

Machine Learning-Based Prediction of Suicidal Thoughts and Behaviors in Adolescents

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Purpose:

- Suicide is the second leading cause of death among adolescents.
- Early identification of risk of future suicidal thoughts and behaviors (STB) could guide preventative interventions.
- Neural connectivity data, previously shown to correlate with STB, provides an opportunity to assess long-term risk.

ML models have the potential to identify individuals at risk of STB in preadolescence, in part using neural connectivity data.

Neuropsychological data from 8,810 children (9.9 years old) in Adolescent Brain Cognitive Behavior study without baseline STB.

Predictors collected at baseline:

- Family history of depression or suicidal behavior
- Family conflict
- Depression and anxiety
- Sleep disturbances
- Demographics (employment/financial status, race, ethnicity, natal sex, age)
- Neural connectivity data (regional structural and functional connectivity)

Machine-learning (ML) methods based on baseline data predict individuals at risk of future STB.

- Three methods (Network regularized logistic regression (LR), gradient boosted trees (GBT), deep learning logistic regression (DL)).
- Trained on 80%, validated on hold-out test set (20%).
- Evaluated using area under receiver operating curve (AUROC) and area under precision recall curve (AUPRC).

Results

Training Set

Test Set

MODEL	AUROC	AUPRC	MODEL	AUROC	AUPRC
DL	0.887	0.329	DL	0.602	0.129
LR	0.651	0.153	LR	0.648	0.168
GBT	0.654	0.151	GBT	0.648	0.144

Important Features

- Family history of depression
- Total behavioral symptoms score
- Connectivity between major networks (retrosplenial temporal and ventral attention networks and cingulo-parietal and thalamic networks)

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