

# Using big data and AI to advance precision psychiatry and suicide prevention



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Dr. Smoller's research focuses on understanding genetic and environmental determinants of psychiatric disorders to develop innovative methods of better preventing and managing mental health disorders. A major component of our work is leveraging AI and the vast resource of real-world health data to enhance risk prediction and treatment selection for psychiatric illness and suicide.

1.7M people attempt suicide annually in the US. Suicide is the second leading cause of death among young people and overall suicide rates have increased by over 30% in the past 20 years. Most people who attempt or die by suicide were seen by a healthcare provider in the preceding month, presenting a crucial opportunity for risk assessment and intervention in healthcare settings. However, research by our group and others shows that clinicians do little better than chance at predicting suicide-related behaviors.

To address this unmet need, we applied AI to electronic health record (EHR) data to identify individuals at high risk of suicide attempt and death. Using longitudinal data from 1.7M patients in the MGB system, we developed and validated an algorithm that successfully identified 45% of suicide attempts and deaths with 90% specificity on average 2–3 years in advance. We subsequently validated this approach and achieved similar performance in five independent health systems across a total of 3.7M patients.

In a prospective study of 2,000 patients in a psychiatric emergency department (ED), our EHR risk algorithm coupled with a brief point-of-care survey outperformed clinicians' suicide attempt predictions up to 6 months following discharge. Of patients in the top decile of predicted risk, 40% attempted suicide within 1 month and nearly 60% attempted suicide within 6 months. Health economic analyses show that implementation of our suicide prediction models, when coupled with evidence-based interventions, is cost-effective for targeting interventions to high-risk patients. 86% of clinicians in a pilot implementation of our survey-based suicide risk scores in the ED found this information clinically valuable.

We have now refined our tool through clinician focus groups and developed a clinical decision support application that can be integrated into EHRs. The app enables point-of-care suicide risk assessment and guides clinicians through personalized care pathways. Following larger-scale clinical trials in ED settings, we plan to bring this app into production and scale its implementation to address the critical unmet need for improved suicide prevention.

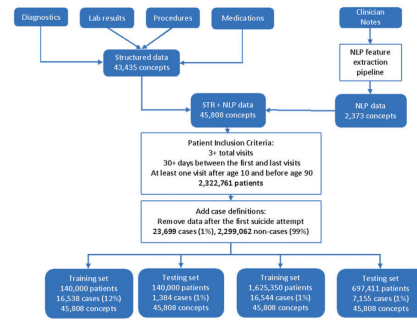


Fig. 1: Illustrative EHR model training/validation workflow

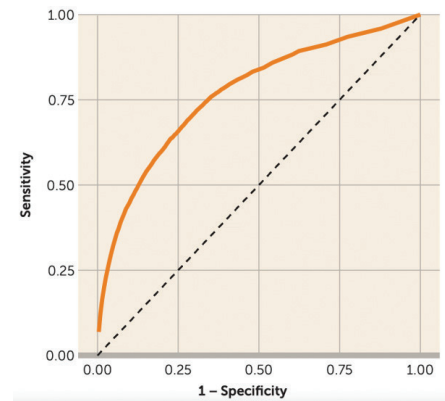


Fig. 2: Model discrimination (AUC = 0.77)

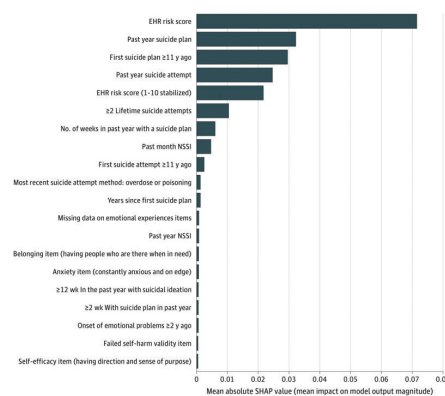


Fig. 3: Predictor importance (SHAP values) for top 20 predictors