



# Machine Learning to Assess Stimulant Therapy Risk for Stimulant Use Disorder

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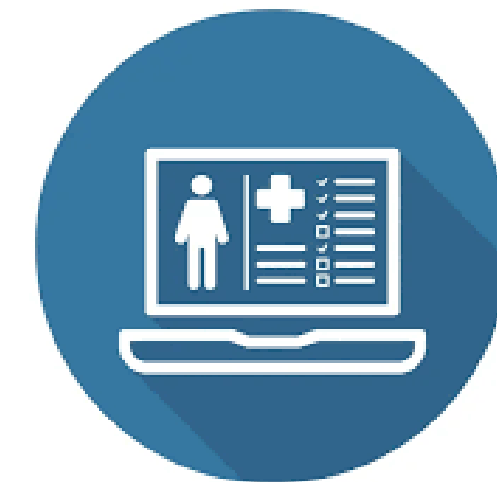
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## BACKGROUND

- Stimulant use disorder (StUD) and stimulant-related overdose deaths have risen dramatically.
- Dispensing of stimulant prescriptions (Rx) has doubled, with concerns for fueling the problems.
- Research is needed to identify the risk factors for StUD among adults treated with stimulants.
- Objective:** Using electronic health records (EHRs) and machine learning (ML) to identify key risk factors for StUD and, ultimately, help guide safer stimulant therapy.

## METHODS

**Data Source:** A retrospective longitudinal study utilizing the TriNetX research database of EHR data.



**Study Sample:** Adults with 1<sup>st</sup> stimulant Rx issued from 2010 through 2021, and

- ≥ 3 stimulant Rx within 90 consecutive days in the study period
- No prior StUD diagnosis in the EHR

## Machine Learning Analysis:

- Tested approaches based on elastic net, random forest, gradient boost, neural network with hyperparameter tuning and fairness analysis importance using SHapley Additive exPlanations (SHAP) method

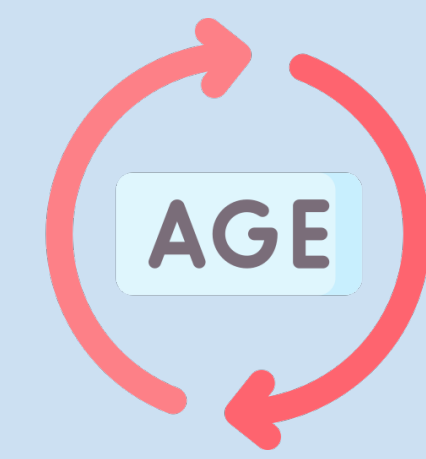


## Risk Factors and Outcome Measure:

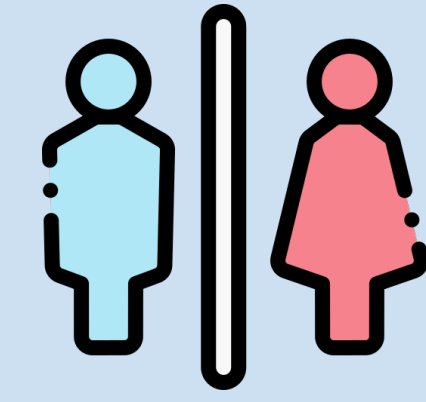
- Potential risk factors: 32 variables, including personal (age, sex, race), clinical (medical/mental health comorbidities), care utilization
- Outcome: New StUD diagnosis (ICD-10: F14, F15)

## RESULTS

**Summary Statistics:** 361,545 adults on stimulant therapy were included:



Mean: 39.2  
SD: 15.5



Male: 39.6%  
Female: 60.4%



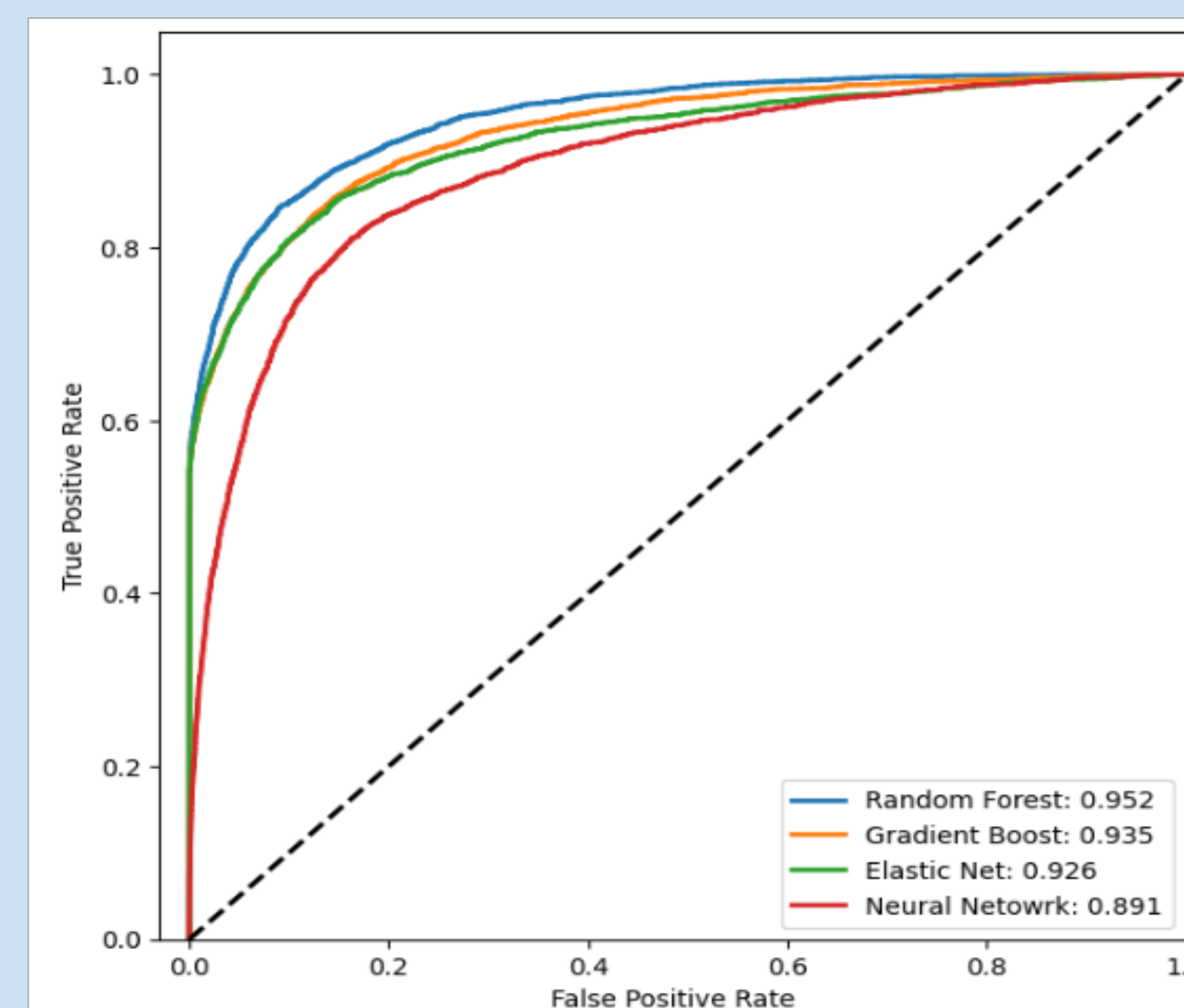
White: 78.8%  
Black: 5.6%  
Hispanic: 5.3%  
Other: 10.3%



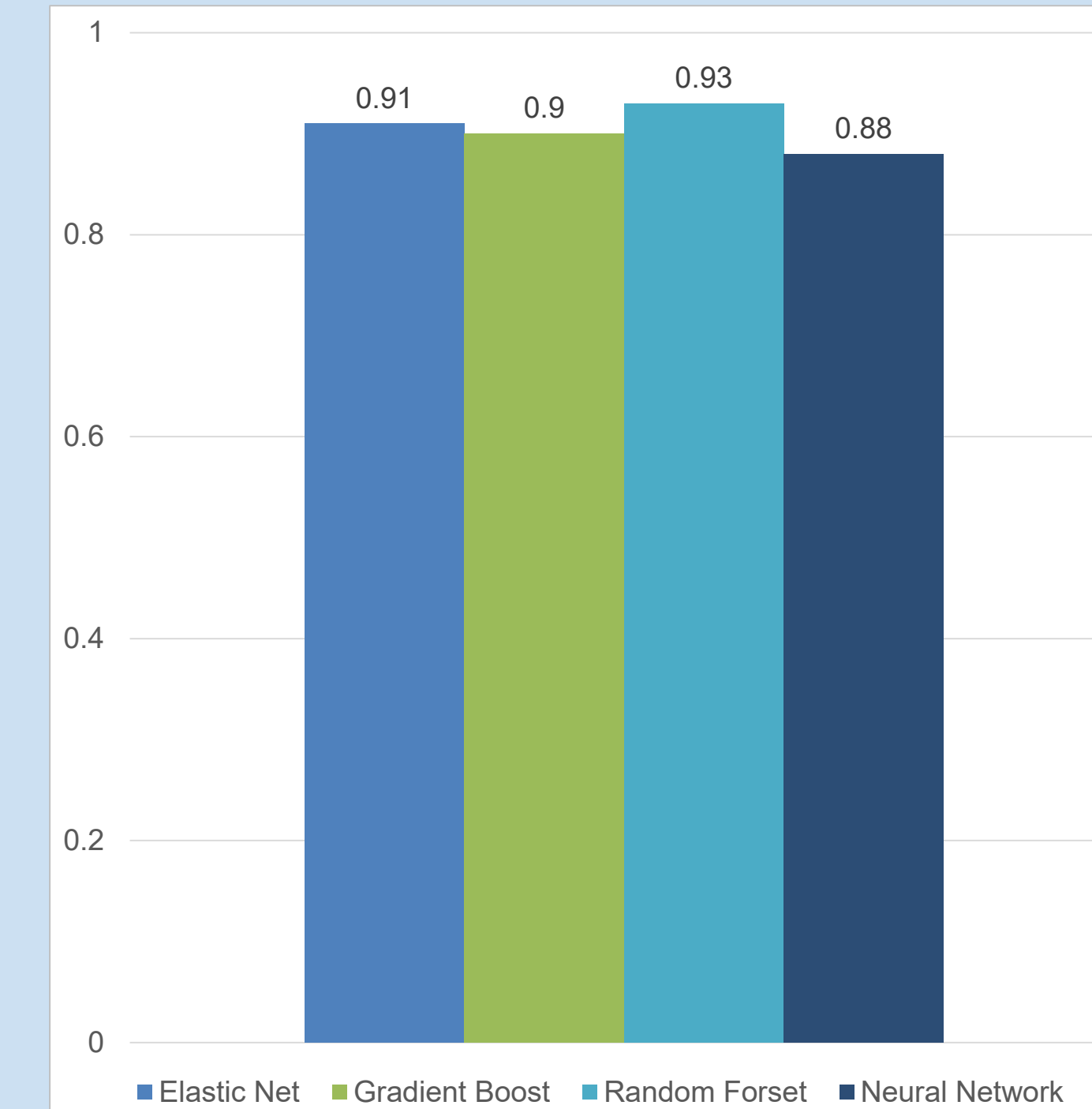
New StUD Dx: 4.3%  
No Dx: 95.7%

## Model Performance Evaluation and Fairness Analysis:

Area Under the Receiver Operating Characteristic Curve

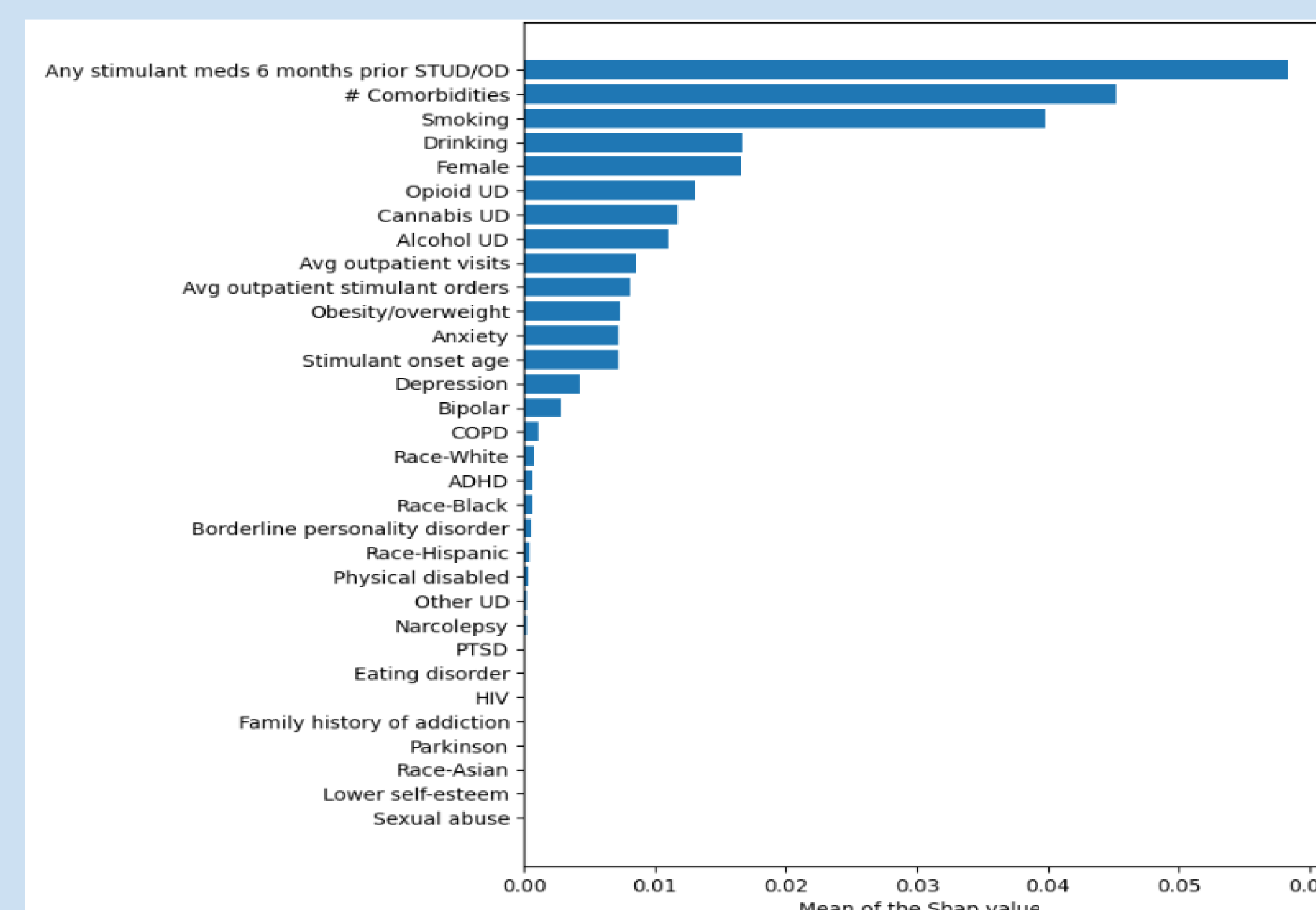


Equalized Odds



- A total of 1481 models were developed and tested
- Random forest model had the best overall performance metrics
- Random forest model had the greatest equalized odds between Whites and racial minority groups.

## Feature Importance from High to Low Impact on StUD:



## CONCLUSION

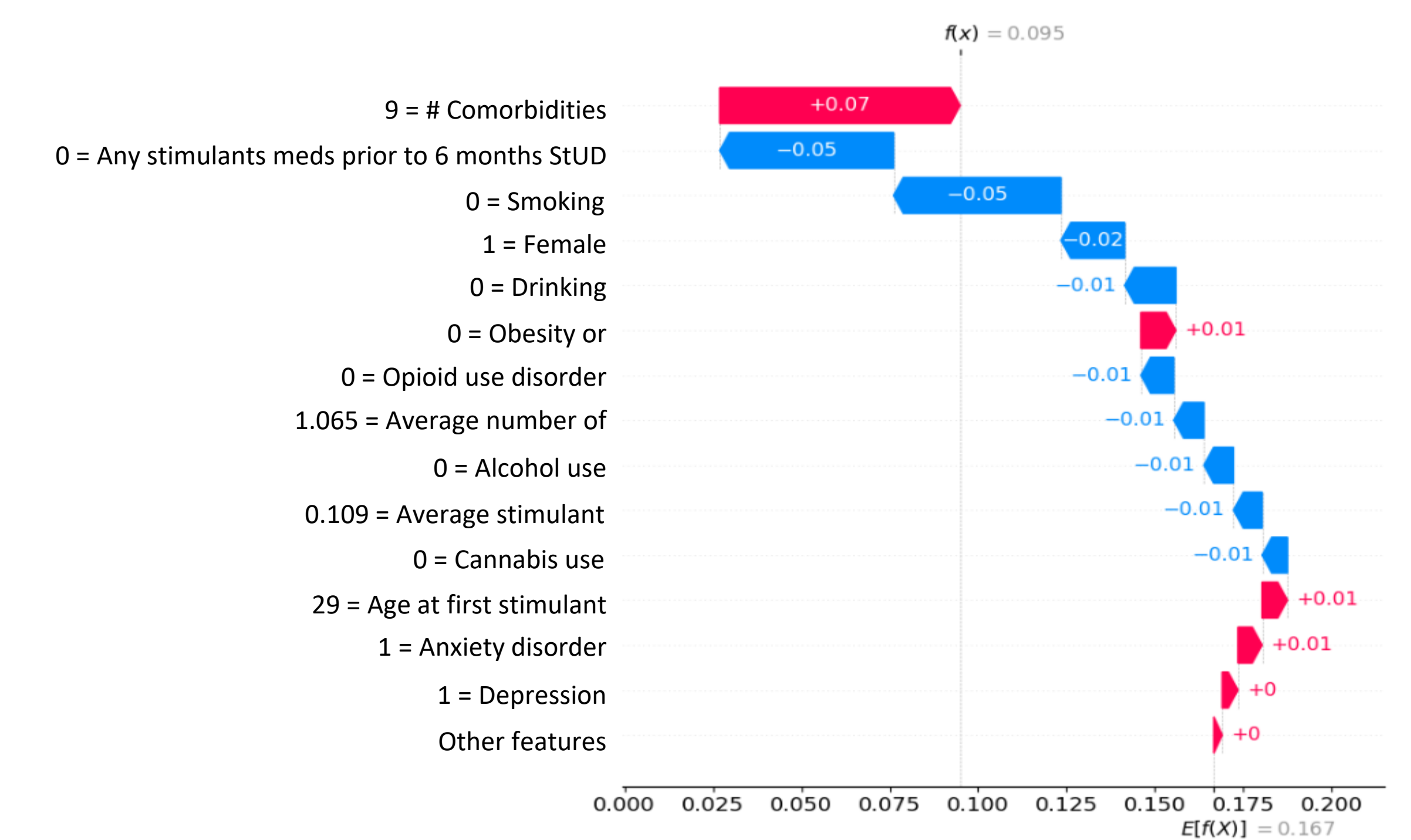
**Random Forest** emerged as the best ML modelling approach for predicting a new StUD diagnosis among those treated with stimulants.

- Strongest risk factor:** Presence of Rx for stimulants within 6 months prior to the StUD diagnosis.
- Other risk factors:** Cigarette smoking; history of substance use and mental health disorder diagnoses; extent of comorbidities

**Fairness Analysis** indicated the random forest model performed equitable across all sex and racial/ethnic subgroups, supporting the fairness of the model's performance.

## CLINICAL IMPLICATION

Clinicians can track the impact of each factor based on its relative importance in influencing the StUD development at the individual patient level, enabling a personalized strategy to reduce the risk of StUD.



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