Purpose of Study

Suicide is the second leading cause of death among adolescents, and early identification of individuals at risk for future suicidal thoughts and behavior (STB) could help guide preventative interventions. Neural connectivity data has previously been shown to correlate with suicidal behavior and provide an opportunity to assess the long-term risk throughout adolescence.

Methods

Neuropsychological data from 8,810 children (9.9 year old) in the Adolescent Brain Cognitive Behavior (ABCD) study without STB were analyzed for risk of STB by age 12. Predictors, collected at baseline, include family history of depression or suicidal behavior, family conflict, depression and anxiety symptoms, sleep disturbances, financial status, employment status, race, ethnicity, natal sex, age, and regional structural and functional connectivity. Three machine learning (ML) methods were used: network regularized logistic regression (LR), gradient boosted trees (GBT), and deep learning logistic regression (DL). Each model was trained on 80% of participants and validated on a hold-out test set (20%). Results presented here are preliminary, based on initial model builds without tuning or resampling in preparation for final analysis. Model performance was evaluated using area under receiver operating curve (AUROC) and area under precision recall curve (AUPRC).

Summary of Results

On the training set, DL model demonstrated the greatest performance compared to LR and GBT (AUROC = 0.887, 0.651, and 0.654, respectively). DL model also had the greatest precision-recall compared to LR and GBT (AUPRC = 0.329, 0.153, and 0.151, respectively).
However, on the test set, LR and GBT had the same performance (AUROC = 0.648) and outperformed DL (AUROC of 0.602). LR demonstrated the greatest precision-recall on the test set compared to DL and GBT (AUPRC = 0.168, 0.129, and 0.144, respectively). Across models, the features that contributed to accuracy including family history of depression, total behavioral symptoms score, and connectivity between major networks, including retrosplenial temporal and ventral attention networks and cingulo-parietal and thalamic networks.

Conclusion

Preliminary analysis demonstrates that ML models have the potential to identify individuals at risk of future suicidal behavior in preadolescence, in part using neural connectivity data. This work has the potential to detect future STB in adolescence and guide interventions and additional points of care.