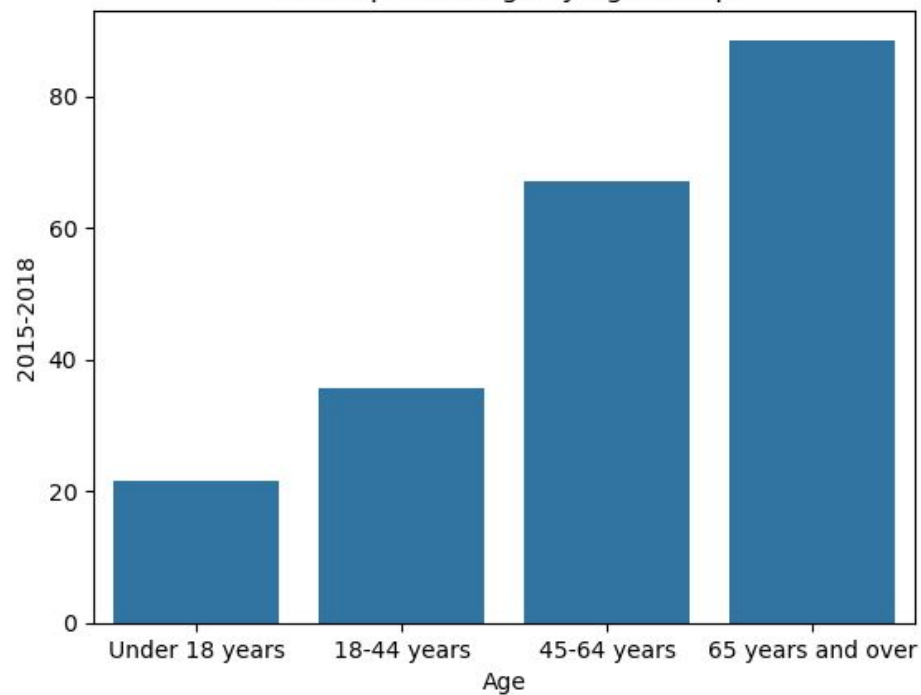
Data Processing & Insights



Prescriptions Dispensed per Year (millions)



Prescription Usage by Age Group

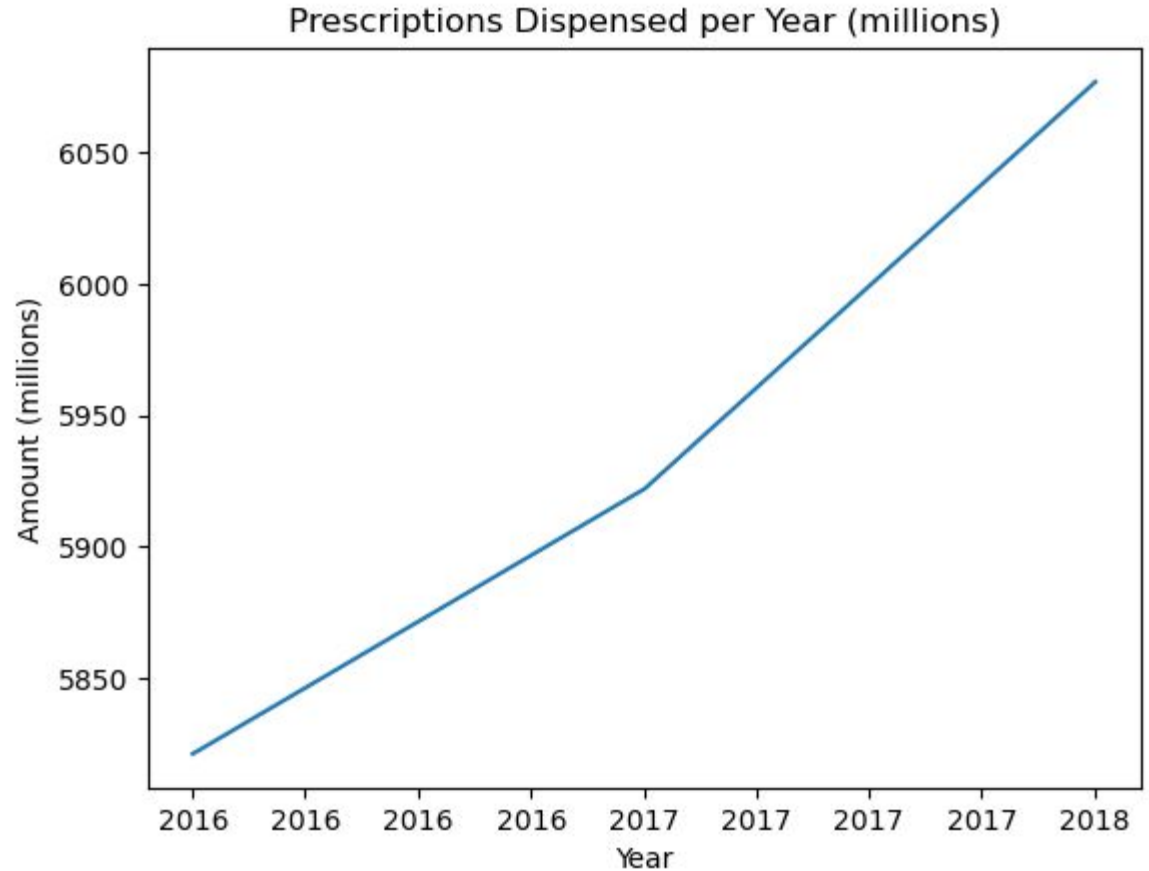


| Prescriptions Dispensed | Prescription Usage | U.S. Population |
|-------------------------|--------------------|-----------------|
| | | |
| 2009-2015* | 1988-2003 | |
| | | |
| | 2011-2018 | |
| | | 2016-2018 |
| 2016-2022 | | |
| | | 2023 |

Model Building & Evaluation

OLS Linear Regression

- Linear relationship
- Bootstrap resampling (small data set)
- Results indicate overfitting





Ridge Regression

- Reduced overfitting
- Hyperparameter tuning
- Overfitted (small dataset)

Bayesian Ridge Regression

- Probabilistic estimates to aid limited data
- Best results



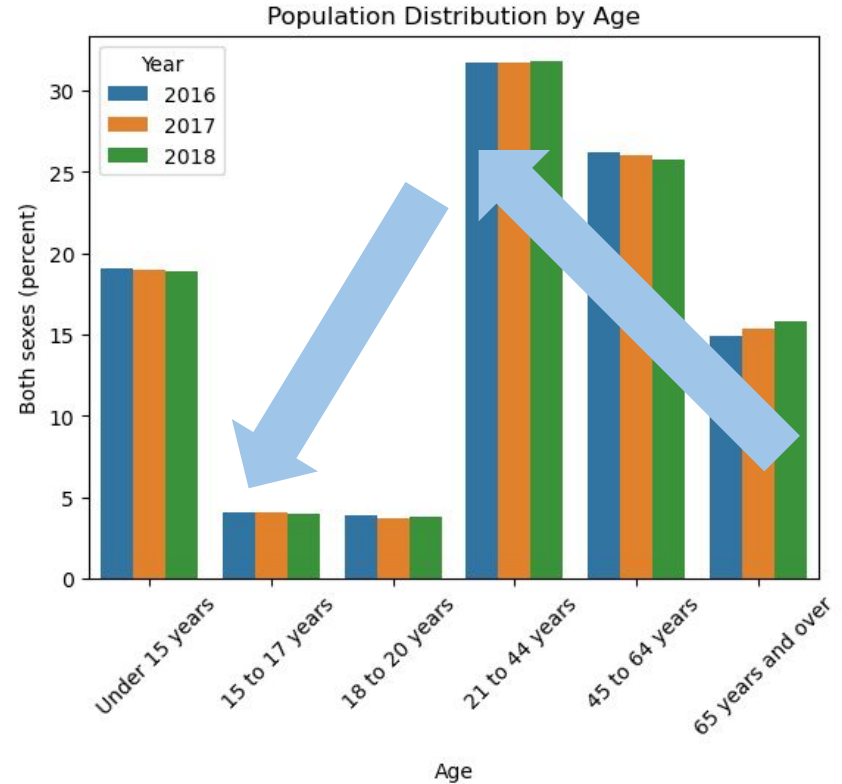
Model Comparison

| Model Name | MSE Relative Error |
|----------------|--------------------|
| OLS | 139.39% |
| Ridge | 131.01% |
| Bayesian Ridge | 3.18% |

Application & Recommendations for Future Work

Application & Recommendations for Future Work

- Predicted Prescriptions to Be Dispensed in 2023: 5940
- Additional data collection





References

1. <https://onlinelibrary.wiley.com/doi/full/10.1002/puh2.213>
2. <https://www.ama-assn.org/delivering-care/public-health/drug-shortages#>
3. <https://www.cdc.gov/chronic-disease/data-research/facts-stats/index.html>
4. <https://westhealth.org/news/a-proven-model-to-combat-u-s-drug-shortages/>