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## **Predicting Treatment-Seeking Status for Alcohol Use Disorder- A Machine Learning Approach**

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Alcohol use disorder (AUD) is a prevalent global health concern; however, few individuals receive treatment. Measures of drinking behavior, psychological problems, and substance dependence have been shown to predict treatment seeking. To our knowledge, alcohol-related polygenic scores (PGS), a genetic measure of liability, have not been tested as predictors of treatment-seeking. We identified 9,103 individuals diagnosed with DSM-IV AUD and indicated treatment-seeking status in the Yale-Penn sample. We implemented a random forest (RF) model to predict treatment-seeking incorporating 91 clinically relevant phenotypes. We calculated ancestry-specific AUD PGS for those with genetic data (African ancestry [AFR] n=3,192, European ancestry [EUR] n=3,553) and generated RF models for each ancestry group, first without and then with PGS. Lastly, we developed models within each ancestry stratified by age (< and ≥40 years old). Sixty-seven percent reported treatment seeking (Mage=40.0, 62.4% male). Across models, top predictors included years of alcohol use and related psychological problems, psychiatric diagnoses, and heart disease. In the models without PGS, we found 79.8% accuracy and 0.85 AUC for EUR and 75% and 0.78 for AFR, respectively; the addition of PGS did not substantially change these metrics. PGS was the 10th most important predictor for EUR and 23rd for AFR. In the age-stratified analysis, PGS ranked 8th for <40 and 48th for ≥40 in EUR ancestry, and it ranked 14th for <40 and 24th for ≥40 in the AFR sample. PGS was a more important predictor in younger individuals with AUD, but incorporating PGS did not substantially alter performance.