

Predicting suicidality with small sets of interpretable reward behavior and survey variables

In the format provided by the
authors and unedited

Lalvani et al. Supplementary Material

Supplementary Material: Methods

Data exclusion

The following quality assurance procedures were implemented as employed in other publications, on deidentified data received from the third party vendor.^{1–4,15} Participants meeting at least one of the following six criteria were omitted from the cohort: (1) participants with ten or more clinician-diagnosed illnesses, (2) participants that selected the same response for at least one section of the survey, (3) participants that rated all images in the behavioral task the same or with a variance of 1 (meaning only two of 7 Likert points were used), (4) participants whose relative preference analysis yielded outliers > 3 IQRS or incomplete measurements, (5) participants that had mis-matching responses to years of education and education level in the survey, (6) participants that completed the questionnaire in less than 800 seconds.

Picture rating task and RPT variable goodness of fit

No time limit was given for the picture rating task, but participants were asked to rate the pictures as quickly as possible, using their first impressions. Post extraction of RPT curves, goodness of fit was assessed by computing R^2 values, adjusted R^2 values (accounting for degrees of freedom), and F -statistics for each participant's model fit (**Table S8**).¹

Description of judgment variables

The curves and preference features^{1,2,5–8} are detailed below.

- (1) The (K, H) curve, consisting of tuples (K_+, H_+) plotted on the positive x-axis and y-axis, and tuples (K_-, H_-) plotted on the negative x-axis and y-axis draws parallels the value

function in Prospect Theory.⁹ The following RPT features were extracted from this curve: *Risk Aversion*, *Loss Resilience*, *Loss Aversion*, *Ante* and *Insurance*. We detail the features below.

- *Loss Aversion*: LA is the absolute value of the ratio of the slope of $(\log K, \log H_-)$ to the slope of $(\log K_+, \log H_+)$. In brief, it quantifies the extent to which a person overweights negative events relative to positive ones. LA a fundamental measure in Kahneman and Tversky's Prospect Theory⁹, which informally states that humans have a cognitive bias to overweight losses relative to gains in the presence of uncertainty.
- *Risk Aversion*: RA is obtained by taking the ratio of the second derivative of the (K_+, H_+) curve to its first derivative, which is a function of K_+ . We calculated Risk Aversion at $K_+ = .5$. In economics, RA measures the degree to which an individual prefers a likely reward relative to a better more uncertain reward.^{1,2,10} RA is a common notion in studies of decision-making under uncertainty.
- *Loss Resilience*: LR is obtained by taking the absolute value of the ratio of the second derivative of the (K, H_-) curve to its first derivative, which is a function of H_- . We calculated Loss Aversion at $K_- = 1.5$. Informally, LR is akin to RA, but in the domain of losses. LR quantifies the extent to which a person prefers to lose a small defined amount in comparison to losing a greater amount with more uncertainty associated with this loss.
- *Ante*: The Ante is the value of K_+ for which $H_+ = 0$. Informally, it measures the value one needs to engage in a game of chance and models the amount of a bid an individual is willing to make to enter a game of chance (e.g., poker).

- *Insurance*: The Insurance is the value of K_- for which $H_- = 0$. It is like the ante, but in the framework of potential losses. Informally, it can be interpreted as the amount of insurance one is willing to acquire to avoid negative outcomes.

(2) The (K, σ) curve, consisting of (K_+, σ_+) on the positive x-axis and y-axis and (K_-, σ_-) on the negative x-axis and y-axis draws parallels to Markowitz's mean variance curve (see ^{5,11} for discussion of this), which is used to find optimal asset portfolios for a fixed value of risk. The (K, σ) curve models the following question: Would an individual prefer a dollar with probability one, or value drawn from a normal distribution with mean of two and variance of two? The RPT features from this curve include: *total reward risk, total aversion risk, reward tipping point, aversion tipping point, peak positive risk and peak negative risk*. We detail these features below.

- *Total reward risk*: The Total RR is the area under the curve, or the integral, of the (K_+, σ_+) curve in the positive quadrant. It can be interpreted as the total value of reward across the range of different risks.
- *Total aversion risk*: Total AR is the area under the curve, or the integral, of the (K_-, σ_-) curve in the positive quadrant. It can be interpreted as the total aversion across the range of different risks (i.e., the amount of overall negative value a person associates to negative stimuli).
- *Reward tipping point*: The Reward TP is the value of K_+ where the derivative $d\sigma_+/dK_+$ is equal to zero. This is the rating intensity corresponding to maximum variance for approach behavior, and reflects the gain or positive outcome that an object or event must have for approach behavior to occur per Markowitz (discussed in ^{5,11}).

- *Aversion tipping point:* The Aversion TP is the value of K_- where the derivative $d\sigma_- / dK_-$ is equal to zero. This is the rating intensity corresponding to maximum variance for avoidance behavior, and reflects the loss or negative outcome that an object or event must have for avoidance behavior to occur per Markowitz (discussed in ^{5,11}).
- *Peak positive risk:* The Peak PR is the value of σ_+ where the derivative $d\sigma_+ / dK_+$ is equal to zero. This corresponds to the maximum variance for approach behavior, and reflects the maximum risk that must be overcome for approach behavior to occur per Markowitz (discussed in ^{5,11}). In this sense, σ_+ models where increases in positive value transition from a relationship with increases in risk, to a relationship with decreases in risk.
- *Peak negative risk:* The Peak NR is the value of σ_- where the derivative $d\sigma_- / dK_-$ is equal to zero. This corresponds to the maximum variance for avoidance behavior, and reflects the maximum risk that must be overcome for avoidance behavior to occur per Markowitz (discussed in ^{5,11}).

(3) The (H_+, H_-) curve allows computation of the relationship between information (i.e., patterns) in approach behaviors to information in avoidance behaviors. The following RPT Features were extracted from this curve: *reward-aversion consistency*, *consistency range*, *reward-aversion tradeoff* and *tradeoff range*. We detail these features below.

- *Reward-aversion consistency:* The RA tradeoff is the average distance of the points on the (H_+, H_-) curve to the origin. Intuitively, this describes how individuals can have strong preferences (i.e., biases) for the same thing, reflecting *conflict*, or having low preferences for something, reflecting *indifference*. This gets at the consistency or compatibility of

approach and avoidance, and how you can both like and dislike something, or be indifferent to both its positive and negative features.

- *Consistency range*: The consistency range is the standard deviation of the distance of the points on the (H_+, H_-) curve to the origin. Intuitively, this quantifies how the points in the HH plane vary with regard to the radial distance from the origin. The variance in this radial distance will reflect how much an individual goes between having *conflicting* preferences and having *indifferent* ones.
- *Reward-aversion tradeoff*: The RA tradeoff is the average polar angle of the points in the (H_+, H_-) curve to the origin. This angle represents the average bias of information towards aversion vs. approach behavior, or the balance of entropies (patterns) in approach and avoidance behavior.
- *Tradeoff range*: The consistency range is the standard deviation of the Reward-aversion tradeoff. Intuitively, this quantifies the standard deviation in the patterns of approach and avoidance behavior. This variance represents the spread for positive preferences and negative preferences across a set of potential goal-objects and is one measure of the breadth of an individual's (or group's) preferences.

Gaussian Mixture Model Analyses

For each prediction outcome of interest with the GMM analysis¹² (**Fig S6**), the feature space in the training data was partitioned into two classes: a symptom-present class and a symptom-absent class. A GMM consists of a mixture of Gaussian distributions, where each Gaussian distribution has a respective probability of generating a sample. A GMM was fit to the feature space for each class, using the *sklearn*¹³ package in Python. The *sklearn* package

implemented the Expectation-Maximization, and was set to terminate when the lower bound average gain was less than a tolerance of 0.001. If the lower bound average gain was greater than 0.001 for 100 iterations, the Expectation-Maximization parameters were used at the 100th iteration and the fitting terminated. The number of mixtures in the GMM was constrained to be less than or equal to ten, and chosen as the number of mixtures that minimized the Bayesian Information Criteria (BIC) score. After fitting the GMM to each class, test data points were classified as belonging to the class whose corresponding GMM produced a larger probability density function (PDF) value for the test point. The mean accuracy, sensitivity, specificity and balanced accuracy were reported for ten iterations of the process above, using a randomized 77%/23% train/test split in each iteration.

Standard Machine Learning Approaches

Standard approaches involved use of four classifiers: random forest classifiers, logistic regression classifiers, neural networks, and support vector machines. In all procedures, ten-fold cross validation was implemented, from which the mean accuracy, sensitivity, specificity and AUC scores were reported.

Random Forest Analysis: Random Forest analysis was performed using the *sklearn*¹³ package in Python. Soft labels were used for majority voting, so that the majority vote was weighted on the probability of the sample belonging to the STB positive class. The BRF was trained using the Gini criterion, and no maximum tree depth was used, so that nodes expanded until leaves were pure or contained at most one sample. Additional details can be found in the *sklearn* documentation¹³.

Logistic Regression Analysis: Logistic regression was implemented with the *sklearn*¹³ package in Python and an L2 penalty term with coefficient equal to one. A tolerance of 10^{-4} was used as the stopping criteria, with the default solver (lbfgs). The default values were used for the implementation and details can be found in the *sklearn* documentation¹³.

Neural Network Analysis: Multilayer perceptron classifiers were implemented with the *sklearn*¹³ package in Python, with relu activation functions and 100 hidden layers. The batch size was equal to the number of samples in the training set, and an L2 regularization term with coefficient 10^{-4} was used. The default optimizer of *Sklearn* (Adam) was implemented (for more details of the implementation of the Adam optimizer, see the *sklearn* documentation¹³).

Support Vector Machine Analysis: Support Vector Machine classifiers were implemented with the with the package *sklearn*¹³ in Python with a radial basis function kernel, using the default parameters in the library so that a scaled L2 penalty was used with coefficient equal to one (for more details of the implementation, see the *sklearn* documentation¹³).

Supplementary Material: Results

Prediction of STB Variables with Gaussian Mixture Model (GMM)

(a) Passive Suicidal Ideation

GMM prediction of passive suicidal ideation (**Table S10a**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (70.3%-77.4%), but sensitivities were much lower, with a range of 26.1% to 54.3%, and specificities in the low to mid 80's. Slightly higher but similar effects were seen for threshold=2.

Prediction of passive suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 83.5% and 86.0%, respectively. Sensitivities and specificities were in the 30-50's and high 90 percent ranges, respectively. Similar effects were observed for a threshold=2 (**Table S11a**).

Lastly, analysis with all potential predictor variables achieved maximum balanced accuracies for both thresholds (70.1% and 72.6% for threshold=1 and threshold=2 respectively).

(b) Active Suicidal Ideation

GMM prediction of active suicidal ideation (**Table S10b**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (72.4%-81.8%), but sensitivities were much lower, with a range of 25.5% to 40.8%, and specificities in the 80's. Slightly higher but similar effects were observed for threshold=2 (**Table S11b**).

Prediction of active suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 91.2% and 91.6%, respectively. Sensitivities and specificities were in the 50's and high 90's. Similar effects were observed for a threshold=2 (**Table S11b**).

Lastly, analysis with all potential predictor variables did not improve the accuracies for threshold=1, but did so for threshold=2, which were 90.7% and 92.3% respectively. The balanced accuracy for threshold = 1 was optimized using RPT features and prior attempts, achieving a balanced accuracy of 77.1%.

(c) Suicide Planning

GMM prediction of suicide planning (**Table S10c**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the

balanced RF approach (80.8%-83.0%), but sensitivities were much lower, with a range of 26.6% to 45.9%, and specificities in the high 80's. Slightly higher but similar effects were observed for threshold=2 (**Table S11c**).

Prediction of suicide planning (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 94.1% and 94.3%, respectively. Sensitivities and specificities were in the high 60's and high 90's. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables did not improve the balanced accuracies for threshold=1 and threshold=2, which were 83.2% and 80.7% respectively. The balanced accuracy for threshold=1 was maximized at 84.0% using RPT features, Loneliness, prior attempts and demographics. On the other hand, the balanced accuracy for threshold=2 was maximized at 84.5% using only RPT features and prior attempts.

(d) Planning for Safety

GMM prediction of planning for safety (**Table S10d**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (68.2%-74.9%), but sensitivities were much lower, with a range of 20.8% to 38.7%, and specificities in the 70-80 percent range. Slightly higher but similar effects were observed for threshold=2 (**Table S11d**).

Prediction of passive suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 86.2% and 87.2%, respectively. Sensitivities and specificities were in the low 40 percent range and mid 90 percent range. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables a maximum balanced accuracy of 71.6% for threshold=1, but was lower for threshold=2 when compared to using just RPT features and prior attempts (i.e., 69.1% vs. 69.9% respectively).

Prediction of STB with Standard Classifiers

Prediction of STB Variables with Random Forest Classifier (RF)

(a) Passive Suicidal Ideation

RF prediction of passive suicidal ideation (**Table S12a**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (78.8%-84.7%), but sensitivities were much lower, with a range of 4.5% to 49.3%, and specificities in the mid to high 90's. Slightly higher but similar effects were seen for threshold=2.

Prediction of passive suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 86.5% and 86.2%, respectively. Sensitivities and specificities were in the low 40's and high 90 percent ranges, respectively. Similar effects were observed for a threshold=2 (**Table S13a**).

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.896 for both threshold=1 and threshold=2).

(b) Active Suicidal Ideation

RF prediction of active suicidal ideation (**Table S12b**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (85.7%-88.5%), but sensitivities were much lower, with a range of 5.5% to

37.4%, and specificities in the high 90's. Slightly higher but similar effects were observed for threshold=2 (**Table S13b**).

Prediction of active suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 92.7% and 92.9%, respectively. Sensitivities and specificities were in the 50's and high 90's. Similar effects were observed for a threshold=2 (**Table S13b**).

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.921 and .93 for threshold=1 and threshold=2 respectively).

(c) Suicide Planning

RF prediction of suicide planning (**Table S12c**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (88.5%-90.5%), but sensitivities were much lower, with a range of 3.5% to 30.6%, and specificities in the high 90's. Slightly higher but similar effects were observed for threshold=2 (**Table S13c**).

Prediction of suicide planning (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 95.4% and 95.6%, respectively. Sensitivities and specificities were in the low 70's and high 90's. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.943 and .944 for threshold=1 and threshold=2 respectively).

(d) Planning for Safety

RF prediction of planning for safety (**Table S12d**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (82.9%-84.6%), but sensitivities were much lower, with a range of 4% to

26%, and specificities in the mid to high 90s. Slightly higher but similar effects were observed for threshold=2 (**Table S13d**).

Prediction of planning for safety (threshold=1) with behavior features merged with report of prior attempts and loneliness was 87.7% and 88.6%, respectively. Sensitivities and specificities were in the low 40 percent range and high 90 percent range. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.828 and .82 for threshold=1 and threshold=2 respectively).

Prediction of STB Variables with Logistic Regression (LR)

(a) Passive Suicidal Ideation

LR prediction of passive suicidal ideation (**Table S14a**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (79.1%-84.8%), but sensitivities were much lower, with a range of 1.9% to 48.6%, and specificities in the mid 90's. Slightly higher but similar effects were seen for threshold=2.

Prediction of passive suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 86.5% and 86.0%, respectively. Sensitivities and specificities were in the low to mid 40s and high 90 percent ranges, respectively. Similar effects were observed for a threshold=2 (**Table S15a**).

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.901 and .905 for threshold=1 and threshold=2 respectively).

(b) Active Suicidal Ideation

LR prediction of active suicidal ideation (**Table S14b**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (85.7%-89.7%), but sensitivities were much lower, with a range of 1% to 37.3%, and specificities in the mid to high 90's. Slightly higher but similar effects were observed for threshold=2 (**Table S15b**).

Prediction of active suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 91.8% and 92.2%, respectively. Sensitivities and specificities were in the high 40's to low 50's and high 90's, respectively. Similar effects were observed for a threshold=2 (**Table S15b**).

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.927 and .934 for threshold=1 and threshold=2 respectively).

(c) Suicide Planning

LR prediction of suicide planning (**Table S14c**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (88.5%-89.7%), but sensitivities were much lower, with a range of 1.5% to 31.2%, and specificities in the high 90's. Slightly higher but similar effects were observed for threshold=2 (**Table S15c**).

Prediction of suicide planning (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 95% and 95.2%, respectively. Sensitivities and specificities were in the mid 60's and high 90's. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.946 and .953 for threshold=1 and threshold=2 respectively).

(d) Planning for Safety

LR prediction of planning for safety (**Table S14d**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (82.8%-84.6%), but sensitivities were much lower, with a range of 0.6% to 28.7%, and specificities in the mid 90s percent range. Slightly higher but similar effects were observed for threshold=2 (**Table S15d**).

Prediction of planning for safety (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 88.2% and 88.4%, respectively. Sensitivities and specificities were in the high 30's to low 40 percent range and high 90 percent range, respectively. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.840 and .832 for threshold=1 and threshold=2 respectively).

Prediction of STB Variables with Neural Networks (NN)

(a) Passive Suicidal Ideation

For NN analysis, we used a Multilayer Perceptron (see Supplemental Methods). NN prediction of passive suicidal ideation (**Table S16a**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (78.9%-84.8%), but sensitivities were much lower, with a range of 1.3% to 53.9%, and specificities in the 90's. Slightly higher but similar effects were seen for threshold=2.

Prediction of passive suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 86% and 85.9%, respectively. Sensitivities and specificities were in mid 30's to mid 40's and high 90 percent ranges, respectively. Similar effects were observed for a threshold=2 (**Table S17a**).

Lastly, analysis with all potential predictor variables achieved maximum balanced accuracies for both thresholds (.899 and .903 for threshold=1 and threshold=2 respectively).

(b) Active Suicidal Ideation

MLP prediction of active suicidal ideation (**Table S16b**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (85.7%-87.9%), but sensitivities were much lower, with a range of 1.8% to 38.1%, and specificities in the 90's. Slightly higher but similar effects were observed for threshold=2 (**Table S17b**).

Prediction of active suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 91.7% and 92%, respectively. Sensitivities and specificities were in the high 40's to low 50's and high 90's. Similar effects were observed for a threshold=2 (**Table S17b**).

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.922 and .929 for threshold=1 and threshold=2 respectively).

(c) Suicide Planning

MLP prediction of suicide planning (**Table S16c**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (88.5%-89.9%), but sensitivities were much lower, with a range of 1.8% to 33.3%, and specificities in the high 90's. Slightly higher but similar effects were observed for threshold=2 (**Table S17c**).

Prediction of suicide planning (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 94.8% and 95.2%, respectively. Sensitivities and specificities

were in the low to mid 60's and high 90's respectively. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.943 and .949 for threshold=1 and threshold=2 respectively).

(d) Planning for Safety

MLP prediction of planning for safety (**Table S16d**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (82.8%-84.6%), but sensitivities were much lower, with a range of 0.7% to 29.1%, and specificities in the mid to high 90's percent range. Slightly higher but similar effects were observed for threshold=2 (**Table S17d**).

Prediction of planning for safety (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 88.2% and 88.3%, respectively. Sensitivities and specificities were in the high 30 percent range and high 90 percent range, respectively. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.843 and .829 for threshold=1 and threshold=2 respectively).

Prediction of STB Variables with Support Vector Machines (SVM)

(a) Passive Suicidal Ideation

SVM prediction of passive suicidal ideation (**Table S18a**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (79.2%-84.2%), but sensitivities were much lower, with a range of 0% to

41.7%, and specificities in the between 95% and 100%, respectively. Slightly higher but similar effects were seen for threshold=2.

Prediction of passive suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness was 79.2% and 83.1%, respectively. Sensitivities and specificities were below 1% and 100%, respectively. Similar effects were observed for a threshold=2 (**Table S19b**).

Lastly, analysis with all potential predictor variables achieved maximum AUC for both thresholds (.888 and .887 for threshold=1 and threshold=2 respectively).

(b) Active Suicidal Ideation

SVM prediction of active suicidal ideation (**Table S18b**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (85.8%-85.9%), but sensitivities were much lower, nearly always zero, and specificities equal to 100%. Slightly higher but similar effects were observed for threshold=2 (**Table S19b**).

Prediction of active suicidal ideation (threshold=1) with behavior features merged with report of prior attempts and Loneliness were both 85.8%. Sensitivities and specificities were 0% and 100%, respectively. Similar effects were observed for a threshold=2 (**Table S19a**).

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.903 and .916 for threshold=1 and threshold=2 respectively).

(c) Suicide Planning

SVM prediction of suicide planning (**Table S18c**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the

balanced RF approach (86.6%), but sensitivities were 0%, and specificities equal to 100%. Slightly higher but similar effects were observed for threshold=2 (**Table S19c**).

Prediction of suicide planning (threshold=1) with behavior features merged with report of prior attempts and Loneliness were both 88.6%. Sensitivities were 0% and specificities 100%. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.924 and .942 for threshold=1 and threshold=2 respectively).

(d) Planning for Safety

SVM prediction of planning for safety (**Table S18d**) for threshold=1 yielded higher accuracies for the fusion of behavior with PHQ8, STAI, and Loneliness features than with the balanced RF approach (82.8%) but sensitivities were equal to 0%, and specificities equal to 100%. Slightly higher but similar effects were observed for threshold=2 (**Table S19d**).

Prediction of planning for safety (threshold=1) with behavior features merged with report of prior attempts and Loneliness were 82.8%. Sensitivities and specificities were 0% and 100%, respectively. Similar effects were observed for a threshold=2.

Lastly, analysis with all potential predictor variables achieved maximum AUC scores for both thresholds (.81 and .777 for threshold=1 and threshold=2 respectively).

Supplementary Material: Tables

Table S1 . BRF Prediction of STB (t = 1)

(A) Feature Set for Predicting STB1 (Passive Ideation)	Accuracy	Sensitivity	Specificity	AUC
RPT	0.590	0.514	0.610	0.598
RPT + PHQ8	0.768	0.835	0.750	0.846
RPT + PHQ8 + STAI	0.777	0.835	0.762	0.864
RPT + PHQ8 + STAI + Loneliness	0.788	0.833	0.777	0.879
RPT + PHQ8 + STAI + Loneliness + Demo.	0.798	0.847	0.785	0.886
RPT + Prior Attempts (between 1-12 months ago)	0.784	0.519	0.854	0.721
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.781	0.743	0.791	0.829
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.793	0.741	0.806	0.856
Entire Feature Set	0.815	0.848	0.806	0.905
(B) Feature Set for Predicting STB2 (Active Ideation)	Accuracy	Sensitivity	Specificity	AUC
RPT	0.638	0.560	0.651	0.644
RPT + PHQ8	0.754	0.843	0.739	0.845
RPT + PHQ8 + STAI	0.756	0.851	0.741	0.861
RPT + PHQ8 + STAI + Loneliness	0.787	0.861	0.775	0.883
RPT + PHQ8 + STAI + Loneliness + Demo.	0.793	0.862	0.781	0.891
RPT + Prior Attempts (between 1-12 months ago)	0.864	0.643	0.900	0.815
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.847	0.783	0.857	0.887
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.855	0.786	0.866	0.900
Entire Feature Set	0.838	0.866	0.833	0.931
(C) Feature Set for Predicting STB3 (Planning for Suicide)	Accuracy	Sensitivity	Specificity	AUC
RPT	0.644	0.575	0.653	0.658
RPT + PHQ8	0.753	0.809	0.746	0.842
RPT + PHQ8 + STAI	0.757	0.816	0.749	0.853
RPT + PHQ8 + STAI + Loneliness	0.794	0.849	0.787	0.882
RPT + PHQ8 + STAI + Loneliness + Demo.	0.804	0.850	0.798	0.894
RPT + Prior Attempts (between 1-12 months ago)	0.922	0.755	0.943	0.890
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.908	0.791	0.923	0.926
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.908	0.819	0.920	0.930
Entire Feature Set	0.886	0.864	0.889	0.948
(D) Feature Set for Predicting STB4 (Planning for Safety)	Accuracy	Sensitivity	Specificity	AUC
RPT	0.594	0.549	0.603	0.616
RPT + PHQ8	0.732	0.709	0.736	0.777
RPT + PHQ8 + STAI	0.723	0.729	0.722	0.781
RPT + PHQ8 + STAI + Loneliness	0.738	0.748	0.736	0.794
RPT + PHQ8 + STAI + Loneliness + Demo.	0.748	0.759	0.745	0.803
RPT + Prior Attempts (between 1-12 months ago)	0.810	0.557	0.863	0.750
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.792	0.614	0.829	0.791
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.787	0.621	0.822	0.807
Entire Feature Set	0.787	0.731	0.799	0.837

Legend. Accuracy, sensitivity, specificity, and receiver operator characteristic area under the curve (AUC) score sfor the balanced random forest prediction of STB1-STB4 with a threshold of one. The threshold of 1 indicates that a score of one for each STB variable is symptom negative, whereas scores of two through five for each STB variable are symptom positive; thus, 2752 participants had a score of 1, 724 had scores of 2-5 for STB1, 2981 participants had a score of 1, 495 had scores of 2-5 for STB2, 3078 participants had a score of 1, 398 had scores of 2-5 for STB3, and 2878 participants had a score of 1, 598 had scores of 2-5 for STB4.. Feature sets for classification start with judgment variables and successively add in the PHQ8 score, the STAI score, loneliness, and demographics respectively. Next, the feature set starts with judgment variables and prior attempts at hurting oneself, and then successively adds in variables for loneliness and demographics (age, gender at birth, ethnicity, education level and handedness), respectively. Finally, all features are used for the prediction of each STB variable. Values are rounded off at three decimal places.

Table S2: Moderation Results

<i>Moderator (Mo) = Age</i>			
RPT Feature	Dependent Variable (Y)	P_β	P_{overall}
LR	STB2	0.038	<0.00001
LR	STB3	0.0021	<0.00001
LR	STB4	0.013	<0.00001
<i>Moderator (Mo) = Loneliness</i>			
RPT Feature	Dependent Variable (Y)	P_β	P_{overall}
LA	STB1	0.019	<0.00001
RA	STB1	0.0056	<0.00001
Reward TP	STB1	0.0036	<0.00001
RA consistency	STB1	0.02000	<0.00001
Aversion TP	STB2	0.0042	<0.00001
RA consistency	STB2	0.0029	<0.00001
Insurance	STB3	0.0019	<0.00001
Reward TP	STB3	0.011	<0.00001
RA tradeoff	STB3	0.027	<0.00001
RA consistency	STB3	0.0007	<0.00001
Consistency range	STB3	0.013	<0.00001
<i>Moderator (Mo) = Prior Attempts</i>			
RPT Feature	Dependent Variable (Y)	P_β	P_{overall}
LR	STB1	0.012	<0.00001
Tradeoff range	STB1	0.0093	<0.00001
Tradeoff range	STB2	0.035	<0.00001
RA consistency	STB2	0.015	<0.00001
<i>Moderator (Mo) = PHQ8</i>			
RPT Feature	Dependent Variable (Y)	P_β	P_{overall}
Peak PR	STB1	0.029	<0.00001
Reward TP	STB1	0.025	<0.00001
Tradeoff range	STB1	0.0040	<0.00001
Tradeoff range	STB2	0.0030	<0.00001
Aversion TP	STB3	0.013	<0.00001
Tradeoff range	STB3	0.0023	<0.00001
Tradeoff range	STB4	0.013	<0.00001
<i>Moderator (Mo) = STAI-S</i>			
RPT Feature	Dependent Variable (Y)	P_β	P_{overall}
Ante	STB1	0.024	<0.00001
Peak PR	STB1	0.015	<0.00001
Tradeoff range	STB1	0.028	<0.00001
Peak PR	STB2	0.012	<0.00001
Aversion TP	STB2	0.020	<0.00001
Tradeoff range	STB2	0.0028	<0.00001
Consistency range	STB2	0.040	<0.00001
Peak PR	STB3	0.045	<0.00001
Tradeoff range	STB3	0.018	<0.00001
Ante	STB4	0.034	<0.00001
Peak PR	STB4	0.015	<0.00001
Peak NR	STB4	0.013	<0.00001

Tradeoff range	STB4	0.050	<0.00001
RA consistency	STB4	0.0090	<0.00001
Consistency range	STB4	0.0015	<0.00001

Legend: List of significant moderations ($\mathbf{P}_{\beta} < 0.05$ and $\mathbf{P}_{\text{overall}} < 0.05$) for the following variables considered as moderators: Age, Loneliness, Prior Attempts, PHQ8 and STAI-S. The preference variables are chosen as the independent variables and STB1-STB4 are chosen as the dependent variables in the moderation analysis.

Table S3: Mediation Results

Mediation (<i>Me</i>) Variables				Step 1: X predicting Y	
Y	<i>Me</i>	X	M	c	p_c
STB1	Primary	RA	Age	-0.065	<0.0001
	Secondary	Age	Ra	-0.326	<0.0001
STB1	Primary	LR	Age	-0.048	0.007
	Secondary	Age	LR	-0.317	<0.0001
STB1	Primary	Peak PR	Age	0.043	0.017
	Secondary	Age	Peak PR	-0.327	<0.0001
STB1	Primary	Aversion TP	Age	-0.049	0.006
	Secondary	Age	Aversion TP	-0.32	<0.0001
STB2	Primary	LR	Age	-0.037	0.039
	Secondary	Age	LR	-0.166	<0.0001
STB2	Primary	Consistency range	Age	-0.051	0.004
	Secondary	Age	Consistency range	-0.193	<0.0001
STB3	Primary	Consistency range	Age	-0.042	0.02
	Secondary	Age	Consistency range	-0.164	<0.0001
STB4	Primary	LR	Age	-0.053	0.003
	Secondary	Age	LR	-0.23	<0.0001
STB4	Primary	Peak PR	Age	0.042	0.019
	Secondary	Age	Peak PR	-0.248	<0.0001
STB4	Primary	Tradeoff range	Age	-0.087	<0.0001
	Secondary	Age	Tradeoff range	-0.217	<0.0001
STB1	Primary	Ante	Loneliness	-0.039	0.032
	Secondary	Loneliness	Ante	0.525	<0.0001
STB1	Primary	Insurance	Loneliness	0.058	0.001
	Secondary	Loneliness	Insurance	0.509	<0.0001
STB1	Primary	Peak NR	Loneliness	-0.049	0.008
	Secondary	Loneliness	Peak NR	0.538	<0.0001
STB1	Primary	Total AR	Loneliness	-0.052	0.004

STB1	Secondary	Loneliness	Total AR	0.534	<0.0001
STB1	Primary	RA tradeoff	Loneliness	0.039	0.032
	Secondary	Loneliness	Ra tradeoff	0.508	<0.0001
STB4	Primary	Total AR	Loneliness	-0.039	0.032
	Secondary	Loneliness	Total AR	0.316	<0.0001
STB1	Primary	LR	STAI	-0.056	0.002
	Secondary	STAI	LR	0.496	<0.0001
STB1	Primary	Insurance	STAI	0.057	0.001
	Secondary	STAI	Insurance	0.476	<0.0001
STB1	Primary	Peak NR	STAI	-0.045	0.012
	Secondary	STAI	Peak NR	0.499	<0.0001
STB1	Primary	Total AR	STAI	-0.053	0.003
	Secondary	STAI	Total AR	0.508	<0.0001
STB1	Primary	LR	PHQ8	-0.051	0.005
	Secondary	PHQ8	LR	0.584	<0.0001
STB1	Primary	Tradeoff range	PHQ8	-0.136	<0.0001
	Secondary	PHQ8	Tradeoff range	0.573	<0.0001
STB1	Primary	RA consistency	PHQ8	0.043	0.016
	Secondary	PHQ8	RA consistency	0.576	<0.0001
STB2	Primary	LR	PHQ8	-0.053	0.003
	Secondary	PHQ8	LR	0.443	<0.0001
STB2	Primary	Total AR	Prior Attempts	-0.046	0.01
	Secondary	Prior Attempts	Total AR	0.786	<0.0001
STB2	Primary	Tradeoff range	Prior Attempts	-0.076	<0.0001
	Secondary	Prior Attempts	Tradeoff range	0.72	<0.0001
STB2	Primary	Consistency range	Prior Attempts	-0.042	0.019
	Secondary	Prior Attempts	Consistency range	0.745	<0.0001
STB3	Primary	Tradeoff range	Prior Attempts	-0.076	<0.0001

STB3	Secondary	Prior Attempts	Tradeoff range	0.754	<0.0001
STB4	Primary	Reward TP	Prior Attempts	-0.042	0.02
	Secondary	Prior Attempts	Reward TP	0.764	<0.0001
STB4	Primary	Tradeoff range	Prior Attempts	-0.053	0.004
	Secondary	Prior Attempts	Tradeoff range	0.607	<0.0001
Mediation (Me) Variables				Step 2: X predicting M	
Y	Me	X	M	a	<i>p_a</i>
STB1	Primary	RA	Age	0.11	<0.0001
	Secondary	Age	Ra	0.104	<0.0001
STB1	Primary	LR	Age	0.142	<0.0001
	Secondary	Age	LR	0.11	<0.0001
STB1	Primary	Peak PR	Age	-0.098	<0.0001
	Secondary	Age	Peak PR	-0.094	<0.0001
STB1	Primary	Aversion TP	Age	0.081	<0.0001
	Secondary	Age	Aversion TP	0.09	<0.0001
STB2	Primary	LR	Age	0.135	<0.0001
	Secondary	Age	LR	0.108	<0.0001
STB2	Primary	Consistency range	Age	0.15	<0.0001
	Secondary	Age	Consistency range	0.143	<0.0001
STB3	Primary	Consistency range	Age	0.152	<0.0001
	Secondary	Age	Consistency range	0.143	<0.0001
STB4	Primary	LR	Age	0.146	<0.0001
	Secondary	Age	LR	0.123	<0.0001
STB4	Primary	Peak PR	Age	-0.111	<0.0001
	Secondary	Age	Peak PR	-0.109	<0.0001
STB4	Primary	Tradeoff range	Age	0.221	<0.0001
	Secondary	Age	Tradeoff range	0.204	<0.0001
STB1	Primary	Ante	Loneliness	-0.113	<0.0001
	Secondary	Loneliness	Ante	-0.118	<0.0001

STB1	Primary	Insurance	Loneliness	0.101	<0.0001
	Secondary	Loneliness	Insurance	0.108	<0.0001
STB1	Primary	Peak NR	Loneliness	-0.072	<0.0001
	Secondary	Loneliness	Peak NR	-0.104	<0.0001
STB1	Primary	Total AR	Loneliness	-0.063	<0.0001
	Secondary	Loneliness	Total AR	-0.073	<0.0001
STB1	Primary	RA tradeoff	Loneliness	0.077	<0.0001
	Secondary	Loneliness	Ra tradeoff	0.09	<0.0001
STB4	Primary	Total AR	Loneliness	-0.069	<0.0001
	Secondary	Loneliness	Total AR	-0.074	<0.0001
STB1	Primary	LR	STAI	-0.089	<0.0001
	Secondary	STAI	LR	-0.043	0.017
STB1	Primary	Insurance	STAI	0.075	<0.0001
	Secondary	STAI	Insurance	0.078	<0.0001
STB1	Primary	Peak NR	STAI	-0.088	<0.0001
	Secondary	STAI	Peak NR	-0.057	0.002
STB1	Primary	Total AR	STAI	-0.056	0.002
	Secondary	STAI	Total AR	-0.065	<0.0001
STB1	Primary	LR	PHQ8	-0.075	<0.0001
	Secondary	PHQ8	LR	-0.046	0.012
STB1	Primary	Tradeoff range	PHQ8	-0.129	<0.0001
	Secondary	PHQ8	Tradeoff range	-0.121	<0.0001
STB1	Primary	RA consistency	PHQ8	0.041	0.023
	Secondary	PHQ8	RA consistency	0.012	0.509
STB2	Primary	LR	PHQ8	-0.082	<0.0001
	Secondary	PHQ8	LR	-0.047	0.01
STB2	Primary	Total AR	Prior Attempts	-0.038	0.033
	Secondary	Prior Attempts	Total AR	-0.04	0.025
STB2	Primary	Tradeoff range	Prior Attempts	-0.082	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.064	<0.0001

STB2	Primary	Consistency range	Prior Attempts	-0.059	0.001
	Secondary	Prior Attempts	Consistency range	-0.07	<0.0001
STB3	Primary	Tradeoff range	Prior Attempts	-0.056	0.002
	Secondary	Prior Attempts	Tradeoff range	-0.041	0.023
STB4	Primary	Reward TP	Prior Attempts	-0.039	0.03
	Secondary	Prior Attempts	Reward TP	-0.04	0.028
STB4	Primary	Tradeoff range	Prior Attempts	-0.063	0.001
	Secondary	Prior Attempts	Tradeoff range	-0.111	<0.0001
Mediation (Me) Variables				Step 3: M predicting Y	
Y	Me	X	M	b'	p_{b'}
STB1	Primary	RA	Age	-0.324	<0.0001
	Secondary	Age	Ra	-0.063	<0.0001
STB1	Primary	LR	Age	-0.314	<0.0001
	Secondary	Age	LR	-0.035	0.055
STB1	Primary	Peak PR	Age	-0.321	<0.0001
	Secondary	Age	Peak PR	0.049	0.007
STB1	Primary	Aversion TP	Age	-0.315	<0.0001
	Secondary	Age	Aversion TP	-0.063	<0.0001
STB2	Primary	LR	Age	-0.166	<0.0001
	Secondary	Age	LR	-0.028	0.118
STB2	Primary	Consistency range	Age	-0.193	<0.0001
	Secondary	Age	Consistency range	-0.044	0.014
STB3	Primary	Consistency range	Age	-0.162	<0.0001
	Secondary	Age	Consistency range	-0.037	0.041
STB4	Primary	LR	Age	-0.226	<0.0001
	Secondary	Age	LR	-0.048	0.008
STB4	Primary	Peak PR	Age	-0.25	<0.0001
	Secondary	Age	Peak PR	0.046	0.01

STB4	Primary	Tradeoff range	Age	-0.219	<0.0001
	Secondary	Age	Tradeoff range	-0.087	<0.0001
STB1	Primary	Ante	Loneliness	0.503	<0.0001
	Secondary	Loneliness	Ante	-0.041	0.025
STB1	Primary	Insurance	Loneliness	0.474	<0.0001
	Secondary	Loneliness	Insurance	0.061	0.001
STB1	Primary	Peak NR	Loneliness	0.514	<0.0001
	Secondary	Loneliness	Peak NR	-0.055	0.003
STB1	Primary	Total AR	Loneliness	0.525	<0.0001
	Secondary	Loneliness	Total AR	-0.056	0.002
STB1	Primary	RA tradeoff	Loneliness	0.485	<0.0001
	Secondary	Loneliness	Ra tradeoff	0.048	0.009
STB4	Primary	Total AR	Loneliness	0.311	<0.0001
	Secondary	Loneliness	Total AR	-0.042	0.019
STB1	Primary	LR	STAI	0.479	<0.0001
	Secondary	STAI	LR	-0.036	0.045
STB1	Primary	Insurance	STAI	0.458	<0.0001
	Secondary	STAI	Insurance	0.058	0.001
STB1	Primary	Peak NR	STAI	0.477	<0.0001
	Secondary	STAI	Peak NR	-0.038	0.035
STB1	Primary	Total AR	STAI	0.496	<0.0001
	Secondary	STAI	Total AR	-0.051	0.004
STB1	Primary	LR	PHQ8	0.547	<0.0001
	Secondary	PHQ8	LR	-0.036	0.046
STB1	Primary	Tradeoff range	PHQ8	0.542	<0.0001
	Secondary	PHQ8	Tradeoff range	-0.134	<0.0001
STB1	Primary	RA consistency	PHQ8	0.531	<0.0001
	Secondary	PHQ8	RA consistency	0.022	0.222
STB2	Primary	LR	PHQ8	0.382	<0.0001
	Secondary	PHQ8	LR	-0.039	0.035
STB2	Primary	Total AR	Prior Attempts	0.782	<0.0001
	Secondary	Prior Attempts	Total AR	-0.047	0.008

STB2	Primary	Tradeoff range	Prior Attempts	0.67	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.074	<0.0001
STB2	Primary	Consistency range	Prior Attempts	0.684	<0.0001
	Secondary	Prior Attempts	Consistency range	-0.052	0.004
STB3	Primary	Tradeoff range	Prior Attempts	0.691	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.06	0.001
STB4	Primary	Reward TP	Prior Attempts	0.605	<0.0001
	Secondary	Prior Attempts	Reward TP	-0.038	0.037
STB4	Primary	Tradeoff range	Prior Attempts	0.496	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.092	<0.0001
Mediation (Me) Variables				Step 3: M (with X) predicting Y	
Y	Me	X	M	b	p_b
STB1	Primary	RA	Age	-0.32	<0.0001
	Secondary	Age	Ra	-0.03	0.085
STB1	Primary	LR	Age	-0.314	<0.0001
	Secondary	Age	LR	<0.0001	0.981
STB1	Primary	Peak PR	Age	-0.32	<0.0001
	Secondary	Age	Peak PR	0.018	0.291
STB1	Primary	Aversion TP	Age	-0.313	<0.0001
	Secondary	Age	Aversion TP	-0.034	0.043
STB2	Primary	LR	Age	-0.164	<0.0001
	Secondary	Age	LR	-0.01	0.56
STB2	Primary	Consistency range	Age	-0.19	<0.0001
	Secondary	Age	Consistency range	-0.017	0.339
STB3	Primary	Consistency range	Age	-0.159	<0.0001
	Secondary	Age	Consistency range	-0.014	0.451

STB4	Primary	LR	Age	-0.223	<0.0001
	Secondary	Age	LR	-0.02	0.264
STB4	Primary	Peak PR	Age	-0.249	<0.0001
	Secondary	Age	Peak PR	0.02	0.268
STB4	Primary	Tradeoff range	Age	-0.21	<0.0001
	Secondary	Age	Tradeoff range	-0.044	0.015
STB1	Primary	Ante	Loneliness	0.505	<0.0001
	Secondary	Loneliness	Ante	0.021	0.176
STB1	Primary	Insurance	Loneliness	0.473	<0.0001
	Secondary	Loneliness	Insurance	0.006	0.711
STB1	Primary	Peak NR	Loneliness	0.513	<0.0001
	Secondary	Loneliness	Peak NR	0.001	0.958
STB1	Primary	Total AR	Loneliness	0.524	<0.0001
	Secondary	Loneliness	Total AR	-0.017	0.276
STB1	Primary	RA tradeoff	Loneliness	0.485	<0.0001
	Secondary	Loneliness	Ra tradeoff	0.002	0.882
STB4	Primary	Total AR	Loneliness	0.31	<0.0001
	Secondary	Loneliness	Total AR	-0.019	0.273
STB1	Primary	LR	STAI	0.478	<0.0001
	Secondary	STAI	LR	-0.015	0.348
STB1	Primary	Insurance	STAI	0.456	<0.0001
	Secondary	STAI	Insurance	0.021	0.184
STB1	Primary	Peak NR	STAI	0.477	<0.0001
	Secondary	STAI	Peak NR	-0.01	0.533
STB1	Primary	Total AR	STAI	0.495	<0.0001
	Secondary	STAI	Total AR	-0.018	0.23
STB1	Primary	LR	PHQ8	0.546	<0.0001
	Secondary	PHQ8	LR	-0.01	0.514
STB1	Primary	Tradeoff range	PHQ8	0.534	<0.0001
	Secondary	PHQ8	Tradeoff range	-0.065	<0.0001
STB1	Primary	RA consistency	PHQ8	0.53	<0.0001
	Secondary	PHQ8	RA consistency	0.015	0.304
STB2	Primary	LR	PHQ8	0.38	<0.0001

STB2	Secondary	PHQ8	LR	-0.018	0.277
STB2	Primary	Total AR	Prior Attempts	0.781	<0.0001
	Secondary	Prior Attempts	Total AR	-0.016	0.148
STB2	Primary	Tradeoff range	Prior Attempts	0.668	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.028	0.025
STB2	Primary	Consistency range	Prior Attempts	0.684	<0.0001
	Secondary	Prior Attempts	Consistency range	<0.0001	0.978
STB3	Primary	Tradeoff range	Prior Attempts	0.689	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.029	0.014
STB4	Primary	Reward TP	Prior Attempts	0.604	<0.0001
	Secondary	Prior Attempts	Reward TP	-0.007	0.534
STB4	Primary	Tradeoff range	Prior Attempts	0.495	<0.0001
	Secondary	Prior Attempts	Tradeoff range	-0.026	0.08
Mediation (Me) Variables				Step 3: X (with M) predicting Y	
Y	Me	X	M	c'	p_{c'}
STB1	Primary	RA	Age	-0.029	0.084
	Secondary	Age	Ra	-0.323	<0.0001
STB1	Primary	LR	Age	-0.004	0.837
	Secondary	Age	LR	-0.317	<0.0001
STB1	Primary	Peak PR	Age	0.011	0.512
	Secondary	Age	Peak PR	-0.325	<0.0001
STB1	Primary	Aversion TP	Age	-0.024	0.157
	Secondary	Age	Aversion TP	-0.317	<0.0001
STB2	Primary	LR	Age	-0.015	0.411
	Secondary	Age	LR	-0.164	<0.0001
STB2	Primary	Consistency range	Age	-0.023	0.203

STB2	Secondary	Age	Consistency range	-0.19	<0.0001
STB3	Primary	Consistency range	Age	-0.018	0.327
	Secondary	Age	Consistency range	-0.162	<0.0001
STB4	Primary	LR	Age	-0.021	0.245
	Secondary	Age	LR	-0.227	<0.0001
STB4	Primary	Peak PR	Age	0.015	0.402
	Secondary	Age	Peak PR	-0.246	<0.0001
STB4	Primary	Tradeoff range	Age	-0.041	0.025
	Secondary	Age	Tradeoff range	-0.208	<0.0001
STB1	Primary	Ante	Loneliness	0.018	0.264
	Secondary	Loneliness	Ante	0.528	<0.0001
STB1	Primary	Insurance	Loneliness	0.011	0.511
	Secondary	Loneliness	Insurance	0.509	<0.0001
STB1	Primary	Peak NR	Loneliness	-0.012	0.455
	Secondary	Loneliness	Peak NR	0.538	<0.0001
STB1	Primary	Total AR	Loneliness	-0.019	0.225
	Secondary	Loneliness	Total AR	0.533	<0.0001
STB1	Primary	RA tradeoff	Loneliness	0.002	0.905
	Secondary	Loneliness	Ra tradeoff	0.508	<0.0001
STB4	Primary	Total AR	Loneliness	-0.017	0.314
	Secondary	Loneliness	Total AR	0.314	<0.0001
STB1	Primary	LR	STAI	-0.014	0.388
	Secondary	STAI	LR	0.495	<0.0001
STB1	Primary	Insurance	STAI	0.023	0.151
	Secondary	STAI	Insurance	0.475	<0.0001
STB1	Primary	Peak NR	STAI	-0.003	0.845
	Secondary	STAI	Peak NR	0.499	<0.0001
STB1	Primary	Total AR	STAI	-0.025	0.099
	Secondary	STAI	Total AR	0.507	<0.0001
STB1	Primary	LR	PHQ8	-0.009	0.532
	Secondary	PHQ8	LR	0.584	<0.0001
STB1	Primary	Tradeoff range	PHQ8	-0.067	<0.0001

STB1	Secondary	PHQ8	Tradeoff range	0.565	<0.0001
STB1	Primary	RA consistency	PHQ8	0.022	0.157
	Secondary	PHQ8	RA consistency	0.576	<0.0001
STB2	Primary	LR	PHQ8	-0.022	0.186
	Secondary	PHQ8	LR	0.442	<0.0001
STB2	Primary	Total AR	Prior Attempts	-0.016	0.149
	Secondary	Prior Attempts	Total AR	0.786	<0.0001
STB2	Primary	Tradeoff range	Prior Attempts	-0.021	0.118
	Secondary	Prior Attempts	Tradeoff range	0.718	<0.0001
STB2	Primary	Consistency range	Prior Attempts	-0.002	0.895
	Secondary	Prior Attempts	Consistency range	0.745	<0.0001
STB3	Primary	Tradeoff range	Prior Attempts	-0.038	0.004
	Secondary	Prior Attempts	Tradeoff range	0.753	<0.0001
STB4	Primary	Reward TP	Prior Attempts	-0.018	0.201
	Secondary	Prior Attempts	Reward TP	0.763	<0.0001
STB4	Primary	Tradeoff range	Prior Attempts	-0.022	0.16
	Secondary	Prior Attempts	Tradeoff range	0.604	<0.0001
Mediation (Me) Variables				T_{eff}	p_{sobel}
Y	Me	X	M	%	
STB1	Primary	RA	Age	54.398	<0.0001
	Secondary	Age	Ra	0.939	0.098
STB1	Primary	LR	Age	92.652	<0.0001
	Secondary	Age	LR	<0.0001	0.981
STB1	Primary	Peak PR	Age	73.838	<0.0001
	Secondary	Age	Peak PR	0.521	0.3
STB1	Primary	Aversion TP	Age	51.33	<0.0001

STB1	Secondary	Age	Aversion TP	0.966	0.06
STB2	Primary	LR	Age	60.293	<0.0001
	Secondary	Age	LR	0.678	0.562
STB2	Primary	Consistency range	Age	55.741	<0.0001
	Secondary	Age	Consistency range	1.267	0.343
STB3	Primary	Consistency range	Age	57.968	<0.0001
	Secondary	Age	Consistency range	1.181	0.453
STB4	Primary	LR	Age	61.37	<0.0001
	Secondary	Age	LR	1.065	0.27
STB4	Primary	Peak PR	Age	65.272	<0.0001
	Secondary	Age	Peak PR	0.861	0.276
STB4	Primary	Tradeoff range	Age	53.334	<0.0001
	Secondary	Age	Tradeoff range	4.162	0.018
STB1	Primary	Ante	Loneliness	100	<0.0001
	Secondary	Loneliness	Ante	<0.0001	0.186
STB1	Primary	Insurance	Loneliness	81.701	<0.0001
	Secondary	Loneliness	Insurance	0.125	0.711
STB1	Primary	Peak NR	Loneliness	75.878	<0.0001
	Secondary	Loneliness	Peak NR	<0.0001	0.958
STB1	Primary	Total AR	Loneliness	63.853	0.001
	Secondary	Loneliness	Total AR	0.23	0.293
STB1	Primary	RA tradeoff	Loneliness	95.111	<0.0001
	Secondary	Loneliness	Ra tradeoff	0.042	0.882
STB4	Primary	Total AR	Loneliness	55.243	<0.0001
	Secondary	Loneliness	Total AR	0.442	0.289
STB1	Primary	LR	STAI	75.795	<0.0001
	Secondary	STAI	LR	0.129	0.382
STB1	Primary	Insurance	STAI	59.636	<0.0001
	Secondary	STAI	Insurance	0.346	0.204
STB1	Primary	Peak NR	STAI	93.139	<0.0001
	Secondary	STAI	Peak NR	0.112	0.541
STB1	Primary	Total AR	STAI	51.902	0.002

STB1	Secondary	STAI	Total AR	0.236	0.253
STB1	Primary	LR	PHQ8	81.25	<0.0001
	Secondary	PHQ8	LR	0.076	0.528
STB1	Primary	Tradeoff range	PHQ8	50.824	<0.0001
	Secondary	PHQ8	Tradeoff range	1.38	<0.0001
STB1	Primary	RA consistency	PHQ8	50.019	0.024
	Secondary	PHQ8	RA consistency	0.032	0.579
STB2	Primary	LR	PHQ8	58.329	<0.0001
	Secondary	PHQ8	LR	0.188	0.317
STB2	Primary	Total AR	Prior Attempts	64.873	0.033
	Secondary	Prior Attempts	Total AR	0.081	0.225
STB2	Primary	Tradeoff range	Prior Attempts	72.368	<0.0001
	Secondary	Prior Attempts	Tradeoff range	0.252	0.058
STB2	Primary	Consistency range	Prior Attempts	95.899	0.001
	Secondary	Prior Attempts	Consistency range	<0.0001	0.978
STB3	Primary	Tradeoff range	Prior Attempts	50.656	0.002
	Secondary	Prior Attempts	Tradeoff range	0.158	0.094
STB4	Primary	Reward TP	Prior Attempts	56.171	0.03
	Secondary	Prior Attempts	Reward TP	0.038	0.549
STB4	Primary	Tradeoff range	Prior Attempts	58.072	0.001
	Secondary	Prior Attempts	Tradeoff range	0.468	0.092

Legend: This table lists the significant mediators and corresponding hypothesis test values, following the four step process of Baron and Kenny (1986)¹⁴. Each step involves a distinct linear regression (see methods), where the regression coefficient and p-value of the regression are reported; all three regressions must show nominal effects for the final mediation analysis to be considered significant. As a further criterion for significance, the Sobel p-value must show $p_{\text{sobel}} <$

0.05 with a mediation effect greater than fifty percent (i.e., $T_{eff} > 50\%$) in the primary analyses. The secondary analyses, obtained by switching the mediator and the independent variable, adds supports to the causal pathway of the mediation when the results are insignificant (i.e., $p_{sobel} > 0.05$ and $T_{eff} < 50\%$). The following variables are considered as mediators in the primary analysis: Age, Loneliness, Prior Attempts, PHQ8 and STAI-S. The judgment variables are the independent variables and STB1-STB4 are the dependent variables in the primary mediation analysis. In the secondary analysis, STB1-STB4 are still chosen as the dependent variables, but the independent variables are now the following: Age, Loneliness, Prior Attempts, PHQ8 and STAI-S. In these secondary analyses, the dependent variables are the judgment variables. The secondary analysis is performed to assure any significant effects are not part of a mixed model.

Table S4. Mediation and Moderation analysis for preference variables.

Mediator (Me)	Dependent Variable (Y)			
	STB 1	STB 2	STB 3	STB 4
Prior Attempts	∅	Total AR, Tradeoff range, Consistency range	Tradeoff range	Reward TP, Tradeoff range
Age	RA, LR, Peak PR, Aversion TP	LR, Consistency range	Consistency range	LR, Peak PR, Tradeoff range
Loneliness	Ante, Insurance, Peak NR, Total AR, RA tradeoff	∅	∅	Total AR
PHQ8	LR, Tradeoff range, RA consistency	LR	∅	∅
STAI	LR, Insurance, Peak NR, Total AR	∅	∅	∅
Moderator (Mo)	Dependent Variable (Y)			
	STB 1	STB 2	STB 3	STB 4
Prior Attempts	LR, Tradeoff range	RA consistency, Tradeoff range,	∅	∅
Age	∅	LR	LR	LR
Loneliness	LA, RA, Reward TP, RA consistency	Aversion TP, RA consistency	Insurance, Reward TP, RA tradeoff, RA consistency, Consistency range	∅
PHQ8	Peak PR, Reward TP, Tradeoff range	Tradeoff range	Aversion TP, Tradeoff range	Tradeoff range
STAI	Peak PR, Tradeoff range	Peak PR, Aversion TP, Tradeoff range, Consistency range	Peak PR, Tradeoff range	Ante, Peak PR, Peak NR, Tradeoff range, RA consistency, Consistency range

Legend. Mediators and moderators, where STB1 – STB4 are the dependent variables, judgment variables are the independent variables, and prior attempts, age, loneliness, PHQ8 and STAI are the mediators or moderators. Specific judgment variables are shown if the mediation or moderation was significant as obtained through the appropriate hypothesis tests specified in the Supplementary Methods.

Table S5: Performance of machine learning prediction of STB in the literature.

<i>Paper</i>	<i>Outcome</i>	<i>#Participants (-/+)</i>	<i># Features</i>	<i># Questions</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
Bernert (2020)* ²¹	SI	-	-	-	0.85	.56-.84	.57-.81	.61-.80
Chen (2021) ¹⁹	SI	99(58/41)	291 brain images	-	.792	.647	.898	.883
McHugh (2019)* ⁴	SI	20 (17/3) – 89049 (889955/54)	-	-	-	.41	.86	.676
Weng (2020) ⁶⁴	SI	153(114/41)	25,168 (imaging)	-	.85	.75	1.0	.94
Wilimitis (2021) ⁶⁵	SI	83394 (80268/3126)	-	-	-	.701	.907	.879
Bernert (2020)* ²¹	SA	-	-	-	.67-.97	.50-1.0	.70-.99	.76-.99
Chen (2021) ¹⁹	SA	91(58/33)	291 brain images	-	.915	.992	.871	.987
Hettige (2017) ⁶⁶	SA	345(214/131)	27	-	.67	.66	.68	.71
McHugh (2020)* ⁵	SA	5414(4957/457) -2960929 (2959689/1240)	-	-	-	.027-.645	-	.59-.88
Nordin (2021) ²⁰	SA	75 (51/24)	15	-	.92	.92	.58	.74
Rozek (2020) ²³	SA	152(126/26)	at least 11 surveys	-	.873	.308	.992	-
Wilimitis (2022) ⁶⁵	SA	83394(82880/514)	-	-	-	.795	.901	.887
Macalli (2021) ⁶⁷	SI or SA	70	-	-	-	.79-.81	.80-.84	.70
Garcia (2021) ⁶⁸	SR	34653 (34431/222)	643 – 2985	2805	-	.853	73.3	.857
Sawhney (2021) ⁶⁹	SR	500 (455/45)	510 words (NLP)	-	-	.59	-	-
Bernert (2020)* ²¹	CS	-	-	-	.70	.28-.69	.91-.95	.70-.80
Kessler (2017) ⁷⁰	CS	975057 (956488/569)	999	-	-	.48	.949	.66

Legend: Accuracies, Sensitivities, Specificities and AUC scores for papers using machine learning to predict the following outcomes: suicidal ideation (SI), suicide attempt(s) (SA), suicide attempt risk (SR) or completed suicide (CS). All papers included in the table report the sensitivity of prediction (papers without a sensitivity are omitted). The number of participants are shown for each paper, with the size of the symptom negative group (for example, SA negative), followed by the size of the symptom positive group (for example, SA positive) in parentheses. The number of features denotes the explicit number of features fed into the machine learning model (where available in the paper) The number of questions denotes the explicit number of questions asked to participants (where available in the paper). * denotes the paper is a review article; ^ denotes that meta-analytic scores were reported for performance metrics (e.g., accuracy, sensitivity, specificity or AUC score) in the paper; - denotes the metric/value was not reported.

Table S6a: Mutual Information of Relative Preference Theory variables and STB

<i>RPT Feature</i>	<i>Passive Ideation</i>	<i>Active Ideation</i>	<i>Suicide Planning</i>	<i>Planning for Safety</i>
<i>Risk Aversion</i>	0.047	0.0	0.001	0.0
<i>Ante</i>	0.058	0.051	0.007	0.0
<i>Loss Resilience</i>	0.032	0.157	0.09	0.068
<i>Insurance</i>	0.001	0.016	0.004	0.016
<i>Loss Aversion</i>	0.002	0.0	0.016	0.021
<i>Peak positive risk</i>	0.188	0.03	0.133	0.073
<i>Reward tipping point</i>	0.036	0.0	0.069	0.202
<i>Total reward risk</i>	0.0	0.0	0.0	0.08
<i>Peak negative risk</i>	0.048	0.069	0.012	0.086
<i>Aversion tipping point</i>	0.044	0.086	0.094	0.238
<i>Total aversion risk</i>	0.162	0.089	0.0	0.04
<i>Reward-aversion tradeoff</i>	0.056	0.102	0.139	0.023
<i>Tradeoff range</i>	0.123	0.256	0.364	0.056
<i>Reward-aversion consistency</i>	0.095	0.143	0.007	0.061
<i>Consistency range</i>	0.11	0.0	0.064	0.037

Table S6b: Summary of Valance of Relationship of Relative Preference Variables for STB

<i>RPT Feature</i>	<i>Passive Ideation</i>	<i>Active Ideation</i>	<i>Suicide Planning</i>	<i>Planning for Safety</i>
<i>Risk Aversion</i>	-	-	-	-
<i>Ante</i>	+	+	+	+
<i>Loss Resilience</i>	-	-	-	-
<i>Insurance</i>	-	-	-	-
<i>Loss Aversion</i>	-	-	-	-
<i>Peak positive risk</i>	+	+	+	+
<i>Reward tipping point</i>	-	+	-	-
<i>Total reward risk</i>	+	+	+	+
<i>Peak negative risk</i>	+	+	+	+
<i>Aversion tipping point</i>	-	-	-	-
<i>Total aversion risk</i>	-	+	-	+
<i>Reward-aversion tradeoff</i>	+	+	+	+
<i>Tradeoff range</i>	-	-	-	-
<i>Reward-aversion consistency</i>	+	+	+	+
<i>Consistency range</i>	-	-	-	-

Legend: (A) Mutual information scores for RPT features across passive and active ideation, planning for suicide and planning for safety (STB1-4). This shows the information obtained about the four STB categories from 15 judgment variables. Values are rounded off at three decimal places. (B) Summary of valence of relationship for judgment variables and each STB variable. Any (+) indicates that the mean value of the RPT feature increases as the severity of STB metric increases, whereas a (-) denotes that the mean value of the judgment variable decreases as the severity of STB metric increases.

TABLE S7: Demographic Frequencies of Cohort

<i>Demographic</i>	<i>Group</i>	<i>Count</i>	<i>Percentage (%)</i>
<i>Gender assigned at birth</i>	Male	1324	38.09
	Female	2138	61.51
	Other or prefer not to answer	14	0.4
<i>Age groups (years)</i>	18-24	205	5.9
	25-34	384	11.05
	35-44	529	15.22
	45-54	609	17.52
	55-64	853	24.54
	65 $\geq$	896	25.78
<i>Highest education level completed</i>	Some high school	101	2.91
	High school graduate	734	21.12
	Some college	1030	29.63
	Bachelor's degree	777	22.35
	Some graduate school	176	5.06
	Graduate degree	564	16.23
	Post-doctoral training	94	2.7
<i>Handedness</i>	Right	2990	86.02
	Left	407	11.71
	Both	79	2.27
<i>Race/Ethnicity</i>	White/Caucasian	2908	83.66
	African American	227	6.53
	Hispanic/Latinx	123	3.54
	Asian or Pacific Islander	122	3.51
	Native American or Alaskan Native	26	0.75
	Mixed racial background	30	0.86
	Other race	16	0.46
	Prefer not to answer	24	0.69

Legend: Five demographics were obtained for subsequent predictive analyses of the cohort. Each demographic (gender, age, education, handedness and race) was partitioned into distinct groups, varying from three to eight groups. The number of individuals of the cohort belonging to each demographic group is displayed, followed by the percentage of the cohort of the demographic group, rounded to two decimal places. Gender identity and race/ethnicity both include a category that allows the cohort member to not report their category.

TABLE S8: Goodness of Fit Parameters for Value and Limit Functions

<i>Curve Set</i>	<i>Curve</i>	<i>Statistic</i>	<i>Mean $\pm$ SD</i>
(log K, H) logarithmic fit	(log K₊, H₊)	R^2	0.92 ± 0.13
		adjusted R^2	0.87 ± 0.21
		F -value	$1.90 \times 10^{30} \pm 2.06 \times 10^{31}$
	(log K₋, H₋)	R^2	0.96 ± 0.07
		adjusted R^2	0.80 ± 0.29
		F -value	$3.61 \times 10^{30} \pm 2.34 \times 10^{31}$
(K, σ) quadratic fit	(K₊, σ₊)	R^2	0.90 ± 0.13
		adjusted R^2	0.84 ± 0.21
		F -value	$1.12 \times 10^{30} \pm 1.50 \times 10^{31}$
	(K₋, σ₋)	R^2	0.94 ± 0.10
		adjusted R^2	0.90 ± 0.17
		F -value	$2.26 \times 10^{30} \pm 5.00 \times 10^{31}$

Legend: Goodness of fit statistics are displayed for individual logarithmic fits (**log K, H**) and quadratic (**K, σ**) fits of the picture rating groups of the IAPS images. For both the positive (approach) and negative (avoidance) curves, goodness of fit statistics are assessed through coefficient of determination (R^2) values, coefficient of determination values adjusted for degrees of freedom (R_{adj}^2) and F -test values (F -value). Participants with less than two of the six picture rating categories were not included in fits. Values are rounded off at two decimal places.

TABLE S9: Relative Preference Theory Variable Statistics

<i>RPT Feature</i>	<i>Statistic</i>	<i>Value</i>
<i>Risk aversion</i>	<i>Mean $\pm$ SD</i>	0.34 $\pm$ 0.125
	<i>SEM</i>	0.0022
	<i>95% CI</i>	[0.34, 0.35]
<i>Ante</i>	<i>Mean $\pm$ SD</i>	0.17 $\pm$ 0.106
	<i>SEM</i>	0.0018
	<i>95% CI</i>	[0.17, 0.18]
<i>Loss resilience</i>	<i>Mean $\pm$ SD</i>	0.32 $\pm$ 0.134
	<i>SEM</i>	0.0024
	<i>95% CI</i>	[0.32, 0.33]
<i>Insurance</i>	<i>Mean $\pm$ SD</i>	-0.21 $\pm$ 0.108
	<i>SEM</i>	0.0018
	<i>95% CI</i>	[-0.21, -0.21]
<i>Loss aversion</i>	<i>Mean $\pm$ SD</i>	0.88 $\pm$ 0.365
	<i>SEM</i>	0.0063
	<i>95% CI</i>	[0.86, 0.89]
<i>Peak positive risk</i>	<i>Mean $\pm$ SD</i>	1.33 $\pm$ 0.290
	<i>SEM</i>	0.0049
	<i>95% CI</i>	[1.32, 1.34]
<i>Reward tipping point</i>	<i>Mean $\pm$ SD</i>	1.48 $\pm$ 0.195
	<i>SEM</i>	0.0034
	<i>95% CI</i>	[1.47, 1.48]
<i>Total reward risk</i>	<i>Mean $\pm$ SD</i>	2.71 $\pm$ 0.759
	<i>SEM</i>	0.0130
	<i>95% CI</i>	[2.68, 2.73]
<i>Peak negative risk</i>	<i>Mean $\pm$ SD</i>	1.52 $\pm$ 0.349
	<i>SEM</i>	0.0059
	<i>95% CI</i>	[1.51, 1.53]
<i>Aversion tipping point</i>	<i>Mean $\pm$ SD</i>	1.48 $\pm$ 0.103
	<i>SEM</i>	0.0019
	<i>95% CI</i>	[1.48, 1.49]
<i>Total aversion risk</i>	<i>Mean $\pm$ SD</i>	3.05 $\pm$ 0.815
	<i>SEM</i>	0.0139
	<i>95% CI</i>	[3.02, 3.08]
<i>Reward-aversion tradeoff</i>	<i>Mean $\pm$ SD</i>	50.04 $\pm$ 11.499
	<i>SEM</i>	0.1950
	<i>95% CI</i>	[49.66, 50.42]
<i>Tradeoff range</i>	<i>Mean $\pm$ SD</i>	40.73 $\pm$ 7.024
	<i>SEM</i>	0.3203
	<i>95% CI</i>	[40.10, 41.36]
<i>Reward-aversion consistency</i>	<i>Mean $\pm$ SD</i>	2.52 $\pm$ 0.256
	<i>SEM</i>	0.0115
	<i>95% CI</i>	[2.50, 2.55]

<i>Consistency range</i>	<i>Mean $\pm$ SD</i>	0.47 $\pm$ 0.298
	<i>SEM</i>	0.0133
	95% CI	[0.44, 0.49]

Legend: Fifteen RPT features, which are derived from the (K, H) , (K, σ) and (H_+, H_-) curves of the IAPS picture rating groups. Five features are derived from the value function (K, H) , six from the quadratic function, and four from the trade-off function (H_+, H_-) . Mean, standard deviation, standard error of mean, and 95% confidence intervals of the values of the fifteen judgment variables are reported for the cohort. Means are rounded off at two decimal places. Standard deviations are rounded off at three decimal places. Standard errors of means are rounded off at four decimal places. Finally, the 95% confidence interval is reported to two decimal places.

Table S10. GMM Prediction of STB (t = 1)

(A) Feature Set for Predicting STB1 (Passive Ideation)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.703	0.261	0.823	0.542
RPT + PHQ8	0.769	0.460	0.852	0.656
RPT + PHQ8 + STAI	0.747	0.469	0.818	0.644
RPT + PHQ8 + STAI + Loneliness	0.774	0.543	0.838	0.691
RPT + PHQ8 + STAI + Loneliness + Demo.	0.772	0.357	0.882	0.619
RPT + Prior Attempts (between 1-12 months ago)	0.835	0.391	0.961	0.676
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.860	0.447	0.956	0.702
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.843	0.443	0.950	0.696
Entire Feature Set	0.847	0.448	0.954	0.701
(B) Feature Set for Predicting STB2 (Active Ideation)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.724	0.255	0.803	0.529
RPT + PHQ8	0.799	0.291	0.884	0.588
RPT + PHQ8 + STAI	0.773	0.337	0.854	0.600
RPT + PHQ8 + STAI + Loneliness	0.818	0.408	0.884	0.646
RPT + PHQ8 + STAI + Loneliness + Demo.	0.835	0.269	0.928	0.599
RPT + Prior Attempts (between 1-12 months ago)	0.912	0.531	0.978	0.756
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.916	0.526	0.975	0.751
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.899	0.543	0.955	0.749
Entire Feature Set	0.907	0.583	0.960	0.771
(C) Feature Set for Predicting STB3 (Planning for Suicide)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.808	0.266	0.883	0.575
RPT + PHQ8	0.814	0.292	0.884	0.588
RPT + PHQ8 + STAI	0.830	0.376	0.893	0.635
RPT + PHQ8 + STAI + Loneliness	0.825	0.459	0.876	0.668
RPT + PHQ8 + STAI + Loneliness + Demo.	0.867	0.234	0.953	0.594
RPT + Prior Attempts (between 1-12 months ago)	0.941	0.680	0.977	0.829
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.943	0.671	0.978	0.825
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.943	0.707	0.973	0.840
Entire Feature Set	0.941	0.692	0.973	0.832
(D) Feature Set for Predicting STB4 (Planning for Safety)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.682	0.208	0.789	0.500
RPT + PHQ8	0.731	0.235	0.833	0.534
RPT + PHQ8 + STAI	0.752	0.387	0.826	0.607
RPT + PHQ8 + STAI + Loneliness	0.749	0.334	0.834	0.584
RPT + PHQ8 + STAI + Loneliness + Demo.	0.762	0.344	0.849	0.597
RPT + Prior Attempts (between 1-12 months ago)	0.862	0.424	0.959	0.692
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.872	0.439	0.963	0.701
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.872	0.472	0.954	0.713
Entire Feature Set	0.866	0.490	0.942	0.716

Legend. Accuracy, sensitivity, specificity, and balanced accuracy for the Gaussian Mixture Model prediction of STB1-STB4. A threshold of one indicated that a score of one for each STB variable was symptom negative, whereas scores of two through five for each STB variables were symptom

positive; thus, 2752 participants had a score of 1, 724 had scores of 2-5 for STB1, 2981 participants had a score of 1, 495 had scores of 2-5 for STB2, 3078 participants had a score of 1, 398 had scores of 2-5 for STB3, and 2878 participants had a score of 1, 598 had scores of 2-5 for STB4.. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S11. GMM Prediction of STB (t = 2)

(A) Feature Set for Predicting STB1 (Passive Ideation)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.781	0.246	0.864	0.555
RPT + PHQ8	0.806	0.397	0.871	0.634
RPT + PHQ8 + STAI	0.808	0.457	0.865	0.661
RPT + PHQ8 + STAI + Loneliness	0.793	0.433	0.851	0.642
RPT + PHQ8 + STAI + Loneliness + Demo.	0.820	0.317	0.899	0.608
RPT + Prior Attempts (between 1-12 months ago)	0.869	0.367	0.956	0.662
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.893	0.450	0.961	0.706
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.885	0.472	0.954	0.713
Entire Feature Set	0.894	0.498	0.955	0.726
(B) Feature Set for Predicting STB2 (Active Ideation)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.812	0.252	0.865	0.559
RPT + PHQ8	0.826	0.245	0.889	0.567
RPT + PHQ8 + STAI	0.845	0.367	0.885	0.626
RPT + PHQ8 + STAI + Loneliness	0.870	0.315	0.927	0.621
RPT + PHQ8 + STAI + Loneliness + Demo.	0.880	0.237	0.947	0.592
RPT + Prior Attempts (between 1-12 months ago)	0.909	0.513	0.949	0.731
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.915	0.486	0.961	0.724
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.918	0.574	0.954	0.764
Entire Feature Set	0.923	0.607	0.954	0.781
(C) Feature Set for Predicting STB3 (Planning for Suicide)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.809	0.325	0.848	0.587
RPT + PHQ8	0.857	0.347	0.901	0.624
RPT + PHQ8 + STAI	0.883	0.294	0.936	0.615
RPT + PHQ8 + STAI + Loneliness	0.877	0.339	0.924	0.632
RPT + PHQ8 + STAI + Loneliness + Demo.	0.900	0.222	0.956	0.589
RPT + Prior Attempts (between 1-12 months ago)	0.939	0.731	0.958	0.845
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.930	0.539	0.961	0.750
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.932	0.649	0.957	0.803
Entire Feature Set	0.938	0.652	0.962	0.807
(D) Feature Set for Predicting STB4 (Planning for Safety)	Accuracy	Sensitivity	Specificity	Balanced Accuracy
RPT	0.732	0.222	0.819	0.521
RPT + PHQ8	0.743	0.275	0.815	0.545
RPT + PHQ8 + STAI	0.778	0.291	0.853	0.572
RPT + PHQ8 + STAI + Loneliness	0.788	0.330	0.864	0.597
RPT + PHQ8 + STAI + Loneliness + Demo.	0.796	0.274	0.881	0.577
RPT + Prior Attempts (between 1-12 months ago)	0.889	0.438	0.960	0.699
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.871	0.409	0.953	0.681
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.879	0.393	0.956	0.674
Entire Feature Set	0.877	0.437	0.946	0.691

Legend. Accuracy, sensitivity, specificity, and balanced accuracy for the Gaussian Mixture Model prediction of STB1-STB4. A threshold of two indicated that a scores of one or two for each STB variable were compared to scores of three through five for each STB variable on the five point

Likert-like scale. A score of one or two indicated none to mild levels of the STB variable, whereas three to five indicated higher levels of the STB variable. In terms of group numbers, 2991 participants had a score of 1 or 2, 485 had scores of 3-5 for STB1, 3155 participants had a score of 1 or 2, 321 had scores of 3-5 for STB2, 3209 participants had a score of 1 or 2, 267 had scores of 3-5 for STB3, and 3004 participants had a score of 1 or 2, 472 had scores of 3-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S12. RF Prediction of STB (t = 1)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.788	0.045	0.983	0.597
RPT + PHQ8	0.829	0.455	0.927	0.847
RPT + PHQ8 + STAI	0.833	0.451	0.933	0.855
RPT + PHQ8 + STAI + Loneliness	0.847	0.493	0.94	0.872
RPT + PHQ8 + STAI + Loneliness + Demo.	0.849	0.494	0.943	0.88
RPT + Prior Attempts (between 1-12 months ago)	0.865	0.407	0.985	0.713
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.862	0.421	0.978	0.825
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.865	0.436	0.977	0.849
Entire Feature Set	0.871	0.534	0.96	0.896
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.857	0.045	0.992	0.641
RPT + PHQ8	0.866	0.233	0.971	0.844
RPT + PHQ8 + STAI	0.87	0.254	0.972	0.852
RPT + PHQ8 + STAI + Loneliness	0.885	0.374	0.97	0.88
RPT + PHQ8 + STAI + Loneliness + Demo.	0.888	0.355	0.976	0.887
RPT + Prior Attempts (between 1-12 months ago)	0.927	0.579	0.985	0.824
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.929	0.578	0.987	0.884
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.929	0.582	0.987	0.893
Entire Feature Set	0.929	0.59	0.986	0.921
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.885	0.035	0.995	0.656
RPT + PHQ8	0.894	0.192	0.985	0.834
RPT + PHQ8 + STAI	0.895	0.213	0.983	0.842
RPT + PHQ8 + STAI + Loneliness	0.905	0.306	0.983	0.877
RPT + PHQ8 + STAI + Loneliness + Demo.	0.91	0.31	0.987	0.893
RPT + Prior Attempts (between 1-12 months ago)	0.954	0.706	0.986	0.885
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.956	0.708	0.989	0.918
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.956	0.704	0.989	0.928
Entire Feature Set	0.956	0.695	0.989	0.943
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.829	0.04	0.993	0.602
RPT + PHQ8	0.832	0.164	0.971	0.76
RPT + PHQ8 + STAI	0.84	0.223	0.968	0.771
RPT + PHQ8 + STAI + Loneliness	0.846	0.26	0.968	0.792

RPT + PHQ8 + STAI + Loneliness + Demo.	0.85	0.26	0.973	0.802
RPT + Prior Attempts (between 1-12 months ago)	0.887	0.437	0.98	0.729
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.886	0.431	0.98	0.766
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.889	0.44	0.982	0.792
Entire Feature Set	0.887	0.437	0.981	0.828

Legend. Accuracy, sensitivity, specificity, and AUC for the Random Forest prediction of STB1-STB4. A threshold of one indicated that a score of one for each STB variable was symptom negative, whereas scores of two through five for each STB variables were symptom positive; thus, 2752 participants had a score of 1, 724 had scores of 2-5 for STB1, 2981 participants had a score of 1, 495 had scores of 2-5 for STB2, 3078 participants had a score of 1, 398 had scores of 2-5 for STB3, and 2878 participants had a score of 1, 598 had scores of 2-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, Loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S13. RF Prediction of STB (t = 2)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.859	0.016	0.996	0.614
RPT + PHQ8	0.867	0.231	0.97	0.838
RPT + PHQ8 + STAI	0.868	0.253	0.968	0.851
RPT + PHQ8 + STAI + Loneliness	0.88	0.323	0.97	0.87
RPT + PHQ8 + STAI + Loneliness + Demo.	0.88	0.304	0.974	0.875
RPT + Prior Attempts (between 1-12 months ago)	0.901	0.452	0.974	0.761
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.903	0.442	0.977	0.837
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.904	0.45	0.978	0.85
Entire Feature Set	0.906	0.482	0.974	0.896
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.906	0.009	0.998	0.644
RPT + PHQ8	0.907	0.08	0.991	0.836
RPT + PHQ8 + STAI	0.907	0.087	0.99	0.845
RPT + PHQ8 + STAI + Loneliness	0.915	0.209	0.987	0.882
RPT + PHQ8 + STAI + Loneliness + Demo.	0.919	0.216	0.99	0.889
RPT + Prior Attempts (between 1-12 months ago)	0.94	0.556	0.979	0.848
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.946	0.557	0.986	0.891
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.944	0.532	0.986	0.902
Entire Feature Set	0.947	0.552	0.987	0.93
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.922	0.008	0.998	0.681
RPT + PHQ8	0.923	0.07	0.994	0.839
RPT + PHQ8 + STAI	0.925	0.102	0.993	0.851
RPT + PHQ8 + STAI + Loneliness	0.929	0.173	0.992	0.891
RPT + PHQ8 + STAI + Loneliness + Demo.	0.931	0.17	0.994	0.907
RPT + Prior Attempts (between 1-12 months ago)	0.959	0.608	0.988	0.883
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.96	0.611	0.989	0.914
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.96	0.607	0.989	0.926
Entire Feature Set	0.961	0.613	0.99	0.944
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.864	0.015	0.997	0.579
RPT + PHQ8	0.861	0.056	0.988	0.741
RPT + PHQ8 + STAI	0.867	0.111	0.985	0.754
RPT + PHQ8 + STAI + Loneliness	0.872	0.167	0.983	0.782

RPT + PHQ8 + STAI + Loneliness + Demo.	0.872	0.156	0.985	0.791
RPT + Prior Attempts (between 1-12 months ago)	0.888	0.342	0.974	0.709
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.891	0.353	0.976	0.765
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.891	0.337	0.978	0.793
Entire Feature Set	0.893	0.365	0.976	0.82

Legend. Accuracy, sensitivity, specificity, and AUC for the Random Forest prediction of STB1-STB4. A threshold of two indicated that a scores of one or two for each STB variable were compared to scores of three through five for each STB variable on the five point Likert-like scale. A score of one or two indicated none to mild levels of the STB variable, whereas three to five indicated higher levels of the STB variable. In terms of group numbers, 2991 participants had a score of 1 or 2, 485 had scores of 3-5 for STB1, 3155 participants had a score of 1 or 2, 321 had scores of 3-5 for STB2, 3209 participants had a score of 1 or 2, 267 had scores of 3-5 for STB3, and 3004 participants had a score of 1 or 2, 472 had scores of 3-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, Loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S14. LR Prediction of STB (t = 1)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.791	0.019	0.994	0.608
RPT + PHQ8	0.832	0.416	0.941	0.862
RPT + PHQ8 + STAI	0.836	0.427	0.944	0.863
RPT + PHQ8 + STAI + Loneliness	0.848	0.486	0.944	0.875
RPT + PHQ8 + STAI + Loneliness + Demo.	0.849	0.51	0.938	0.882
RPT + Prior Attempts (between 1-12 months ago)	0.865	0.401	0.987	0.732
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.86	0.44	0.971	0.842
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.868	0.486	0.969	0.863
Entire Feature Set	0.872	0.559	0.954	0.901
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.857	0.01	0.997	0.636
RPT + PHQ8	0.869	0.305	0.963	0.861
RPT + PHQ8 + STAI	0.872	0.33	0.962	0.863
RPT + PHQ8 + STAI + Loneliness	0.879	0.373	0.963	0.883
RPT + PHQ8 + STAI + Loneliness + Demo.	0.885	0.419	0.962	0.89
RPT + Prior Attempts (between 1-12 months ago)	0.918	0.484	0.99	0.823
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.922	0.511	0.99	0.895
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.925	0.555	0.987	0.906
Entire Feature Set	0.925	0.569	0.984	0.927
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.885	0.015	0.997	0.663
RPT + PHQ8	0.888	0.224	0.974	0.85
RPT + PHQ8 + STAI	0.889	0.234	0.974	0.853
RPT + PHQ8 + STAI + Loneliness	0.897	0.312	0.972	0.878
RPT + PHQ8 + STAI + Loneliness + Demo.	0.901	0.352	0.972	0.889
RPT + Prior Attempts (between 1-12 months ago)	0.95	0.646	0.989	0.889
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.952	0.659	0.99	0.932
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.954	0.667	0.991	0.935
Entire Feature Set	0.952	0.665	0.989	0.946
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.828	0.006	0.999	0.623
RPT + PHQ8	0.828	0.197	0.959	0.791
RPT + PHQ8 + STAI	0.838	0.249	0.961	0.793
RPT + PHQ8 + STAI + Loneliness	0.846	0.287	0.962	0.808

RPT + PHQ8 + STAI + Loneliness + Demo.	0.849	0.307	0.961	0.811
RPT + Prior Attempts (between 1-12 months ago)	0.882	0.373	0.988	0.756
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.884	0.389	0.987	0.8
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.887	0.411	0.986	0.819
Entire Feature Set	0.883	0.421	0.979	0.84

Legend. Accuracy, sensitivity, specificity, and AUC for the Logistic Regression prediction of STB1-STB4. A threshold of one indicated that a score of one for each STB variable was symptom negative, whereas scores of two through five for each STB variables were symptom positive; thus, 2752 participants had a score of 1, 724 had scores of 2-5 for STB1, 2981 participants had a score of 1, 495 had scores of 2-5 for STB2, 3078 participants had a score of 1, 398 had scores of 2-5 for STB3, and 2878 participants had a score of 1, 598 had scores of 2-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, Loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S15. LR Prediction of STB (t = 2)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.86	0.007	0.998	0.632
RPT + PHQ8	0.872	0.319	0.962	0.862
RPT + PHQ8 + STAI	0.877	0.338	0.964	0.865
RPT + PHQ8 + STAI + Loneliness	0.881	0.372	0.964	0.879
RPT + PHQ8 + STAI + Loneliness + Demo.	0.883	0.398	0.962	0.882
RPT + Prior Attempts (between 1-12 months ago)	0.898	0.354	0.986	0.783
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.902	0.401	0.983	0.862
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.901	0.422	0.978	0.875
Entire Feature Set	0.905	0.485	0.973	0.905
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.907	0	0.999	0.653
RPT + PHQ8	0.908	0.185	0.981	0.862
RPT + PHQ8 + STAI	0.909	0.208	0.981	0.867
RPT + PHQ8 + STAI + Loneliness	0.912	0.276	0.977	0.887
RPT + PHQ8 + STAI + Loneliness + Demo.	0.918	0.315	0.98	0.896
RPT + Prior Attempts (between 1-12 months ago)	0.941	0.487	0.987	0.861
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.944	0.526	0.987	0.907
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.945	0.526	0.987	0.919
Entire Feature Set	0.945	0.544	0.985	0.934
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.923	0.002	0.999	0.703
RPT + PHQ8	0.921	0.119	0.988	0.86
RPT + PHQ8 + STAI	0.923	0.181	0.985	0.865
RPT + PHQ8 + STAI + Loneliness	0.924	0.221	0.982	0.894
RPT + PHQ8 + STAI + Loneliness + Demo.	0.929	0.288	0.982	0.907
RPT + Prior Attempts (between 1-12 months ago)	0.961	0.619	0.99	0.913
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.96	0.607	0.989	0.94
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.96	0.613	0.989	0.944
Entire Feature Set	0.959	0.612	0.988	0.953
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.864	0.001	1	0.626
RPT + PHQ8	0.858	0.105	0.976	0.781
RPT + PHQ8 + STAI	0.864	0.147	0.977	0.785
RPT + PHQ8 + STAI + Loneliness	0.866	0.182	0.974	0.802

RPT + PHQ8 + STAI + Loneliness + Demo.	0.871	0.209	0.975	0.808
RPT + Prior Attempts (between 1-12 months ago)	0.891	0.307	0.983	0.745
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.892	0.325	0.981	0.797
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.892	0.319	0.982	0.816
Entire Feature Set	0.891	0.335	0.978	0.832

Legend. Accuracy, sensitivity, specificity, and AUC for the Logistic Regression prediction of STB1-STB4. A threshold of two indicated that a scores of one or two for each STB variable were compared to scores of three through five for each STB variable on the five point Likert-like scale. A score of one or two indicated none to mild levels of the STB variable, whereas three to five indicated higher levels of the STB variable. In terms of group numbers, 2991 participants had a score of 1 or 2, 485 had scores of 3-5 for STB1, 3155 participants had a score of 1 or 2, 321 had scores of 3-5 for STB2, 3209 participants had a score of 1 or 2, 267 had scores of 3-5 for STB3, and 3004 participants had a score of 1 or 2, 472 had scores of 3-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S16. NN Prediction of STB (t = 1)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.789	0.013	0.994	0.604
RPT + PHQ8	0.832	0.524	0.913	0.861
RPT + PHQ8 + STAI	0.838	0.507	0.926	0.862
RPT + PHQ8 + STAI + Loneliness	0.848	0.539	0.93	0.878
RPT + PHQ8 + STAI + Loneliness + Demo.	0.845	0.515	0.931	0.882
RPT + Prior Attempts (between 1-12 months ago)	0.86	0.367	0.989	0.734
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.859	0.448	0.967	0.836
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.864	0.484	0.964	0.861
Entire Feature Set	0.868	0.565	0.948	0.899
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.857	0.018	0.996	0.642
RPT + PHQ8	0.865	0.283	0.962	0.859
RPT + PHQ8 + STAI	0.868	0.306	0.961	0.862
RPT + PHQ8 + STAI + Loneliness	0.879	0.381	0.961	0.882
RPT + PHQ8 + STAI + Loneliness + Demo.	0.881	0.401	0.96	0.889
RPT + Prior Attempts (between 1-12 months ago)	0.917	0.479	0.99	0.814
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.92	0.537	0.983	0.891
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.92	0.535	0.984	0.899
Entire Feature Set	0.918	0.566	0.977	0.922
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.885	0.018	0.997	0.67
RPT + PHQ8	0.887	0.174	0.979	0.853
RPT + PHQ8 + STAI	0.888	0.222	0.974	0.857
RPT + PHQ8 + STAI + Loneliness	0.899	0.333	0.972	0.883
RPT + PHQ8 + STAI + Loneliness + Demo.	0.902	0.384	0.969	0.89
RPT + Prior Attempts (between 1-12 months ago)	0.948	0.625	0.99	0.894
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.952	0.65	0.991	0.93
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.951	0.65	0.99	0.931
Entire Feature Set	0.95	0.658	0.988	0.943
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.828	0.007	0.998	0.622
RPT + PHQ8	0.829	0.222	0.955	0.783
RPT + PHQ8 + STAI	0.839	0.271	0.957	0.792
RPT + PHQ8 + STAI + Loneliness	0.843	0.291	0.957	0.805

RPT + PHQ8 + STAI + Loneliness + Demo.	0.846	0.331	0.953	0.815
RPT + Prior Attempts (between 1-12 months ago)	0.882	0.373	0.987	0.748
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.883	0.393	0.985	0.796
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.886	0.413	0.984	0.818
Entire Feature Set	0.881	0.411	0.979	0.843

Legend. Accuracy, sensitivity, specificity, and AUC for the Neural Network prediction of STB1-STB4. A threshold of one indicated that a score of one for each STB variable was symptom negative, whereas scores of two through five for each STB variables were symptom positive; thus, 2752 participants had a score of 1, 724 had scores of 2-5 for STB1, 2981 participants had a score of 1, 495 had scores of 2-5 for STB2, 3078 participants had a score of 1, 398 had scores of 2-5 for STB3, and 2878 participants had a score of 1, 598 had scores of 2-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S17. NN Prediction of STB (t = 2)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.859	0.003	0.998	0.63
RPT + PHQ8	0.868	0.306	0.959	0.86
RPT + PHQ8 + STAI	0.866	0.327	0.954	0.864
RPT + PHQ8 + STAI + Loneliness	0.878	0.379	0.959	0.879
RPT + PHQ8 + STAI + Loneliness + Demo.	0.88	0.403	0.957	0.881
RPT + Prior Attempts (between 1-12 months ago)	0.897	0.352	0.985	0.783
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.9	0.393	0.982	0.857
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.898	0.402	0.978	0.872
Entire Feature Set	0.898	0.468	0.968	0.903
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.907	0.002	1	0.655
RPT + PHQ8	0.908	0.144	0.986	0.859
RPT + PHQ8 + STAI	0.906	0.195	0.979	0.866
RPT + PHQ8 + STAI + Loneliness	0.915	0.293	0.979	0.888
RPT + PHQ8 + STAI + Loneliness + Demo.	0.916	0.313	0.978	0.892
RPT + Prior Attempts (between 1-12 months ago)	0.94	0.47	0.987	0.862
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.942	0.516	0.985	0.903
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.943	0.509	0.987	0.912
Entire Feature Set	0.942	0.538	0.984	0.929
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.922	0.004	0.999	0.711
RPT + PHQ8	0.921	0.089	0.99	0.86
RPT + PHQ8 + STAI	0.923	0.18	0.985	0.867
RPT + PHQ8 + STAI + Loneliness	0.927	0.239	0.984	0.898
RPT + PHQ8 + STAI + Loneliness + Demo.	0.928	0.293	0.981	0.908
RPT + Prior Attempts (between 1-12 months ago)	0.96	0.59	0.99	0.911
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.959	0.59	0.99	0.937
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.957	0.572	0.989	0.94
Entire Feature Set	0.958	0.604	0.988	0.949
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.864	0	0.999	0.62
RPT + PHQ8	0.86	0.062	0.985	0.775
RPT + PHQ8 + STAI	0.865	0.159	0.976	0.78
RPT + PHQ8 + STAI + Loneliness	0.869	0.187	0.976	0.797

RPT + PHQ8 + STAI + Loneliness + Demo.	0.87	0.236	0.97	0.808
RPT + Prior Attempts (between 1-12 months ago)	0.89	0.284	0.985	0.734
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.891	0.307	0.983	0.79
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.892	0.34	0.979	0.81
Entire Feature Set	0.889	0.323	0.978	0.829

Legend. Accuracy, sensitivity, specificity, and AUC for the Neural Network prediction of STB1-STB4. A threshold of two indicated that a scores of one or two for each STB variable were compared to scores of three through five for each STB variable on the five point Likert-like scale. A score of one or two indicated none to mild levels of the STB variable, whereas three to five indicated higher levels of the STB variable. In terms of group numbers, 2991 participants had a score of 1 or 2, 485 had scores of 3-5 for STB1, 3155 participants had a score of 1 or 2, 321 had scores of 3-5 for STB2, 3209 participants had a score of 1 or 2, 267 had scores of 3-5 for STB3, and 3004 participants had a score of 1 or 2, 472 had scores of 3-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S18. SVM Prediction of STB (t = 1)

<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.792	0	1	0.522
RPT + PHQ8	0.831	0.383	0.95	0.863
RPT + PHQ8 + STAI	0.84	0.41	0.953	0.863
RPT + PHQ8 + STAI + Loneliness	0.842	0.417	0.953	0.872
RPT + PHQ8 + STAI + Loneliness + Demo.	0.844	0.435	0.951	0.878
RPT + Prior Attempts (between 1-12 months ago)	0.792	0.002	1	0.695
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.795	0.014	1	0.837
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.793	0.006	1	0.852
Entire Feature Set	0.851	0.462	0.953	0.888
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.858	0	1	0.542
RPT + PHQ8	0.858	0	1	0.804
RPT + PHQ8 + STAI	0.858	0.001	1	0.852
RPT + PHQ8 + STAI + Loneliness	0.859	0.008	1	0.874
RPT + PHQ8 + STAI + Loneliness + Demo.	0.865	0.069	0.997	0.871
RPT + Prior Attempts (between 1-12 months ago)	0.858	0	1	0.791
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.858	0	1	0.868
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.858	0	1	0.883
Entire Feature Set	0.875	0.15	0.996	0.903
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.886	0	1	0.541
RPT + PHQ8	0.886	0	1	0.753
RPT + PHQ8 + STAI	0.886	0	1	0.8
RPT + PHQ8 + STAI + Loneliness	0.886	0	1	0.862
RPT + PHQ8 + STAI + Loneliness + Demo.	0.886	0	1	0.861
RPT + Prior Attempts (between 1-12 months ago)	0.886	0.004	1	0.866
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.886	0.001	1	0.906
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.886	0	1	0.92
Entire Feature Set	0.889	0.027	1	0.924
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.828	0	1	0.548
RPT + PHQ8	0.828	0	1	0.705
RPT + PHQ8 + STAI	0.828	0	1	0.762
RPT + PHQ8 + STAI + Loneliness	0.828	0	1	0.782

RPT + PHQ8 + STAI + Loneliness + Demo.	0.831	0.021	0.999	0.77
RPT + Prior Attempts (between 1-12 months ago)	0.828	0	1	0.74
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.828	0	1	0.768
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.828	0	1	0.769
Entire Feature Set	0.838	0.066	0.998	0.81

Legend. Accuracy, sensitivity, specificity, and AUC for the Support Vector Machine prediction of STB1-STB4. A threshold of one indicated that a score of one for each STB variable was symptom negative, whereas scores of two through five for each STB variables were symptom positive; thus, 2752 participants had a score of 1, 724 had scores of 2-5 for STB1, 2981 participants had a score of 1, 495 had scores of 2-5 for STB2, 3078 participants had a score of 1, 398 had scores of 2-5 for STB3, and 2878 participants had a score of 1, 598 had scores of 2-5 for STB4.. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Table S19. SVM Prediction of STB (t = 2)

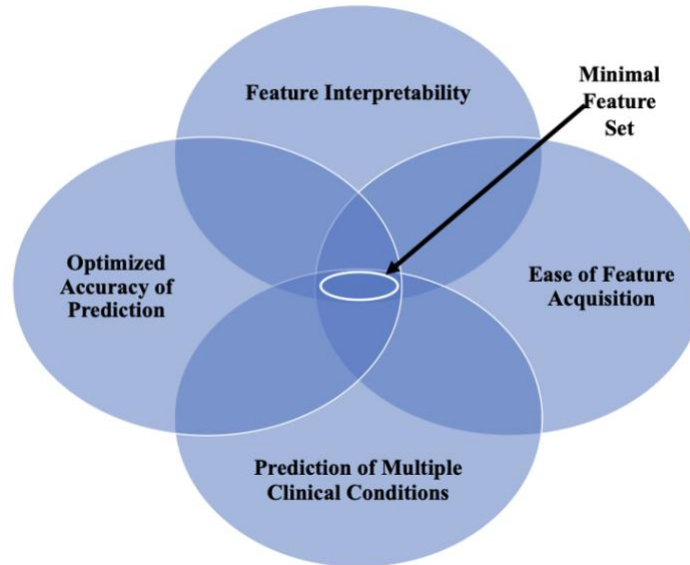
<i>(A) Feature Set for Predicting STB1 (Passive Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.86	0	1	0.518
RPT + PHQ8	0.86	0	1	0.78
RPT + PHQ8 + STAI	0.861	0.002	1	0.847
RPT + PHQ8 + STAI + Loneliness	0.861	0.008	1	0.869
RPT + PHQ8 + STAI + Loneliness + Demo.	0.863	0.028	0.998	0.862
RPT + Prior Attempts (between 1-12 months ago)	0.86	0	1	0.74
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.86	0	1	0.813
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.86	0	1	0.82
Entire Feature Set	0.87	0.089	0.997	0.887
<i>(B) Feature Set for Predicting STB2 (Active Ideation)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.908	0	1	0.526
RPT + PHQ8	0.908	0	1	0.733
RPT + PHQ8 + STAI	0.908	0	1	0.73
RPT + PHQ8 + STAI + Loneliness	0.908	0	1	0.846
RPT + PHQ8 + STAI + Loneliness + Demo.	0.908	0	1	0.844
RPT + Prior Attempts (between 1-12 months ago)	0.908	0	1	0.839
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.908	0	1	0.888
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.908	0	1	0.887
Entire Feature Set	0.908	0	1	0.916
<i>(C) Feature Set for Predicting STB3 (Planning for Suicide)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.923	0	1	0.549
RPT + PHQ8	0.923	0	1	0.754
RPT + PHQ8 + STAI	0.923	0	1	0.769
RPT + PHQ8 + STAI + Loneliness	0.923	0	1	0.85
RPT + PHQ8 + STAI + Loneliness + Demo.	0.923	0	1	0.865
RPT + Prior Attempts (between 1-12 months ago)	0.923	0	1	0.896
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.923	0	1	0.93
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.923	0	1	0.937
Entire Feature Set	0.923	0	1	0.942
<i>(D) Feature Set for Predicting STB4 (Planning for Safety)</i>	<i>Accuracy</i>	<i>Sensitivity</i>	<i>Specificity</i>	<i>AUC</i>
RPT	0.864	0	1	0.512
RPT + PHQ8	0.864	0	1	0.592
RPT + PHQ8 + STAI	0.864	0	1	0.69
RPT + PHQ8 + STAI + Loneliness	0.864	0	1	0.721

RPT + PHQ8 + STAI + Loneliness + Demo.	0.864	0	1	0.723
RPT + Prior Attempts (between 1-12 months ago)	0.864	0	1	0.726
RPT + Loneliness + Prior Attempts (between 1-12 months ago)	0.864	0	1	0.743
RPT + Loneliness + Prior Attempts (between 1-12 months ago) + Demo.	0.864	0	1	0.751
Entire Feature Set	0.864	0	1	0.777

Legend. Accuracy, sensitivity, specificity, and AUC for the Support Vector Machine prediction of STB1-STB4. A threshold of two indicated that a scores of one or two for each STB variable were compared to scores of three through five for each STB variable on the five point Likert-like scale. A score of one or two indicated none to mild levels of the STB variable, whereas three to five indicated higher levels of the STB variable. In terms of group numbers, 2991 participants had a score of 1 or 2, 485 had scores of 3-5 for STB1, 3155 participants had a score of 1 or 2, 321 had scores of 3-5 for STB2, 3209 participants had a score of 1 or 2, 267 had scores of 3-5 for STB3, and 3004 participants had a score of 1 or 2, 472 had scores of 3-5 for STB4. Feature sets first start with judgment variables (RPT) and successively include the PHQ8 score, the STAI score, loneliness, and demographics respectively. Analyses were also conducted using a feature set with only judgment variables and prior attempts at hurting oneself, followed by successively adding Loneliness and demographic (Demo.) variables (age, gender at birth, ethnicity, education level and handedness). Last, all features were included for the prediction of each STB variable. Values were rounded off at three decimal places.

Supplementary Material: Figures

Figure S1: Study Objective



Four considerations, including variable interpretability, ease of variable acquisition or measurement, optimization accuracy of condition prediction (in this case STB metrics) and prediction of multiple clinical conditions need to be balanced for prediction of STB variables and the broader set of mental health concerns. These four considerations are all necessary if the prediction of STB and other conditions is going to ultimately have clinical utility.

Figure S2: Picture Rating Task

Picture Survey

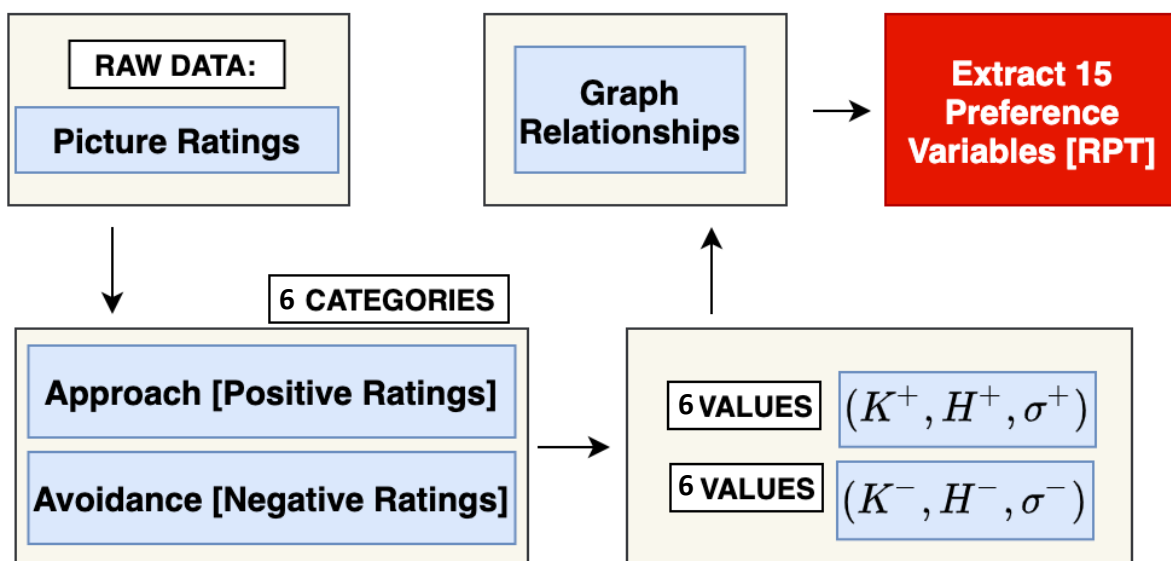


Please rate:

-3	-2	-1	0	1	2	3
☐	☐	☐	☐	☐	☐	☐

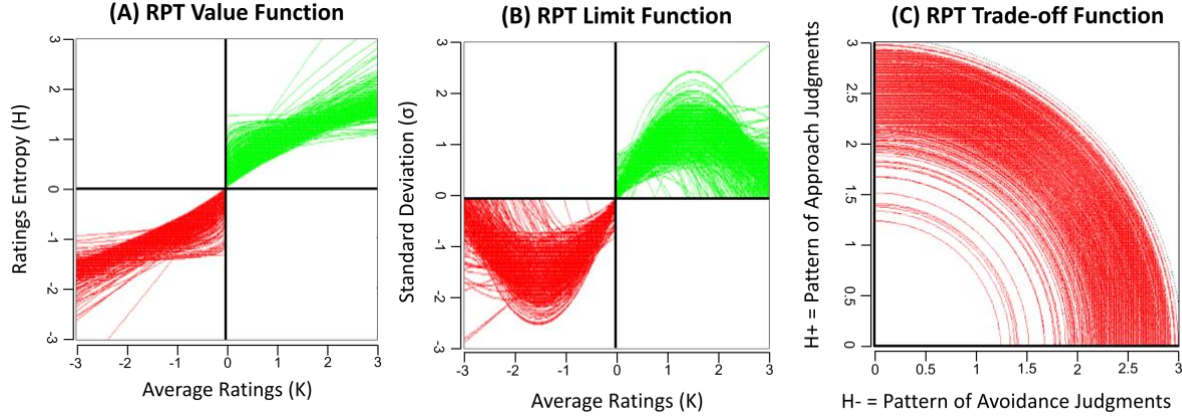
An example of an image in the rating task. A score of -3 indicates a strong disliking of an image, a score of 0 indicates a neutral response to an image, and a score of +3 indicates a strong liking of an image.

Figure S3: Extraction of Relative Preference Theory variables from Picture Rating Task



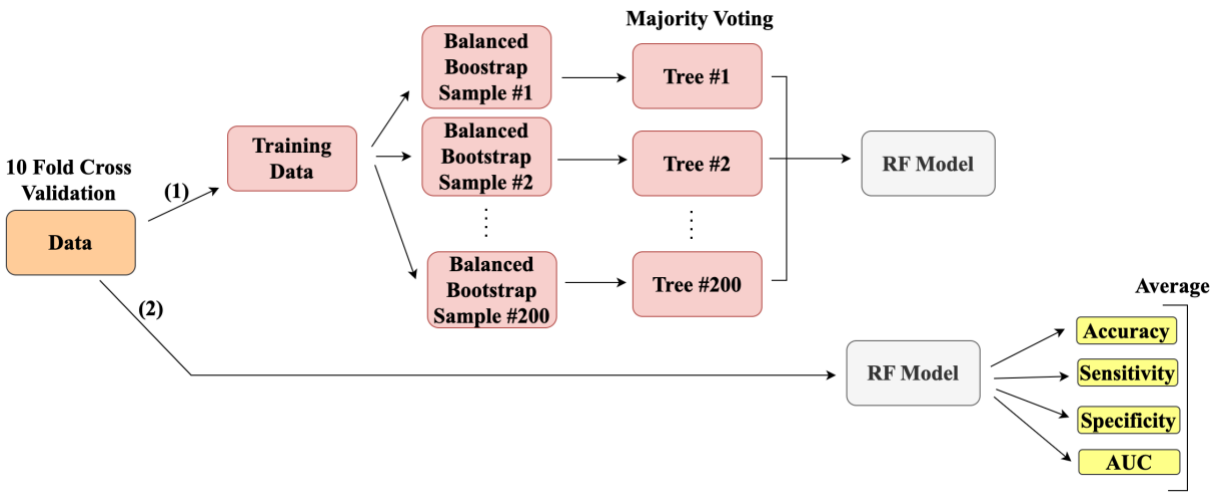
The process of extracting relative preference theory variables from the raw data. The picture ratings for each participant are subdivided into two groups—positive and negative ratings. Next the mean ratings (K), the entropy of ratings (H) and the standard deviation of ratings (σ) are computed for each of the nine categories of images, for each group of positive and negative ratings. Relative preference variables are then extracted from the (K, H) , (K, σ) and (H, σ) curves derived from these tuples.

Figure S4: RPT curves for judgment in 500 randomly selected subjects



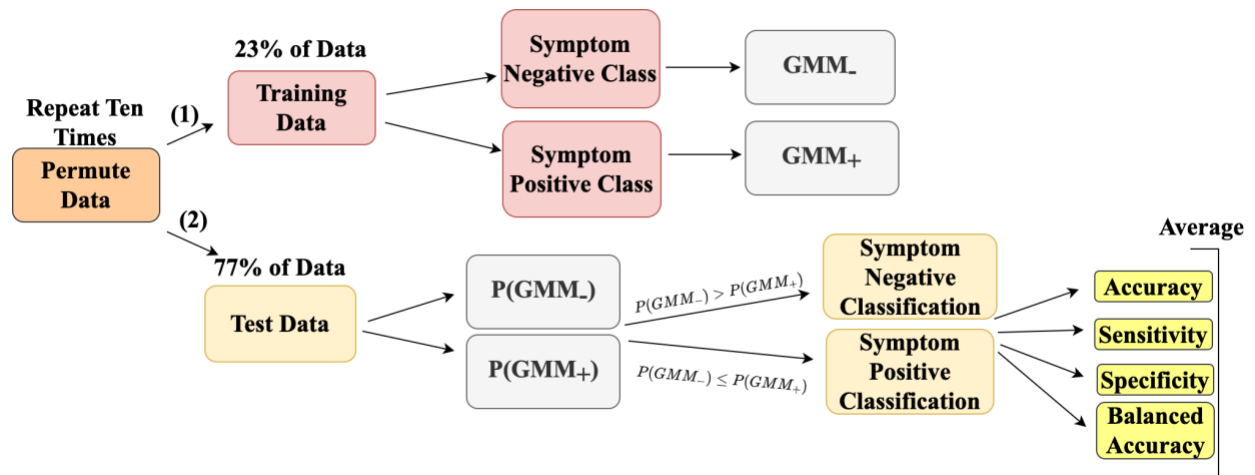
The power law fits of the value function (A) are obtained by fitting a power law between the mean ratings (K) and the entropies (H) for the ratings of the six groups of IAPS images. The power law fits are conducted separately for positive mean ratings (K_+, H_+) (green) and negative mean ratings (K_-, H_-) (red). The value function corresponds to Kahneman's prospect theory. (B) Quadratic fits of the mean ratings (K) and their standard deviations (σ) for the ratings of the six groups of IAPS images. The quadratic fits are fit separately for positive mean ratings (K_+, σ^+) (green) and negative mean ratings (K_-, σ^-) (red). The curve corresponds to Markowitz' Portfolio Theory, in which mean-variance analysis can be conducted to ascertain the minimum risk an individual must accept to obtain a reward in expectation. (C) The tradeoff-plots are obtained by generating a fit from plotting entropy of positive ratings (H_+) to negative ratings (H_-) of the IAPS image groups.

Figure S5: BRF Schema



A balanced random forest classifier was implemented on the dataset with ten fold cross validation, so that the data set was partitioned into ten distinct partitions, where nine of the ten partitions were used for training and one of the ten partitions was used for testing, with the process repeating ten times so that each distinct partition was used for testing. Random forest classifiers contain a collection of decision trees that are trained on subsamples of the data, and the majority vote of the decision trees is used for classification, which is averaged by the probability of the estimate for each tree (this process is known as bagging). The subsamples are chosen with replacement, so that any subsample may contain the same item from the original sample more than one time. The random forest classifier contained 200 trees, with each tree being fed a randomly subsampled balanced partition of the data, so that half of the subsample belonged to the STB-positive class and the other half of the subsample belonged to the STB-negative set. The balanced dataset was obtained by downsampling the majority class in each subsample. With the exception of balancing each bootstrap sample, the balanced random forest classifier was analogous to a regular random forest classifier. The accuracy, sensitivity, specificity and AUC score were reported on the testing set. These metrics were averaged over the ten iterations of cross-validation.

Figure S6: GMM Schema



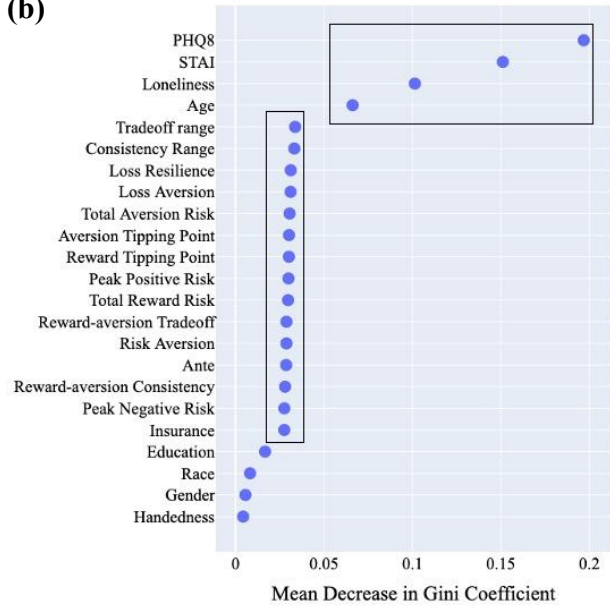
Gaussian mixture models (GMM) were used to model both the STB-positive class and the STB-negative class for classification. Gaussian mixture models correspond to a mixture of Gaussian distributions, each being drawn from with a respective probability. Two Gaussian mixture models were fit to the training data, where the training data was randomly selected to contain 77% of the overall data. A GMM was fit to the the feature set corresponding to the STB-positive class and a separate GMM was fit to the feature set corresponding to the STB-negative class. The number of Gaussian mixtures in each of the two GMMs were chosen by evaluating the number of mixtures that minimized the Bayesian Information Criteria (BIC) score, with the constraint that the number of mixtures be between one and ten. After completing this process, the performance was evaluated on the testing data. Given a sample from the test set, the probability of that sample of belonging to each GMM was evaluated using the probability density function of each GMM. The sample was subsequently classified as belonging to the class of the GMM which produced the greater probability. The accuracy, sensitivity, specificity and balanced accuracy were calculated for the testing set. The entire procedure was then repeated ten times, which each iteration producing a randomized 77/23 train/test split of the data. The average of the accuracy, sensitivity, specificity and balanced accuracy over the ten iterations was subsequently reported.

Figure S7: Gini Importance, Passive Suicidal Ideation ($t=1$) with PHQ8 and STAI

(a)

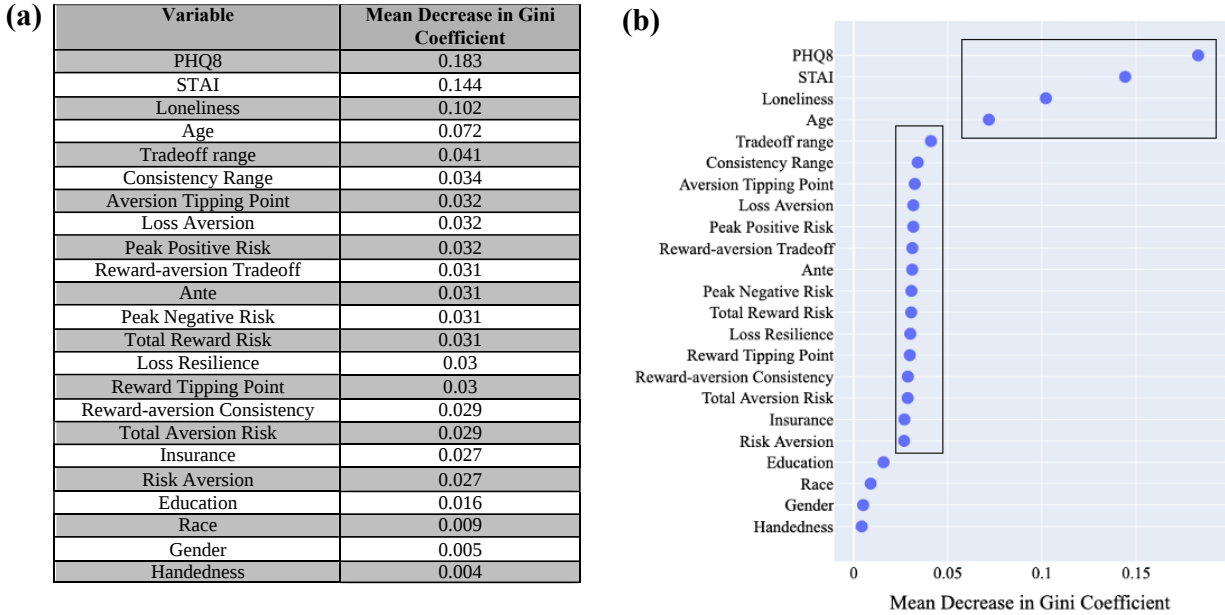
Variable	Mean Decrease in Gini Coefficient
PHQ8	0.197
STAI	0.151
Loneliness	0.101
Age	0.066
Tradeoff range	0.034
Consistency Range	0.033
Loss Resilience	0.031
Loss Aversion	0.031
Total Aversion Risk	0.031
Aversion Tipping Point	0.03
Reward Tipping Point	0.03
Peak Positive Risk	0.03
Total Reward Risk	0.03
Reward-aversion Tradeoff	0.029
Risk Aversion	0.029
Ante	0.029
Reward-aversion Consistency	0.028
Peak Negative Risk	0.028
Insurance	0.028
Education	0.017
Race	0.008
Gender	0.006
Handedness	0.004

(b)



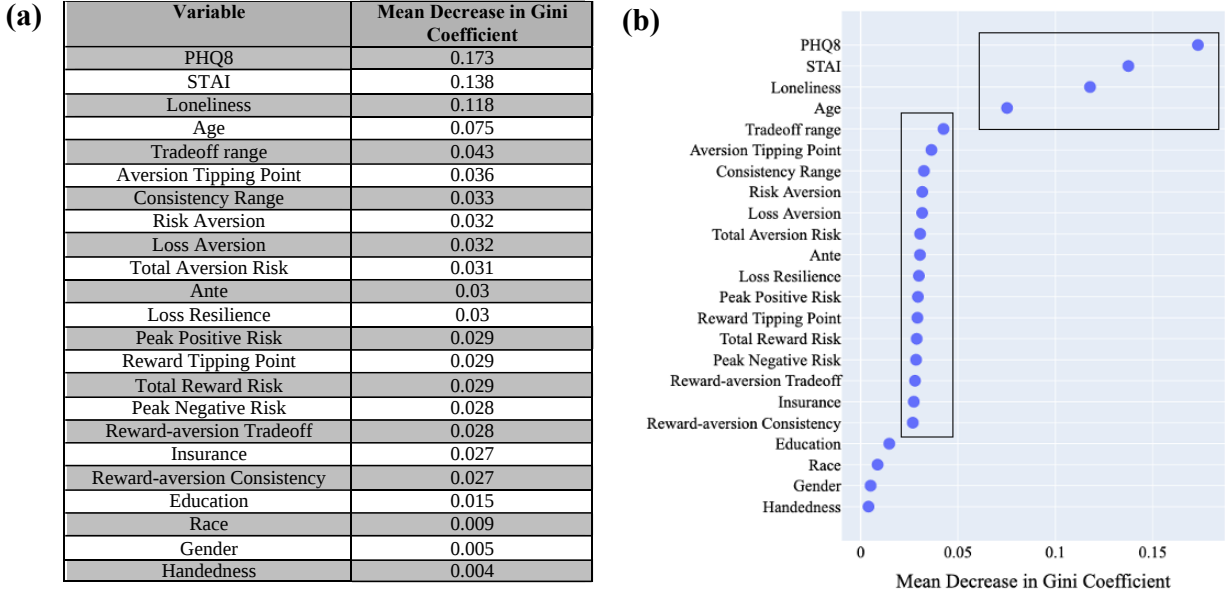
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S8: Gini Importance, Passive Suicidal Ideation (t=2) with PHQ8 and STAI



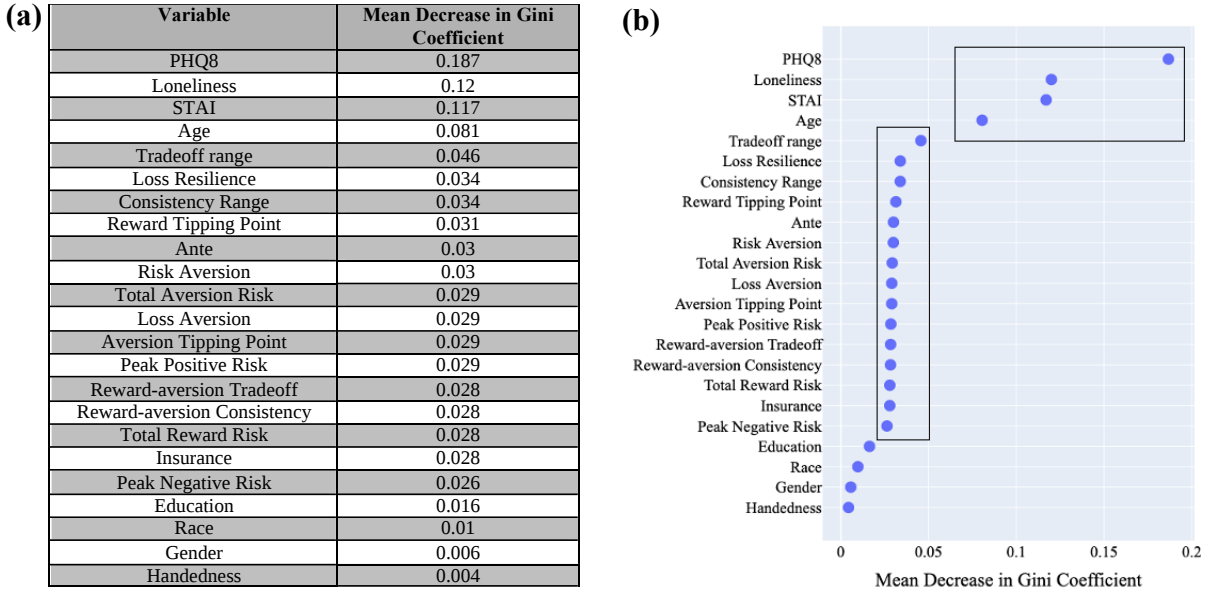
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S9: Gini Importance, Active Suicidal Ideation (t=1) with PHQ8 and STAI



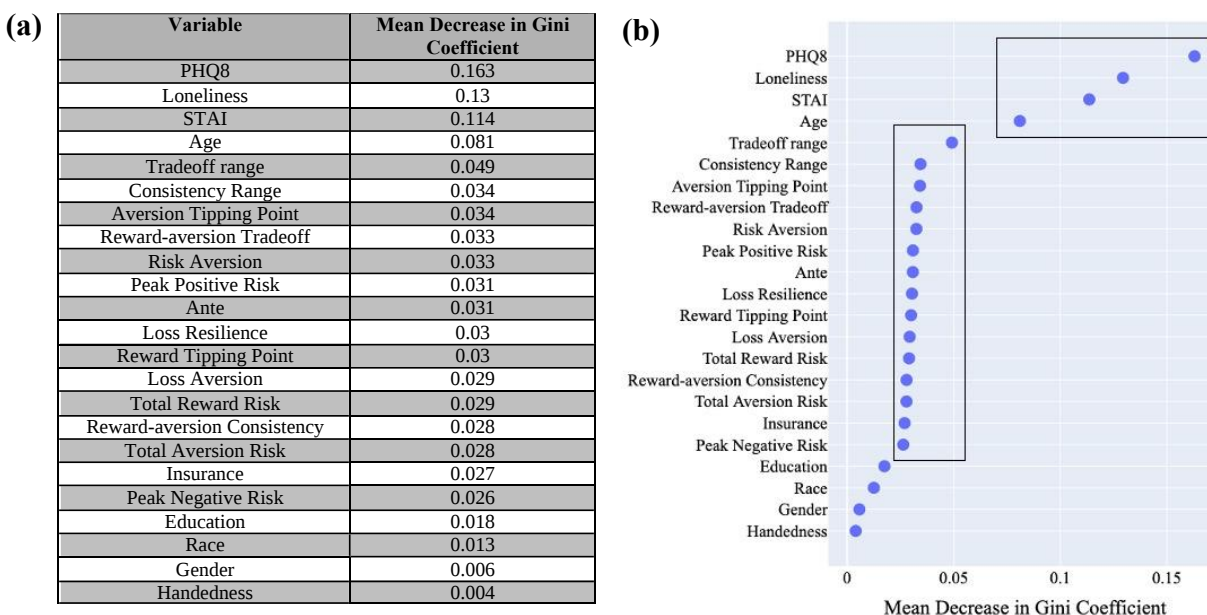
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S10: Gini Importance, Active Suicidal Ideation (t=2) with PHQ8 and STAI



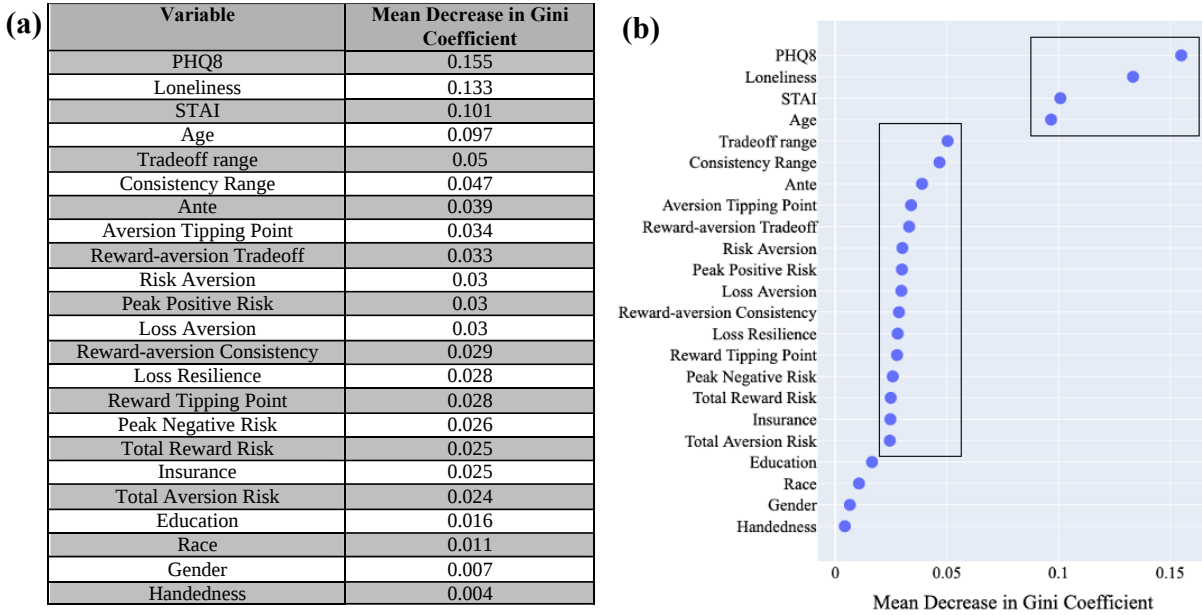
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S11: Gini Importance, Planning for Suicide (t=1) with PHQ8 and STAI



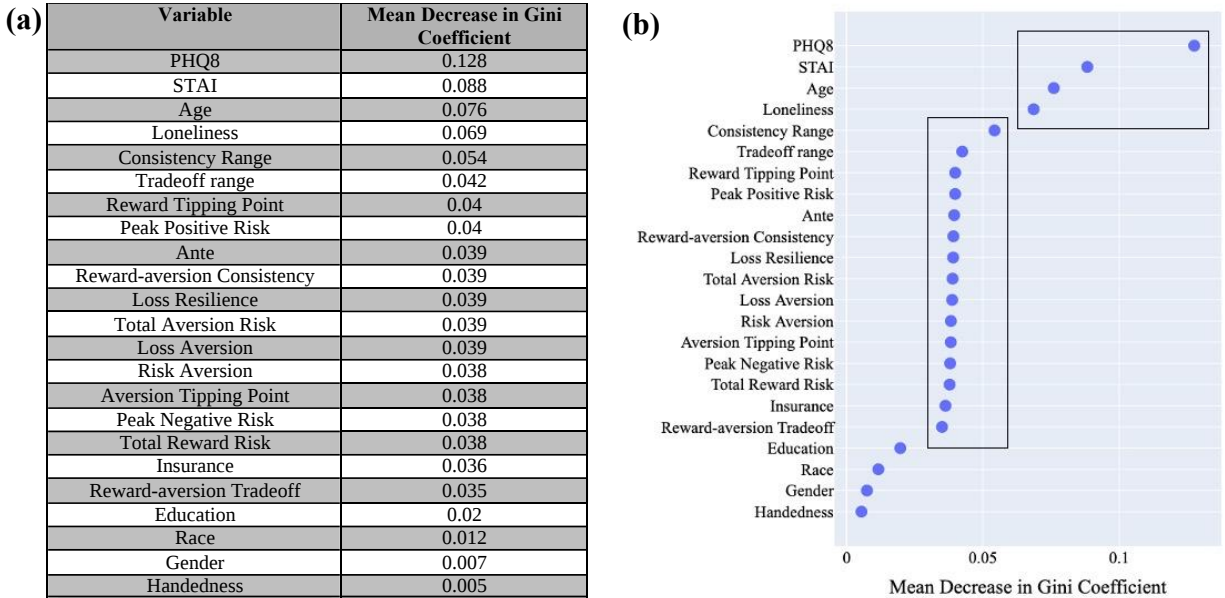
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S12: Gini Importance, Planning for Suicide (t=2) with PHQ8 and STAI



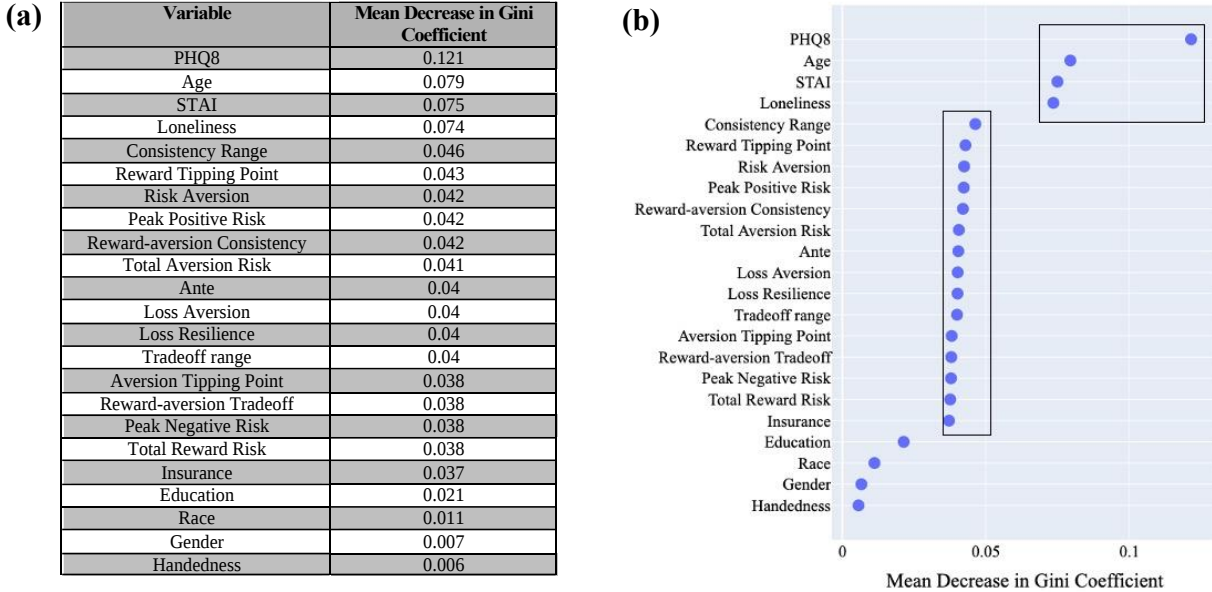
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S13: Gini Importance, Planning for Safety (t=1) with PHQ8 and STAI



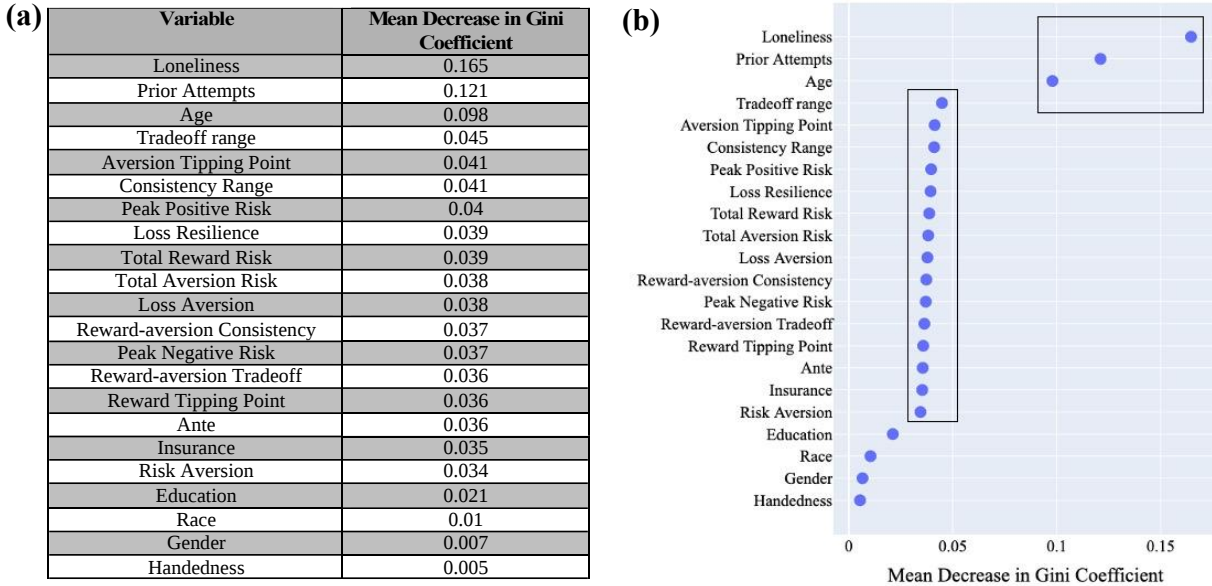
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S14: Gini Importance, Planning for Safety (t=2) with PHQ8 and STAI



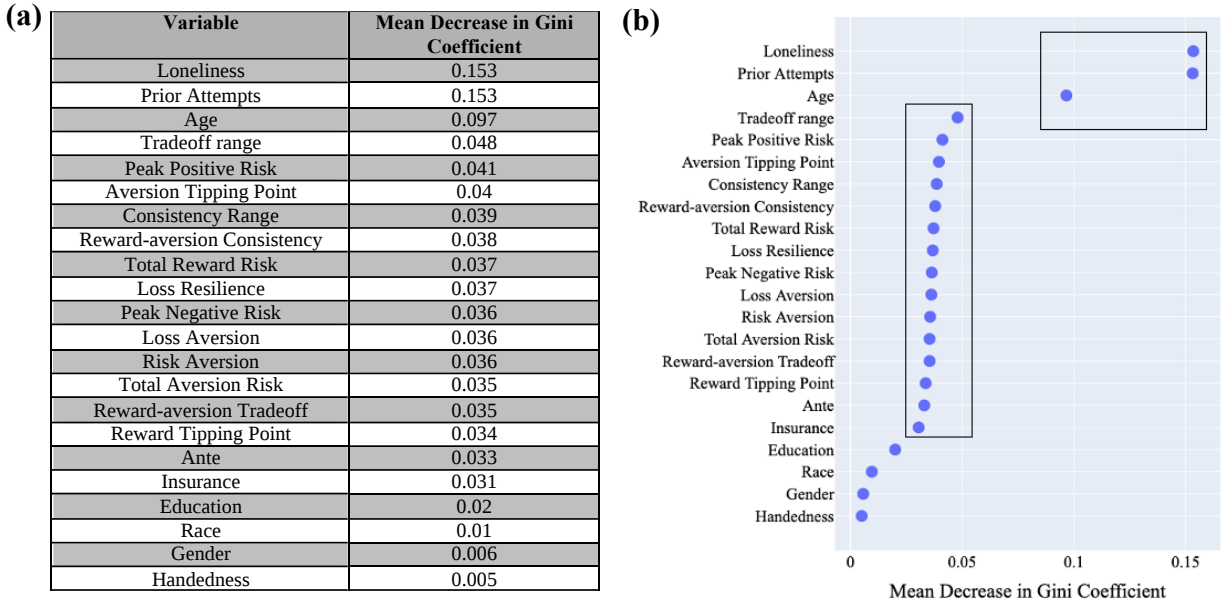
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with PHQ8, STAI, and self-reported loneliness metrics. Figures S7, S9, S11, and S13 represent thresholds of 1, whereas Figures S8, S10, S12, S14 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S15: Gini Importance, Passive Suicidal Ideation (t=1) with Prior Attempts



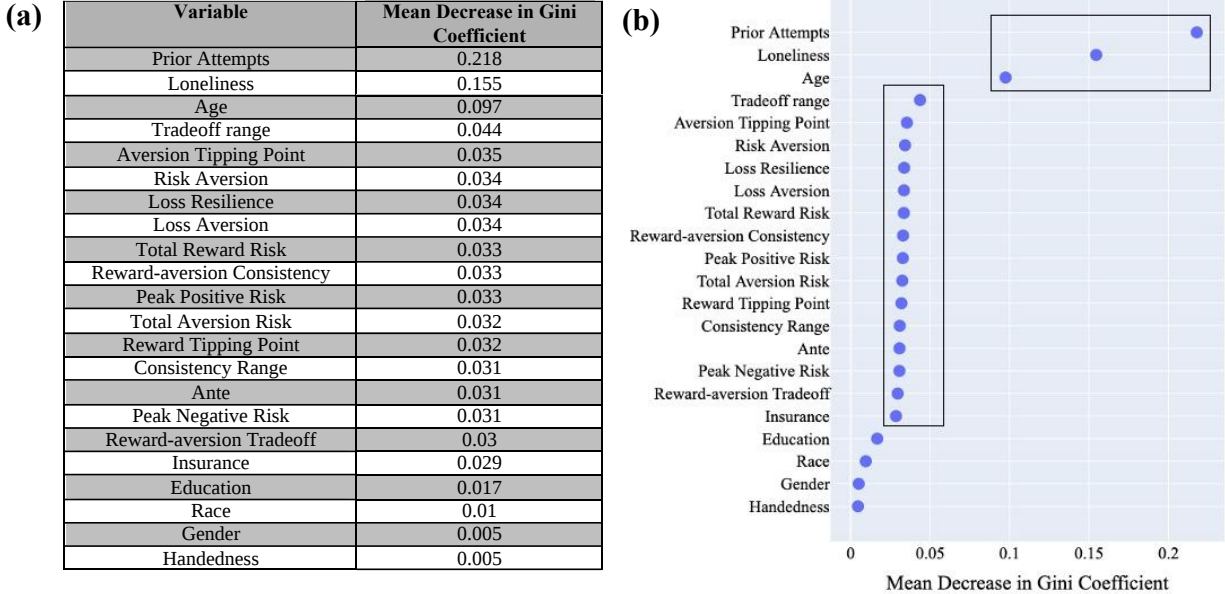
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S16: Gini Importance, Passive Suicidal Ideation (t=2) with Prior Attempts



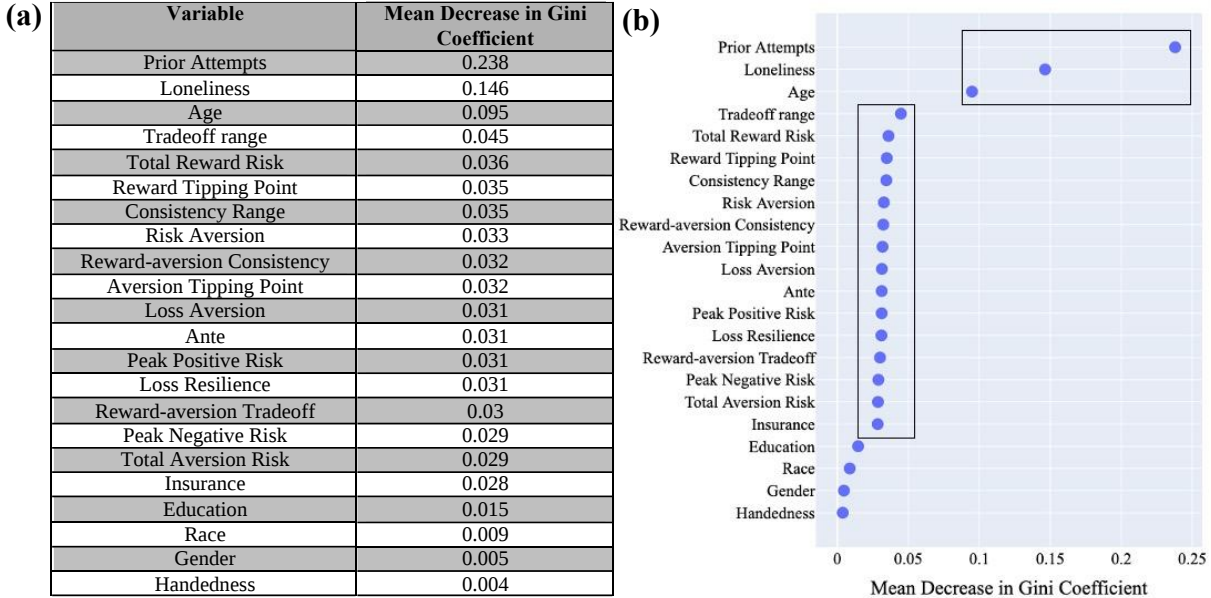
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S17: Gini Importance, Active Suicidal Ideation (t=1) with Prior Attempts



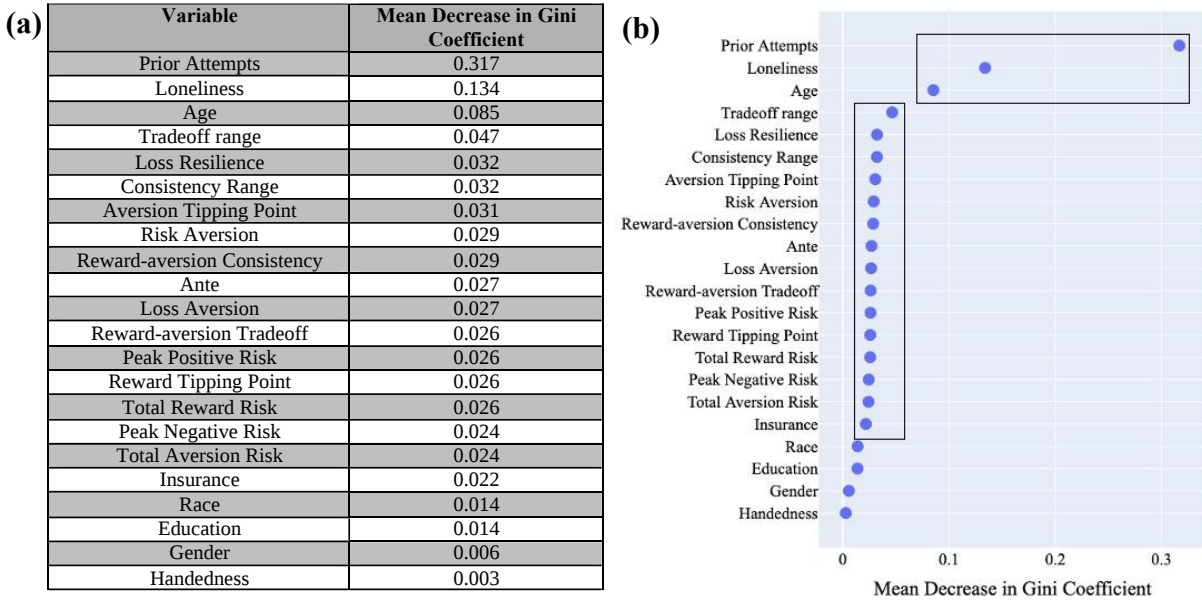
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S18: Gini Importance, Active Suicidal Ideation (t=2) with Prior Attempts



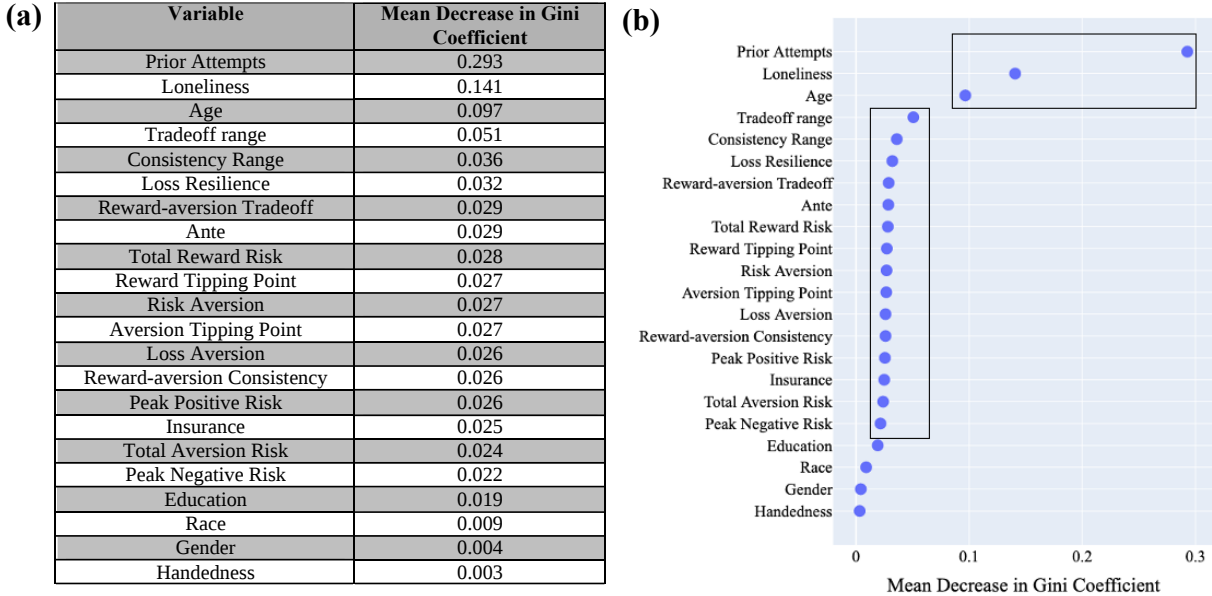
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S19: Gini Importance, Planning for Suicide (t=1) with Prior Attempts



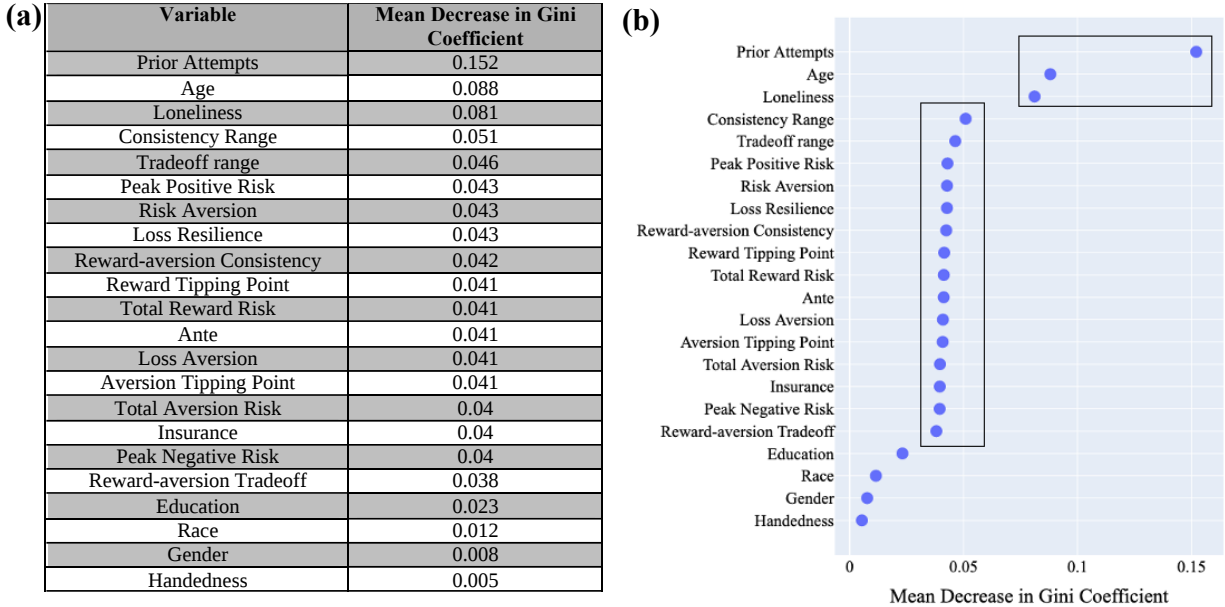
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S20: Gini Importance, Planning for Suicide (t=2) with Prior Attempts



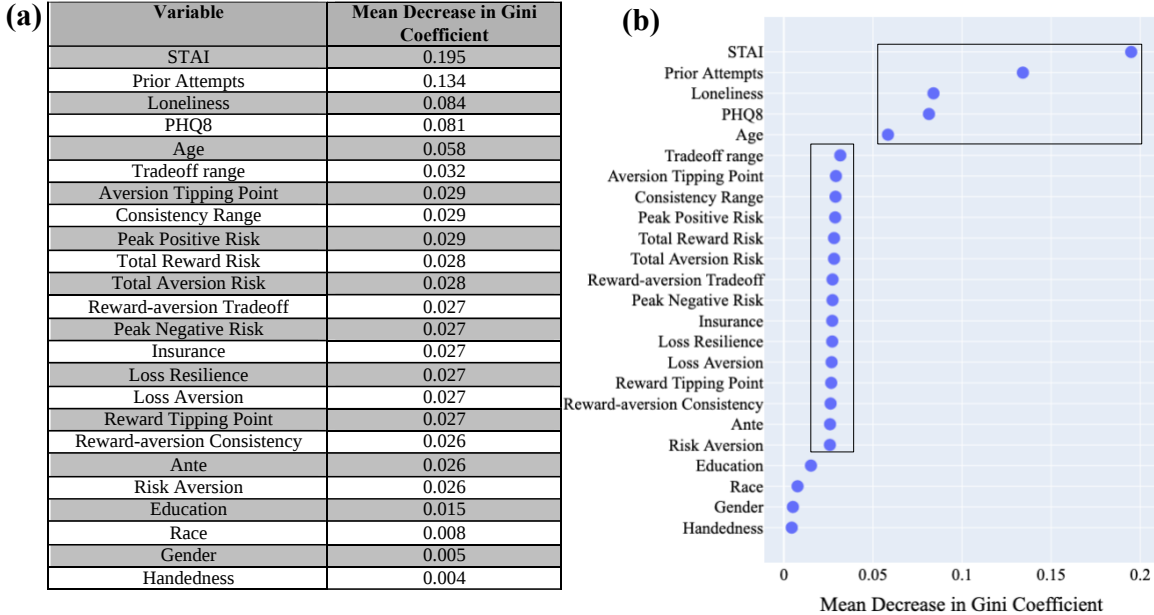
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S21: Gini Importance, Planning for Safety (t=1) with Prior Attempts



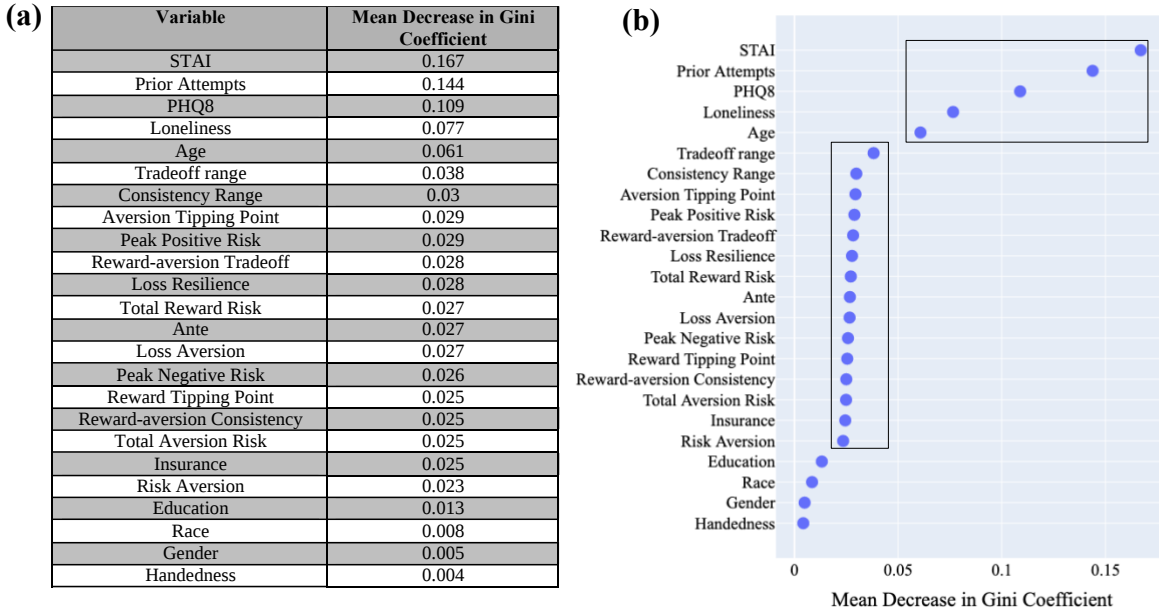
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm and self-reported loneliness metrics. Figures S15, S17, S19, and S21 represent thresholds of 1, whereas Figures S16, S18, S20 represent thresholds of 2 for the STB variable being predicted. Please note that one of the figures for threshold 2 is shown as Fig. 5. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S22: Gini Importance, Passive Suicidal Ideation (t=1) with all variables



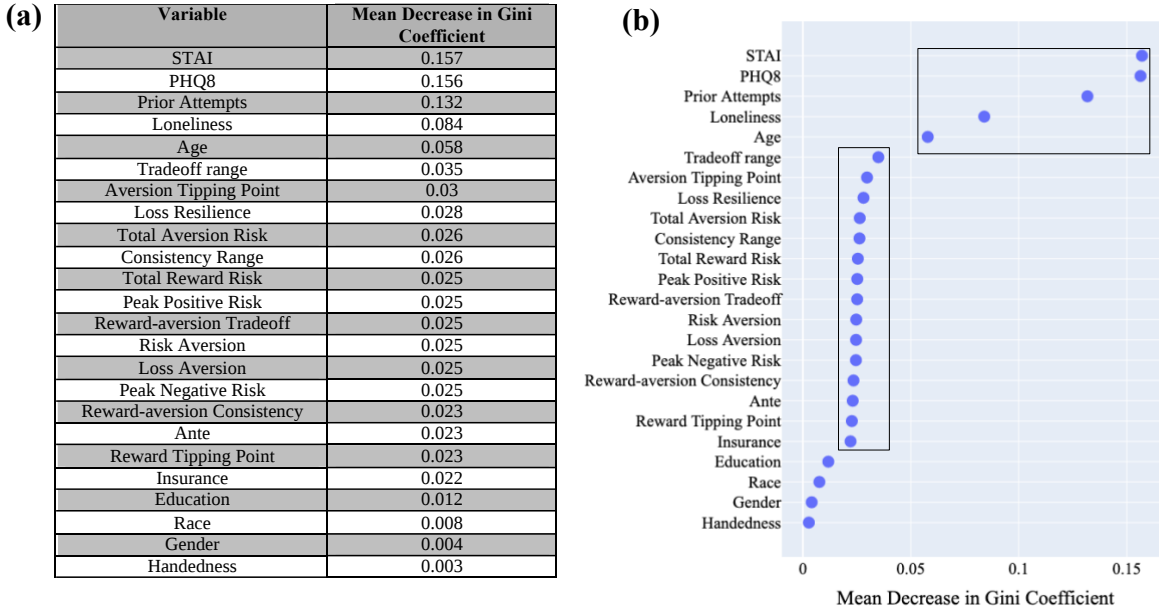
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S23: Gini Importance, Passive Suicidal Ideation (t=2) with all variables



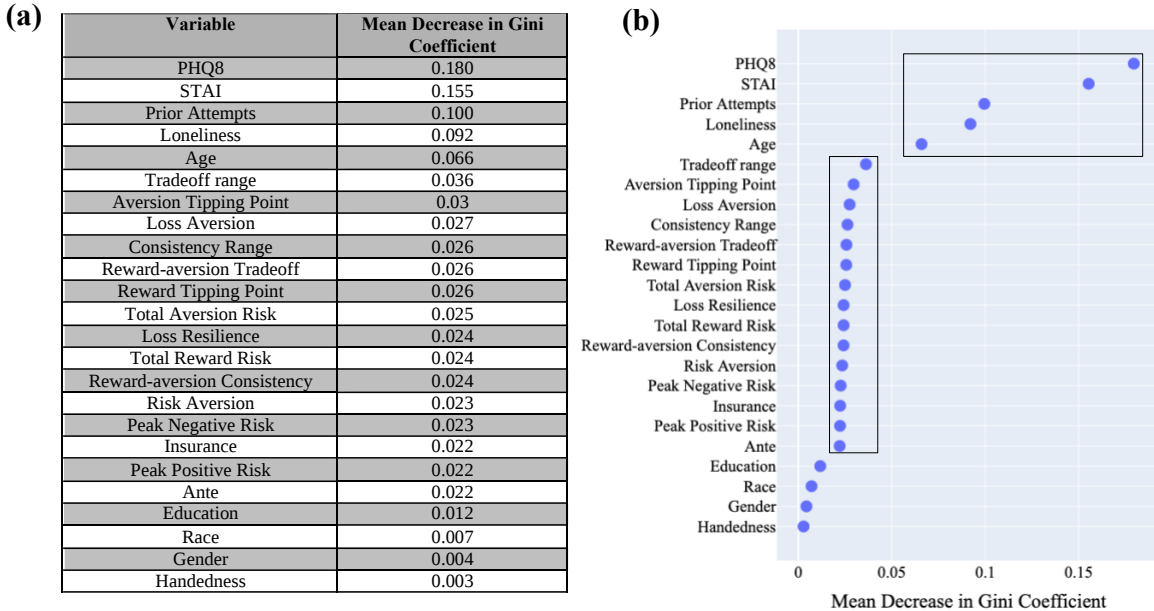
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S24: Gini Importance, Active Suicidal Ideation (t=1) with all variables



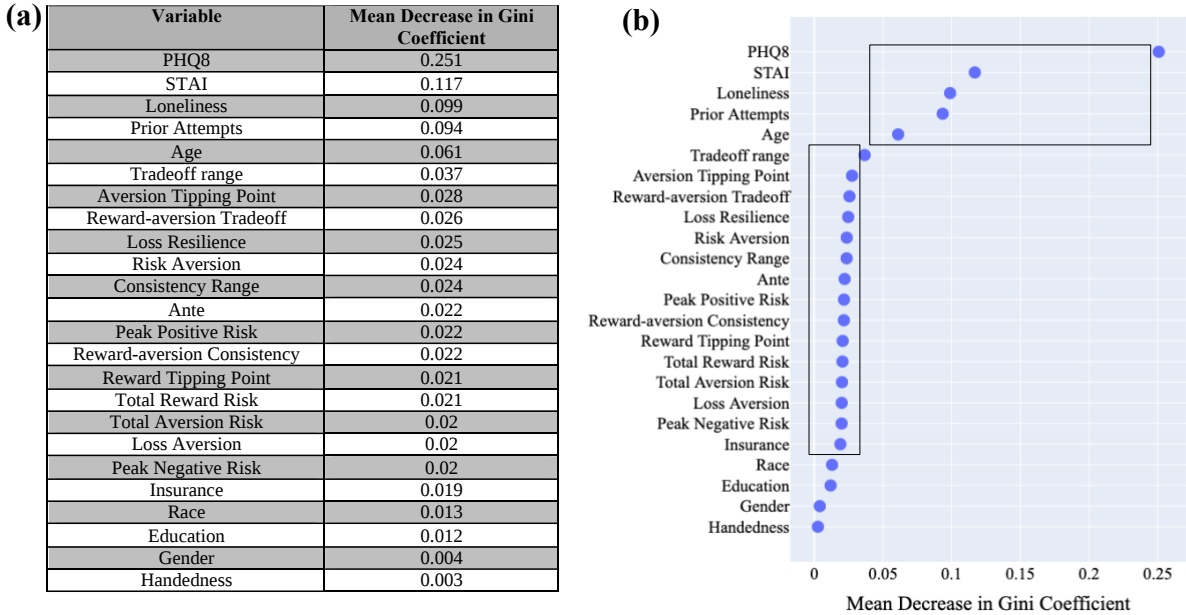
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S25: Gini Importance, Active Suicidal Ideation (t=2) with all variables



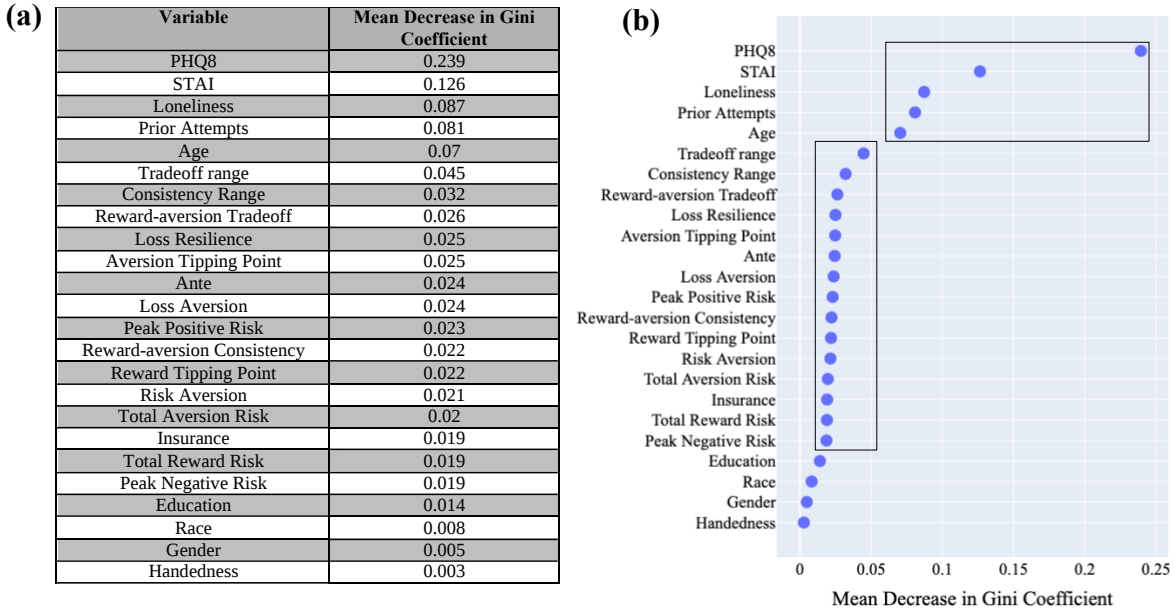
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S26: Gini Importance, Planning for Suicide (t=1) with all variables



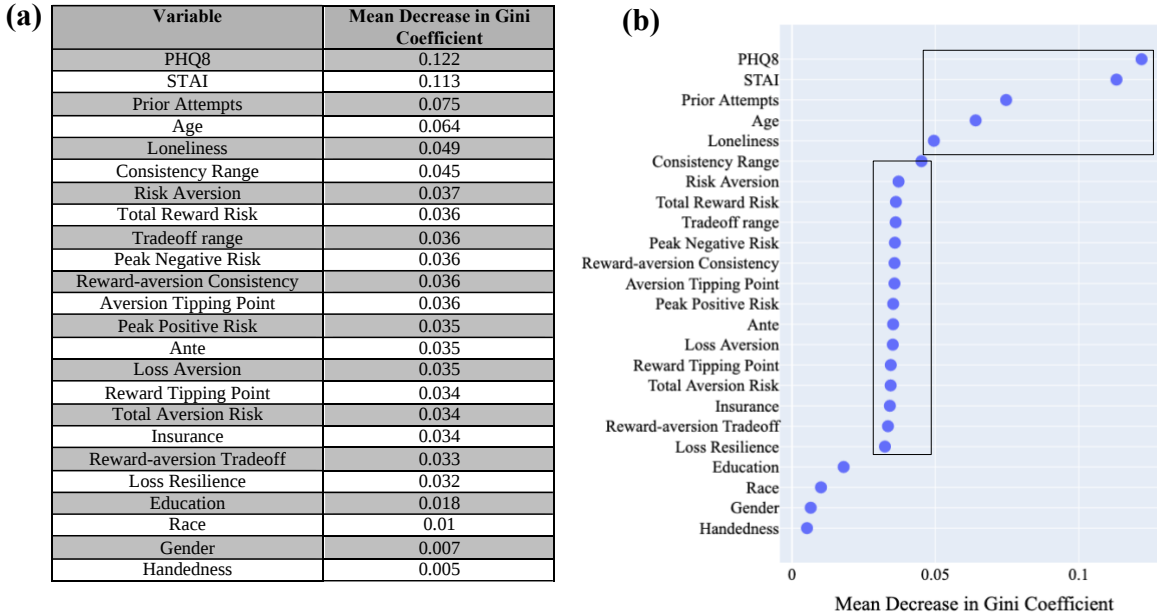
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S27: Gini Importance, Planning for Suicide (t=2) with all variables



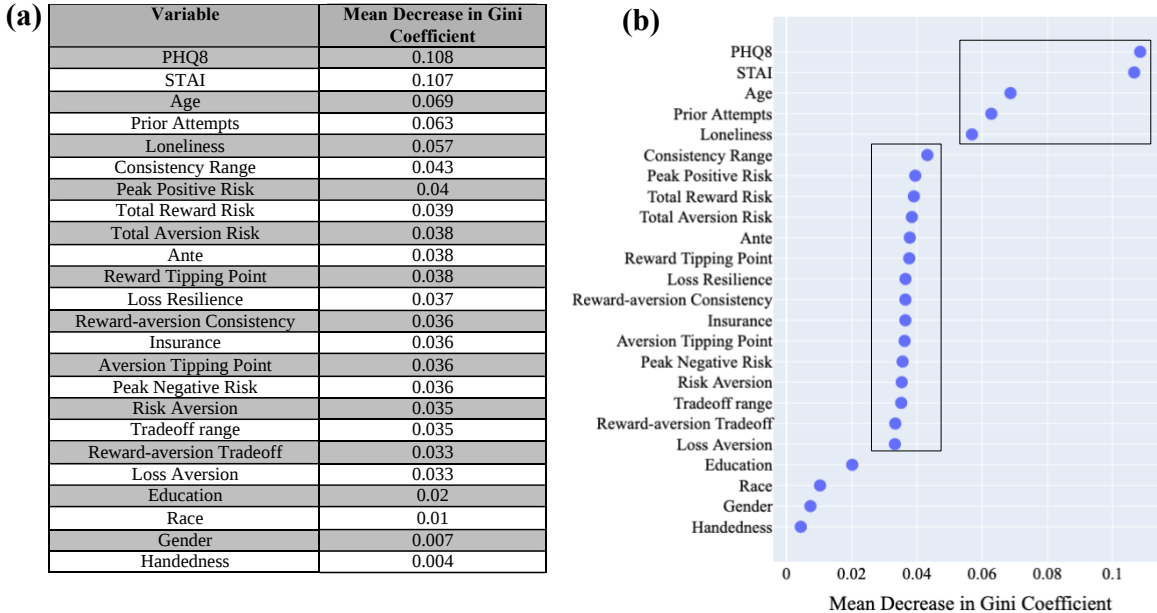
Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S28: Gini Importance, Planning for Safety (t=1) with all variables



Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

Figure S29: Gini Importance, Planning for Safety (t=2) with all variables



Gini importance values used to predict the 4 STB metrics using a BRF with 15 judgment variables, 5 demographic indices, along with prior attempts at self-harm, PHQ8, STAI, and self-reported loneliness metrics. Figures S22, S24, S26, and S28 represent thresholds of 1, whereas Figures S23, S25, S27, S29 represent thresholds of 2 for the STB variable being predicted. The numerical values displayed on the left in (a) for each figure are the mean decrease in Gini coefficient from removing each variable. The larger the mean decrease in Gini coefficient, the greater importance the feature places in the classifier. A visual display of the Gini importance values is shown in (b). Note that two boxes are shown; the highest box highlights the top variables in terms of feature importance; the middle boxes represent the Gini values of the behavioral variables.

References

1. Azcona, E. A. *et al.* Discrete, recurrent, and scalable patterns in human judgement underlie affective picture ratings. (2022).
2. Stefanopoulos, L. *et al.* Predicting depression history from a short reward/aversion task with behavioral economic features. *ICBHI 2022 Proceedings* (In press; see also upload to figshare as: <https://figshare.com/s/7ca7dd257bb1689086d0>)
3. Woodward, S. F. *et al.* Anxiety, Post–COVID-19 Syndrome-Related Depression, and Suicidal Thoughts and Behaviors in COVID-19 Survivors: Cross-sectional Study. *JMIR Form Res* **6**, e36656 (2022).
4. Bari, S. *et al.* The Prevalence of Psychotic Symptoms, Violent Ideation, and Disruptive Behavior in a Population With SARS-CoV-2 Infection: Preliminary Study. *JMIR Form Res* **6**, e36444 (2022).
5. Kim, B. W. *et al.* Recurrent, Robust and Scalable Patterns Underlie Human Approach and Avoidance. *PLoS One* **5**, e10613 (2010).
6. Viswanathan, V. *et al.* A Quantitative Relationship between Signal Detection in Attention and Approach/Avoidance Behavior. *Front Psychol* **8**, (2017).
7. Viswanathan, V. *et al.* Age-related striatal BOLD changes without changes in behavioral loss aversion. *Front Hum Neurosci* **9**, (2015).
8. Livengood, S. L. *et al.* Keypress-Based Musical Preference Is Both Individual and Lawful. *Front Neurosci* **11**, (2017).
9. Kahneman, D. & Tversky, A. Prospect Theory: An analysis of decision under risk. *Econometrica* **47**, 263–292 (1970).
10. Wang, S., Krajchich, I., Adolphs, R. & Tsuchiya, N. The Role of Risk Aversion in Non-Conscious Decision Making. *Front Psychol* **3**, (2012).
11. Markowitz, H. M. Portfolio selection. *J Finance* **7**, 77–91 (1952).
12. Hand, D. J., McLachlan, G. J. & Basford, K. E. Mixture Models: Inference and Applications to Clustering. *Appl Stat* **38**, 384 (1989).
13. Pedregosa *et al.* Scikit-learn: Machine Learning in Python. *Journal of Machine Learning Research* (2011).
14. Baron, R. M. & Kenny, D. A. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* **51**, 1173–1182 (1986).
15. Vike, N. L. *et al.* The Relationship Between a History of High-risk and Destructive Behaviors and COVID-19 Infection: Preliminary Study. *JMIR Form Res* **7**, e40821 (2023).