

Comparing Predictive Models: Traditional Versus Modern Statistical Approaches for Economic Outcomes in Major Depressive Disorder

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INTRODUCTION

- In 2008, the World Health Organization (WHO) identified major depressive disorder (MDD) as the third leading contributor to the global burden of disease.¹
- Approximately 3.8% of the population experiences depression. Prevalence is 5% among adults (4% in men, 6% in women) and 5.7% among adults aged 60 and older.²
- Between 2010 and 2018, the prevalence of MDD among adults in the United States rose by 12.9%, growing from 15.5 million to 17.5 million individuals. Additionally, the percentage of adults aged 18–34 with MDD increased from 34.6% to 47.5%.³
- The economic burden associated with adults experiencing MDD increased 37.9% from \$236.6 billion to \$326.2 billion (values adjusted to the year 2020).^{3,4}

OBJECTIVE

- This study aims to compare conventional and contemporary statistical techniques using negative binomial regression (NB2) and XGBoost to predict healthcare expenses and its drivers in patients diagnosed with MDD.

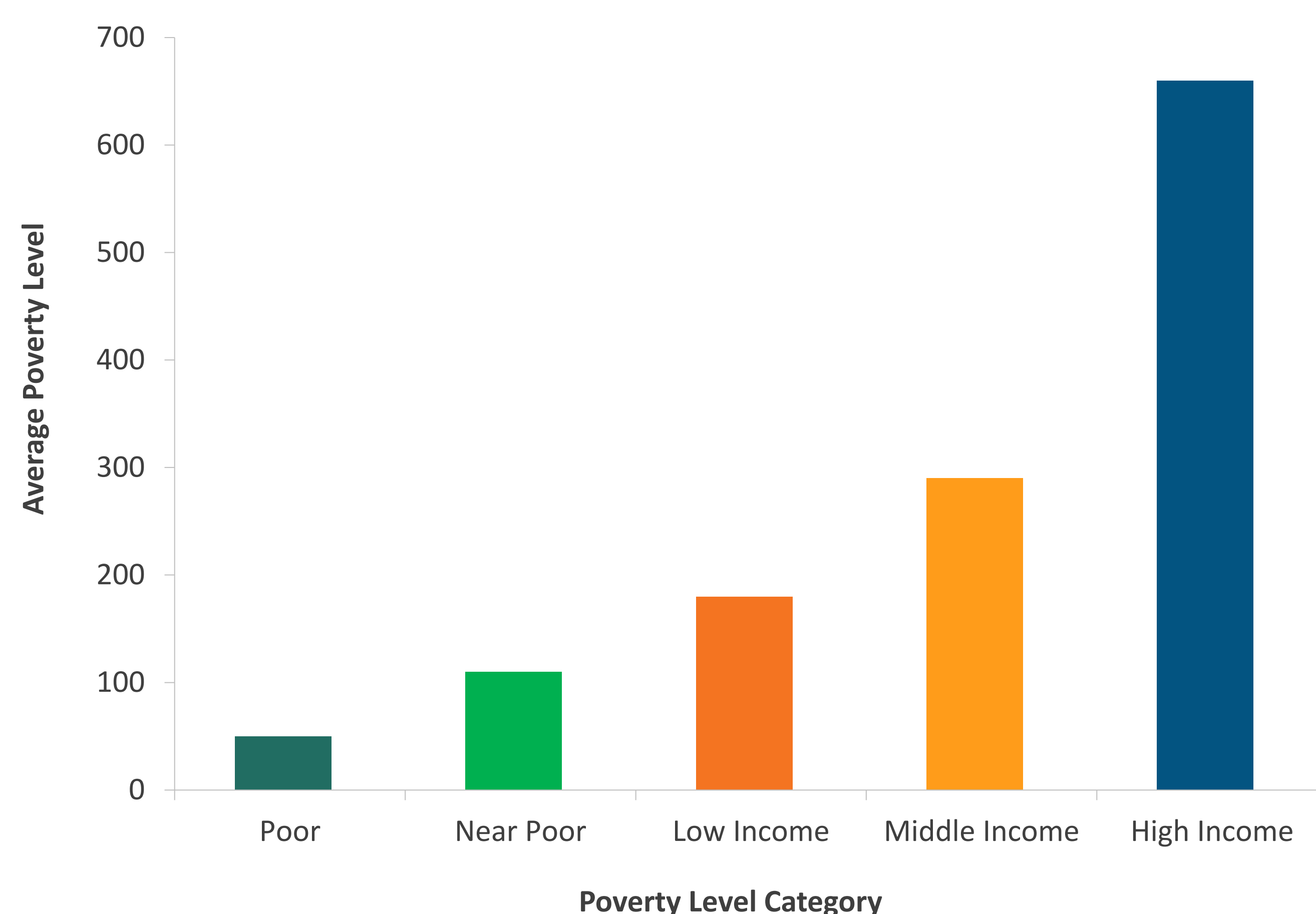
METHODS

- A longitudinal retrospective study was conducted using the household component of the Medical Expenditure Panel Survey (MEPS) database (2017-2021). Patients with a primary diagnosis of MDD were included; however, those with a diagnosis of bipolar disorder, anxiety disorder, unspecified mental disorder, and schizophrenia were excluded.
- The index event was defined as the first diagnosis of MDD.
- NB2 and XGBoost were used to estimate the healthcare costs for patients within a year of the index event.

RESULTS

- Among 2,596 patients who met the inclusion criteria, the average age was 52.5 years (standard deviation (SD): 17.7), with 69% being women. About 65% of the patients belonged to the high- and middle-income category.

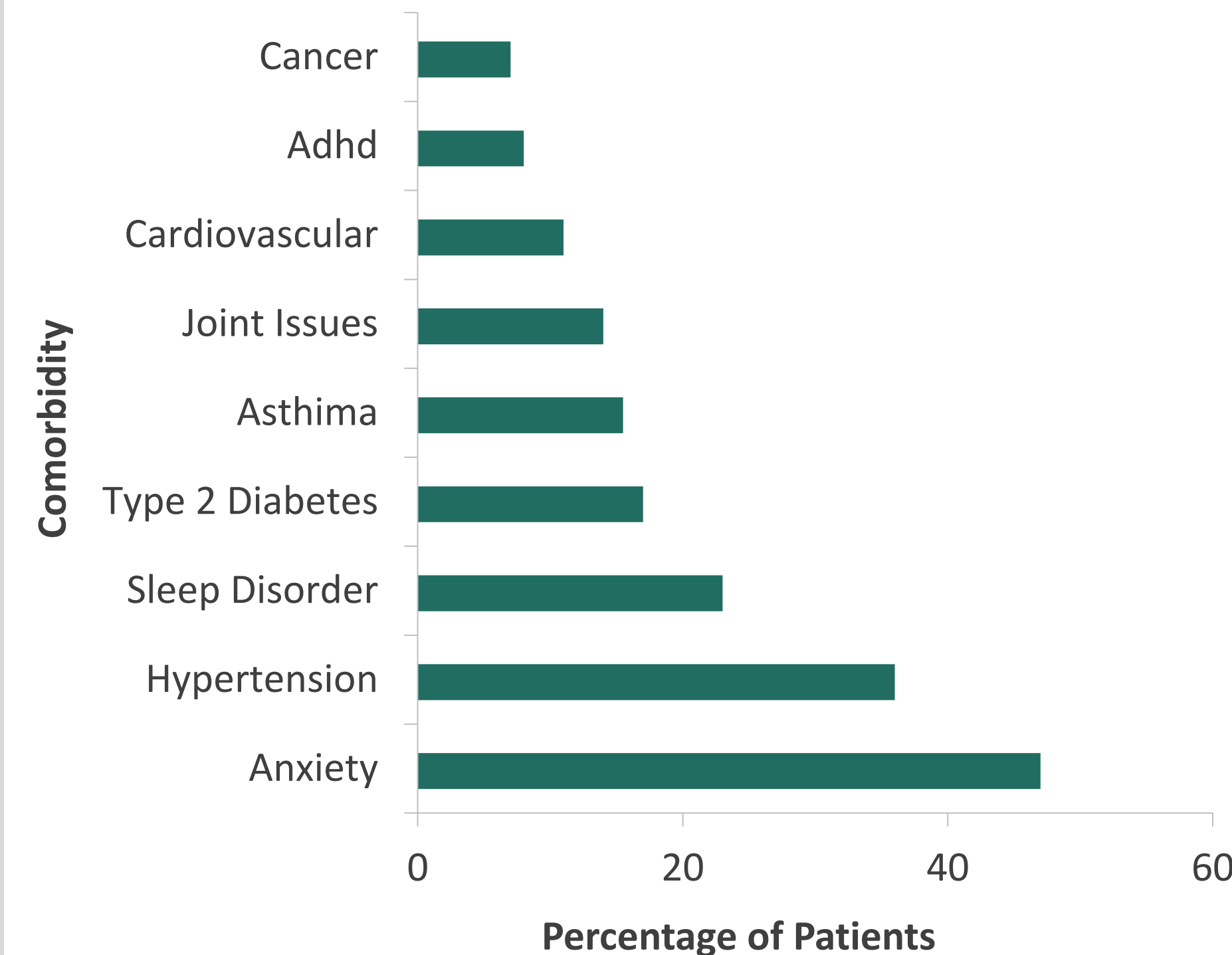
Figure 1: Distribution of Poverty Level



RESULTS

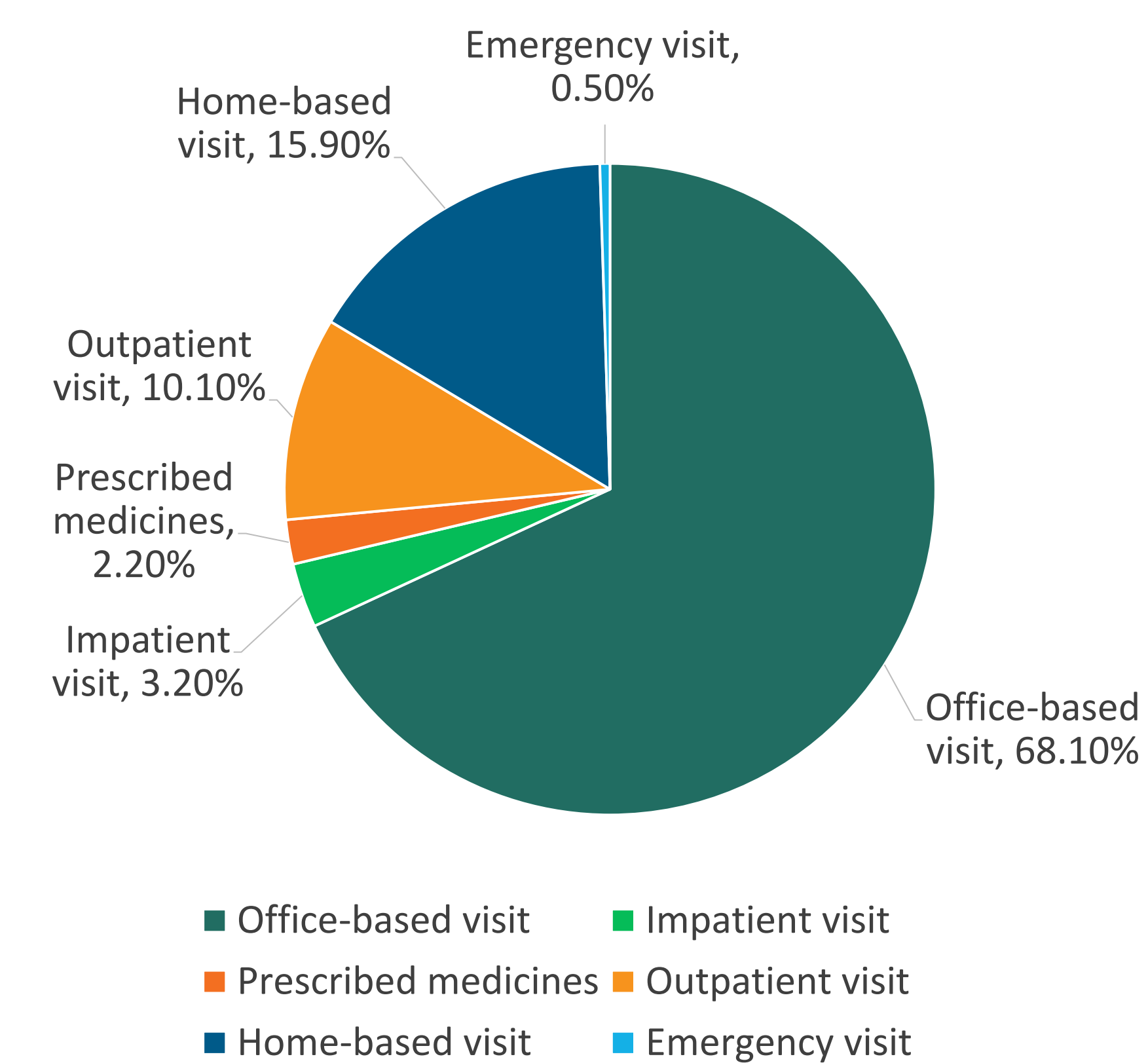
- The most prevalent comorbidities were anxiety (47%), hypertension (37%), and sleep disorders (23%).

Figure 2: Prevalence of Comorbid Conditions



- The majority of the healthcare cost borne by MDD patients stemmed from office-based visits (68%), with home-based visits accounting for 16%, and outpatient visits for 10% during the follow-up years spanning from 2019 to 2021.

Figure 3: Total Cost Distribution Across Categories



- The root mean squared error (RMSE) was computed to compare model performance between the methods. The XGBoost model yielded an RMSE 19% lower than the negative binomial model, indicating a better prediction accuracy with XGBoost.
- Hyperparameter tuning was conducted to minimize the disparities between actual and predicted values.

- The negative binomial method identified individual income, depressive medications, and psychoactive substance disorder as the major predictors of healthcare cost. Age, gender, anxiety, hypertension, and selective serotonin reuptake inhibitors (SSRI) were identified as additional significant covariates using the XGBoost method.

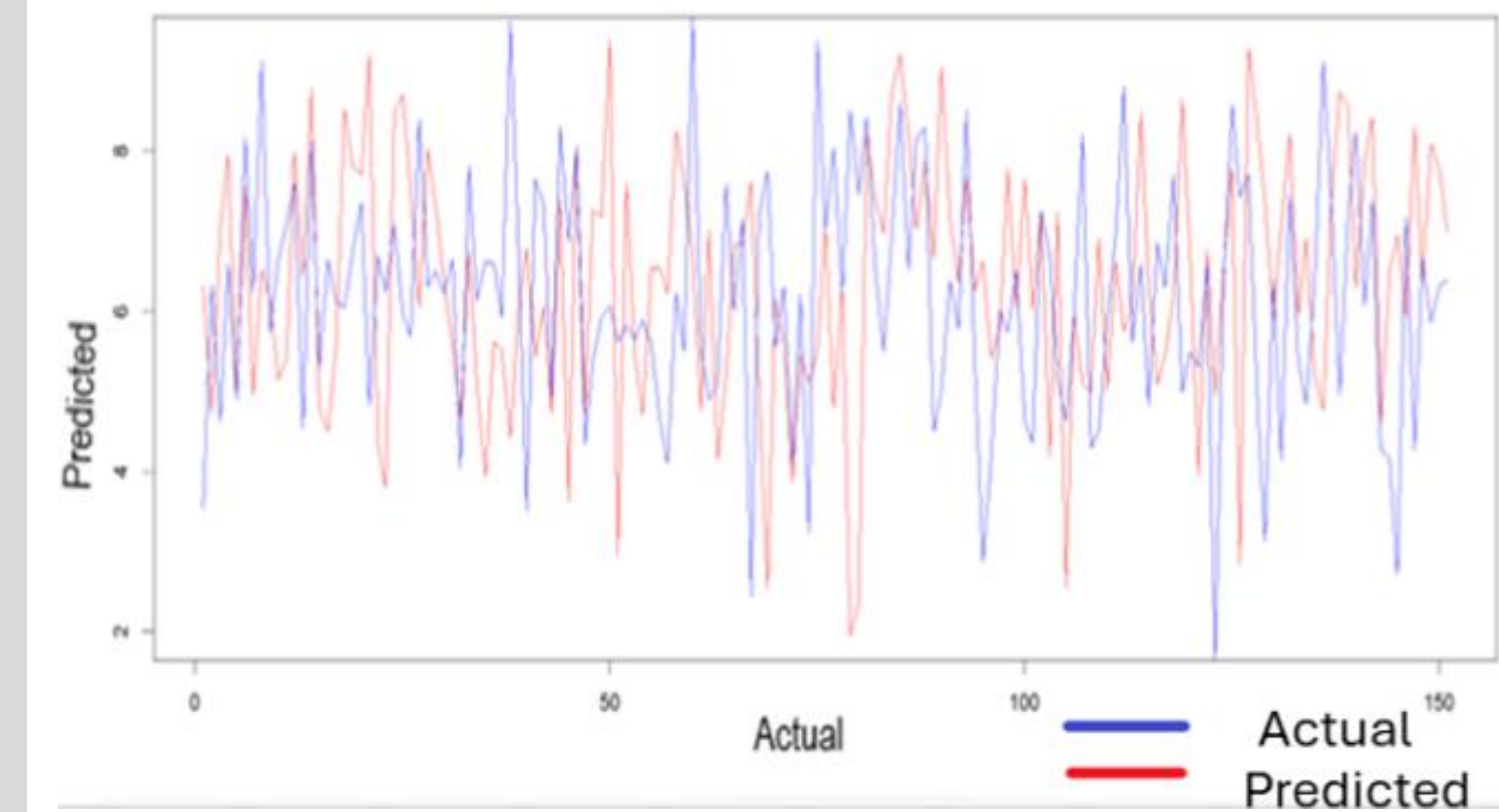
Table 1: Significant Predictors of MDD

Variables	Negative Binomial	XGBoost
Demographics:		
Age	✓	✓
Gender	✓	✓
Personal Income	✓	✓
Marital Status	✓	✓
Comorbidities:		
Anxiety	✓	✓
Hypertension	✓	✓
Cardiovascular	✓	✓
Attention deficit hyperactivity disorder	✓	✓
Other Mental Disorders	✓	✓
Medications:		
Selective serotonin reuptake inhibitors	✓	✓
Serotonin and norepinephrine reuptake inhibitors	✓	✓
Tricyclic antidepressant	✓	✓
Other depressive medications	✓	✓

RESULTS

- The actual vs. predicted values helped in predicting the accuracy and reliability of the XGBoost model. The following graph showed good predictive performance.

Figure 4: Actual vs. Predicted Values



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CONCLUSIONS

- The XGBoost model outperformed the traditional regression-based model in terms of predictive accuracy.
- XGBoost proved to be more effective in highlighting additional key cost drivers.
- Both models observed similar predictors, but XGBoost proved to be more effective in highlighting additional key drivers of cost.
- The economic burden of patients with MDD showed increasing costs over time in both models, particularly with office-based visit costs expanding at a faster rate over time.

DISCLOSURES

PM, RJ, KM, and JKO are employees of Atria. This study was funded by Atria.

POSTER PRESENTED AT

ISPOR US, Atlanta, 05 May – 08 May 2024

