P135
Poster Session - Mental Health - Day 1 (Poster)

Machine Learning-based Predictions of Cross-Sectional and Follow-Up Mental Health from Sleep Quality, Lifestyle, Personality, and Demographics

Vincent Küppers*[1][2], Hanwen Bi[2][3], Sama Rahimi[2], Wen Liu[2][3], Yashaswini Kg[2], Mahnaz Olfati[4], Simon B. Eickhoff[2][3], Masoud Tahmasian[1][2][3]

[1]*Department of Nuclear Medicine, University Hospital and Medical Faculty, University of Cologne, Cologne, Germany*, [2]*Institute of Neuroscience and Medicine, Brain & Behaviour (INM-7), Research Centre Jülich, Jülich, Germany*, [3]*Institute of Systems Neuroscience, Medical Faculty and University Hospital Düsseldorf, Heinrich Heine University Düsseldorf, Düsseldorf, Germany*, [4]*Institute of Medical Science and Technology, Shahid Beheshti University, Tehran, Iran*

Introduction:

Existing studies have provided evidence for the link between sleep quality, lifestyle, personality, and demographics with mental health. However, they have primarily focused on univariate associations and population-wide effects. The complex interaction between these factors at the individual participant level calls for a multivariate approach to assess their combined roles in predicting cross-sectional and follow-up mental health using a machine learning predictive model.

Method:

From the eNKI-Rockland Sample cohort, 630 participants were divided into a training set with baseline data (562 individuals, 21-85 years, 376 females), and a test set with baseline and one-year follow-up data (68 individuals, 40-71 years, 52 females). Our data include sleep quality (seven components of the Pittsburgh Sleep Quality Index), lifestyle (alcohol and tobacco use, physical activity, social contacts within/outside the family, diet/eating behavior), personality (NEO-Five-Factor-Inventory), and demographics (age, sex, and socio-economic status). Mental health was assessed using the sum of the items associated with affective (anxiety/depressive) and somatic problems as defined by the Adult Self Report questionnaire. Support vector machine with rbf kernel was trained and hyperparameters tuned using a 5-fold, 10-times repeated nested cross-validation on the training set. The trained models were then applied to the test set for cross-sectional test and follow-up test results.

Results:

Sleep quality (alone) moderately predicted depressive symptoms (training R^2 = 0.16, test-cross-sectional R^2 = 0.25, test-follow-up R^2 = 0.22) but not anxiety (R^2 = 0.06, 0.06, 0.06) and somatic problems (R^2 = 0.05, 0, -0.04). Lifestyle variables didn't improve predictions, while adding personality traits substantially increased predictive accuracy for mental health outcomes, mainly for anxiety and depressive symptoms, but not somatic problems (training R^2 = 0.30, 0.41, 0.08;

test-cross-sectional R2 = 0.43, 0.65, 0) test-follow-up R2 = 0.47, 0.60, -0.16, respectively). Adjustment for age and sex, or including all demographic information as features, didn't alter these outcomes.

Conclusion:

We found strong associations between sleep, personality traits, and affective mental health well-being. Although we didn't find a robust predictive role of lifestyle, our findings suggest that personalized mental health improvement strategies should consider the integrated role of personality and sleep quality.

Conflict of Interest: No-