

Predictive Modeling of the 30-Day Behavioral Health Readmission Risk in a Medicaid Population

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Introduction

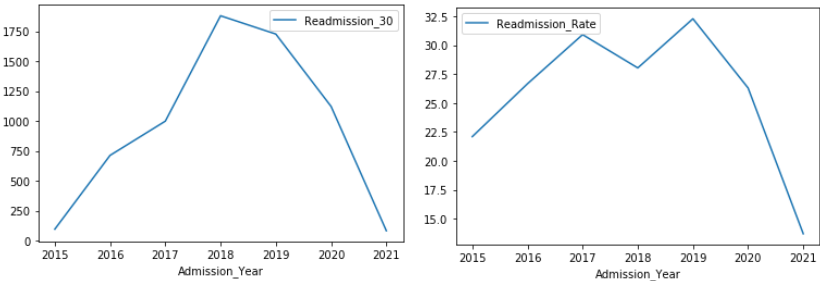
- Behavioral Health related readmissions are on the rise over the past four years among Highmark Health Options members
- Application of machine learning has revealed that men aged 35-50 have highest chances of readmitting within 30 days of initial discharge of a behavioral health related treatment event

Objective

The primary aim of this study is to predict the risk of 30-day behavioral health (BH) readmission in a Medicaid population. The secondary aim is to identify risk factors of 30-day BH readmission

Methods

- Population: Highmark Health Options members aged 18 or older in Delaware were included if they had any behavioral health disorder diagnosis identified as part of any inpatient hospital stay between 2015-01-01 and 2020-12-31
- Definitions: BH admissions were defined as admissions with BH ICD-10 codes listed in any diagnosis field of the claim. The index admission was established as any admission of BH treatment
- Readmission Event: A 30-day readmission event was defined as any BH admission occurred 1-30 days after the discharge date of the index admission
- Data: For this study we used claims, social determinants of health (SDoH), and demographic data in the past 365 days of index admission
- Features: For every member we created Temporal Embeddings for treatment events using ICD-10 codes, one-hot embeddings for CPT and NDC Codes, a matrix for NDC dosage duration and quantity, and the SDoH factors associated with a member at the time of index admission

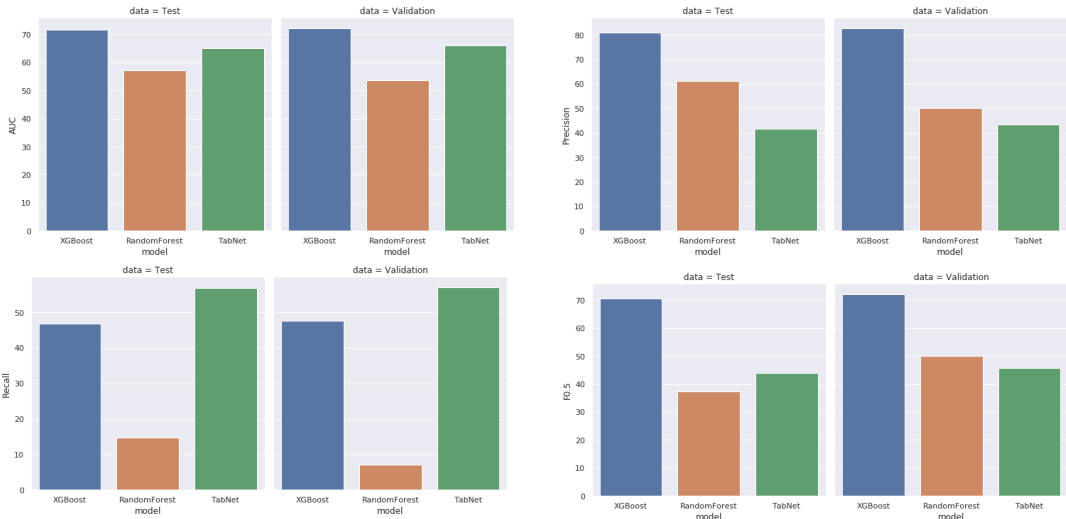


Behavioral Health related Readmission Counts and Readmission Rates computed from member claims 2015-01-01 to 2021-03-31.

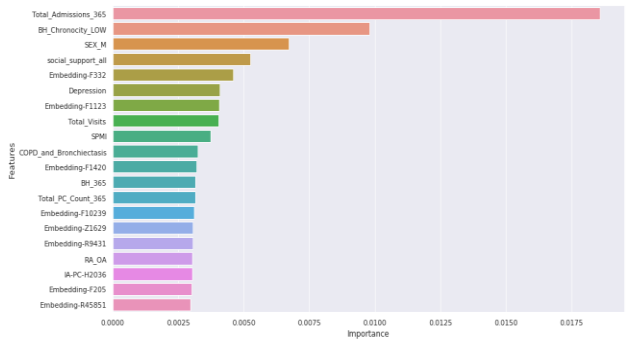
Results

- There were a total of 8,710 unique members involved in the study which had 26,786 index admissions with 6,099 30-day BH readmission events
- Among the three machine learning models tested on the dataset, XGBoost had the higher score of Area Under the Curve (AUC) and Precision than RF and TabNet (AUC: XGB-0.7388, RF-0.6948, TabNet-0.6531; Precision: XGB-0.6715, RF-0.6104, TabNet-0.4125), while TabNet had the highest recall (TabNet - 0.5901, XGB - 0.5721, RF - 0.4967)

Machine Learning Evaluation Results



Top 20 Indicators of 30-day BH Readmission



Conclusion

Using machine learning models, we were able to identify members with a high likelihood of 30-day BH readmission events. Total Admissions in past year, gender, total visits in past year, SPMI, and chronicity were the high-impact risk factors of 30-day readmission events.

Limitations

- The study is limited to Highmark Health Options members in the state of Delaware
- Missingness present in the dataset posed a challenge to obtain better results
- The model's results are heavily dependent on SDoH and collecting this data during the observation window was vital in making correct predictions

