Supplemental Tables for Rosellini, et al. “Pre-deployment predictors of psychiatric disorders and interpersonal violence during combat deployment.”

Supplemental Table 1. Overview of the 273 independent variables used to predict the outcomes, organized by broad conceptual category

I. Self-report (158 predictors)

Socio-Demographic (8 variables)	Standard survey questions were used to define the socio-demographic variables. Dichotomous variables included: sex, college educational attainment, immigrant status, having any biological children, carrying a gun, and carrying any weapon. Categorical variables included race/ethnicity and marital status.
Mental Disorders (36 variables)	All mental disorder variables were dichotomous except for one categorical variable. Most DSM-IV mental disorder constructs were assessed using the self-report computerized version of the Composite International Diagnostic Interview screening scales (CIDI-SC; Kessler & Ustün, 2014), including: major depressive episode, bipolar I-II or subthreshold bipolar disorder, generalized anxiety disorder, panic disorder, intermittent explosive disorder, conduct disorder, oppositional defiant disorder, substance use disorder, and attention-deficit/hyperactivity disorder (ADHD in the past 6 months, not lifetime). Posttraumatic stress disorder (PTSD) was assessed using a screening version of the PTSD Checklist (Weathers, Litz, Herman, Huska, & Keane, 1993). In addition to dichotomous predictors representing 30-day and lifetime disorders (defined via CIDI diagnostic algorithms), questions assessing symptom severity (using a 1-5 response scale) that were asked to all soldiers (i.e., before skip outs) were subjected to exploratory factor analysis. Results suggested to create several scales, all of which were standardized (e.g., scales to reflect 30-day MDE/GAD symptoms; 30-day general health symptoms [concentration, sleep, memory problems]; general frequency of anger/irritability), The majority of the aforementioned disorders were assessed over the respondent's lifetime as well as in the 30 days prior to completing the survey. Lifetime social phobia, agoraphobia, specific phobia, and obsessive-compulsive disorder were assessed using single-item screeners adapted from the Family History Screen (disorders were considered present if persistent for at least one full year; Weissman et al., 2000). Lifetime insomnia was assessed using an adapted version of the American Insomnia Survey (Kessler et al., 2010). A categorical variable was defined to represent the total number of lifetime disorders (exactly 1, exactly 2, 3+ disorders). Lifetime nicotine dependence was assessed using questions adapted from the CIDI (Kessler & Ustün, 2014). Nicotine dependence was considered present if the respondent endorsed three or more dependence symptoms. Pre-deployment head injuries were assessed using the same questions used to define the during-deployment head injury outcome. These questions were developed by Army STARRS investigators. Head injury was considered present if the respondent reported six or more total lifetime head injuries. Current treatment or counseling at the time of the survey (for psychological problems) with a mental health professional or any other type of provider (e.g., medical doctor, spiritual leader) was assessed using questions adapted from the Land Combat Study (Hoge et al., 2004). A dichotomous variable was created to represent current treatment with any type of provider.
Stressors (64 variables)	The stress variables, all but two of which were dichotomous, were operationalized using questions that assessed 12-month and lifetime events occurring both within and outside of the family, lifetime non-combat traumatic events, adversity experienced during childhood, and prior unit-level and deployment-related events. Questions assessing 16 stressful events in the 12 months prior to the survey within social (e.g., divorce, death of a loved one) and non-social domains (e.g., car accident, police trouble) were adapted from the Life Events Questionnaire and DoD Survey of Health Related Behaviors (Bray et al., 2009; Brugha & Cragg, 1990). We defined dichotomous variables for each stressful event as well as for any stressful events in the 12 months prior to the survey. Severe overall stress in the past 12 months was assessed using a question adapted from the CIDI (Kessler & Ustün, 2014). Questions assessing the number of times each of 16 non-combat traumatic events (e.g., physical assault, sexual assault, suicide of close friend) occurred over the soldiers' lifetime were adapted from the CIDI. Dichotomous variables were defined to represent whether each of the non-combat traumatic events had occurred. A dichotomous variable representing 7+ total lifetime traumas (i.e., the 50th percentile for total number of traumas) was also created. Questions asking about the occurrence-frequency of childhood adversities were adapted from the Family History Screen (Weissman et al., 2000), CIDI (Kessler & Ustün, 2014), Adverse Childhood Experiences Survey (Felitti et al., 1998), and Childhood Trauma Questionnaire (Bernstein, Ahluvalia, Pogge, & Handelsman, 1997) to assess parent-family psychopathology (e.g., internalizing, externalizing disorders), maladaptive family functioning (e.g., sexual, physical, or emotional abuse), and other family adversities (e.g., parent death or suicide). We operationalized dichotomous variables from these questions to define any occurrence of each type of childhood adversity. Questions asking about 15 prior deployment stressful experiences (e.g., wounded by enemy, responsible for death of ally) were adapted from the Deployment Risk and Resilience Inventory (King, King, Vogt, Knight,

	& Samper, 2006). A dichotomous variable representing being in the top 20% of the distribution of total number of prior deployment stressors was also created. The ability to cope with stress after returning from deployment was assessed using questions developed by STARRS investigators and defined by a dichotomous variable (at least "somewhat better" coping abilities post-deployment). The two categorical stressor variable were: (a) a categorical predictor reflecting severity of unit-level bullying over the past year (None; Mild; Moderate; Severe; Very Severe) and, (b) a predictor representing soldiers in the top 20%, 21-80%, and 81-100% of the distribution for unit-level stressful experiences (e.g., feeling that one could not rely on other unit members, believing that unit leaders displayed favoritism) based on nine questions developed for Army STARRS.
Personality (36 variables)	The survey included 91 questions adapted from previously validated self-report personality questionnaires, intended to assess a total of 28 constructs (Akiskal et al., 2005; Bartholomew & Horowitz, 1991; Chapman, Chapman, & Raulin, 1976; First, Gibbon, Spitzer, & Williams, 1997; Frost, Marten, Lahart, & Rosenblate, 1990; Gosling, Renfrow, & Swann, 2003; Hazan & Shaver, 1987; Kugler & Jones, 1992; Mullins-Sweatt, Jamerson, Samuel, Olson, & Widiger, 2006; Nock, Wedig, Holmberg, & Hooley, 2008; Reynolds, 1982; Scheier, Carver, & Bridges, 1994; Van Orden, Witte, Gordon, Bender, & Joiner, 2008; Wagstaff & Rowledge, 1995; Whiteside & Lynam, 2001). Most (87) of the items were used to develop 24 rationally-derived scales confirmed using exploratory and confirmatory factor analysis (detailed results available by request): bipolar/affective lability, borderline personality traits, trait anger/irritability, negative urgency (impulsivity), emotional reactivity, neuroticism, antisocial personality traits, moral standards, premedication (a facet of impulsivity), agreeableness, dispositional optimism, perseverance (impulsivity), sensation seeking (impulsivity), acquired suicide capability, openness to experiences, extraversion, social anhedonia, stoicism, trait hopelessness, perceived burdensomeness, perceived mattering, conscientiousness, resiliency, and social desirability. The remaining four items were used to define dichotomous variables representing four attachment styles (secure; dismissive; fearful; preoccupied) as well as two dichotomous variables representing the other possible attachment styles (multiple attachments; no attachment style).We also used exploratory factor analysis to identify five empirically-interpretable higher-order factors based on the rationale scales: negative affectivity, thoughtfulness, fearlessness, social/emotional independence, and negative cognitions. For most personality traits, categorical variables were created to represent whether respondents were in the top 20% or top 80% of the distribution of scores for the scale of interest, though dichotomous variables representing whether respondents were in the top 15-25% of the distribution were used for scales composed of three or fewer questions (e.g., bipolar/affective lability).
Social Networks (6 variables)	Questions were developed by STARRS investigators to assess the size of affiliative network (e.g., number of people who the soldier had to spend time with, number of people the soldier felt close to, number of people the soldier felt cared for them, number of family or friends they could rely on during times of need). Dichotomous variables were defined to represent if a respondent was in the bottom 15-25% of the distribution for size of these different types of social support networks (i.e., smaller networks). Family network during childhood was assessed using questions from the Adverse Childhood Experiences Survey (Bernstein, Ahluvalia, Pogge, & Handelsman, 1997), and defined by a dichotomous variable representing if the soldier was in the bottom 20% of the distribution for positive family network (i.e., poor network).
Self-harm (8 variables)	Questions assessing lifetime and 30-day history of suicidal and self-harm behaviors were adapted from the Columbia-Suicide Severity Rating Scale (Posner et al., 2008). Dichotomous variables were created to operationalize lifetime presence of suicidal ideation, plans, intent, and attempts, self-harm behaviors, and ever doing "dangerous things" because of suicidal ideation. Dichotomous variables were also created to represent suicidal ideation and plans in the 30 days prior to the survey.
II. Administrative (115 variables)	
Army Career (13 variables)	We examined several Army career variables that were defined from personnel tracking administrative databases. Most of these variables were coded categorically: age of enlistment (e.g., <20, 20-21, 22-26, etc.), age at time of current deployment (<20, 20-22, 23+), number of previous deployments (0, 1, 2), rank (e.g., E1-E4, E6-E7, etc.), demotion in the past 12 months (dichotomous), Armed Forces Qualification Test (AFQT) scores at enlistment (0-32%, 33-75%,76%+), three military occupational specialty (MOS) variables (direct combat arms, indirect combat arms, and combat support),and positive drug test in the past 12 months (dichotomous). In addition, we defined five categorical variables based on soldier's scores on their most recent Global Assessment Tool assessment (GAT; Peterson, Park, & Castro, 2011): family fitness, emotional fitness, social fitness, spiritual fitness, and overall score.

Prior Crime (6 variables)	Dichotomous variables were created from Army criminal records to define four measures of crime perpetration in the past 12 months (major physical violence [e.g., aggravated assault], minor violence [e.g., simple assault], major sexual violence [e.g., rape], and *any* type of crime perpetration), as well as two measures of past 12-month victimization (major physical violence and minor violence).
Treatment (96 variables)	Numerous dichotomous variables were created from health record administrative databases representing the presence-treatment (i.e., pharmacotherapy, outpatient treatment, and inpatient treatment) of mental and physical disorders. National Drug Code (NDC) psychotropic medication codes were collapsed into 15 categories (e.g., antianxiety, antidepressant, antipsychotic) and 25 sub-categories (e.g., SSRI, SNRI, TCA) using the First Databank (FDB) Enhanced Therapeutic Classification System™ (www.fdbhealth.com). These categorizations were used to create 42 dichotomous variables representing different prescriptions received in the past 12 months (e.g., analgesics, benzodiazepine, MAOI, SSRI, SNRI). We also distinguished 26 categories of mental disorder diagnoses largely focused on aggregated ICD-9-CM codes (e.g., ADHD/learning disorders [ICD-9-CM 314.0-315.9]), eight additional categories of behavioral stressors (e.g., marital problems, other stressors/adversities, suicidal ideation and self-damaging behavior), and a summary measure of any of these 34 diagnoses. These variables included dichotomous yes/no variables for any past year inpatient admission or outpatient visit diagnoses. Separate summary variables were also created to reflect *any* past 3-month and past 12-month mental health treatment. As many soldiers had healthcare visits for physical-mental disorder combinations, variables were also included on comorbid physical disorders. Physical disorders were classified into a single physical category that included the 17 major ICD-9-CM categories (e.g., diseases of the circulatory system [ICD-9-CM 520-579]). However, we also distinguished between four particular physical disorders of interest: traumatic brain injury (TBI); other severely traumatic injuries (amputations, burns, sensory losses, paralysis); pain diagnoses; and sleep diagnoses (distinguishing dysomnias and parasomnias).

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Supplemental Table 2. Descriptions of the classifiers used in the super learner

Algorithm	R package	Description
I. Regularization		
Elastic net MPP=0.1 MPP=0.3 MPP=0.5 MPP=0.7 MPP=0.9	*glmnet* (Friedman, Hastie, & Tibshirani, 2016)	• Elastic net is a regularization method that minimizes the problem of overlap among predictors by explicitly penalizing over-fitting with a composite penalty $\lambda\{\text{MPP} \times P_{lasso} + (1-\text{MPP}) \times P_{ridge}\}$, where MPP is a mixing parameter penalty with values between 0 and 1 that controls relative weighting between two types of penalties, the lasso penalty (P_{lasso}) and the ridge penalty (P_{ridge}). The parameter λ controls the total amount of penalization. The ridge penalty handles multicollinearity by shrinking all coefficients smoothly towards 0 but retains all variables in the model. The lasso penalty allows simultaneous coefficient shrinkage and variable selection, tending to select at most one predictor in each strongly correlated set, but at the expense of giving unstable estimates in the presence of high multicollinearity. The elastic net approach of combining the ridge and lasso penalties has the advantage of yielding more stable and accurate estimates than either ridge or lasso alone while maintaining model parsimony.
II. Spline		• Adaptive spline regression flexibly captures interactions and linear and non-linear associations
Adaptive splines	*earth* (Milborrow, Hastie, Tibshirani, Miller, & Lumley, 2016)	• Linear segments (splines) of varying slopes are connected and smoothed to create piece-wise curves (basis functions) • Final fit is built using a stepwise procedure that selects the optimal combination of basis functions
Adaptive polynomial splines	*polspline* (Kooperberg, 2015)	• Earth and polymars are generally similar, but differ in the order which basis functions (e.g., linear versus nonlinear) are added to build the final model
III. Decision tree		• Decision tree methods capture interactions and non-linear associations
Random forest	*randomForest* (Liaw & Wiener, 2002)	• Independent variables are partitioned (based on values) and stacked to build decision trees and ensemble an aggregate "forest" • Random forests builds numerous trees in bootstrapped samples and generates an aggregate tree by averaging across trees (reducing overfit)
Bayesian additive regression trees	*BayesTree* (Chipman & McCulloch, 2016)	• Bayesian trees are based on an underlying probability model (priors) for the structure and likelihood for data in terminal nodes; aggregate tree is generated by averaging across tree posteriors (reducing overfit)
IV. Support vector machines		• Support vector machines treats each independent variables as dimensions in high dimensional space and attempts to identify the best hyperplane to separate the sample into classes (e.g., cases and non-cases)
Linear kernel	*e1401* (Meyer et al., 2015)	• Goal is to find the hyperplane with the maximum margin between the two closest points in space
V. Generalized Boosted Regression Models		
Adaptive boosting	*gbm* (Ridgeway, 2017)	• Adaptive boosting is a meta-algorithm that iteratively fits decision-trees using weights to adjust for cases classified incorrectly in the prior iteration • This allows subsequent iterations to focus on predicting more difficult cases

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Supplemental Table 3. Tetrachoric correlation matrix for all 10 observed during-deployment outcomes

	MDE (3+ months)	GAD (3+ months)	Anger (6+ attacks)	Suicidality	Head injury
Mental disorders[a]					
MDE (3+ months)	--				
GAD (3+ months)	0.81	--			
Other symptoms[a]					
Anger attacks (6+)	0.39	0.41	--		
Suicidality	0.58	0.44	0.27	--	
Head injury	0.23	0.27	0.26	0.17	--

	Bullied or hazed by unit	Got into a fight
Violence[b]		
Bullied or hazed by unit	--	
Got into a fight	0.45	--

Abbreviations: MDE, major depressive episode; GAD, generalized anxiety disorder.
[a]Mental disorders and other symptoms occurring during deployment were assessed at T2 and T3. A total of 7,081 soldiers completed T0, T2 and/or T3.
[b]Violence occurring during deployment was assessed at T1. A total of 7,048 soldiers completed T0 and T1.

Supplemental Table 4. Relative contributions of each classifier/algorithm in the super learner ensemble, by outcome

Classifier	Predictor Set	MDE (3+ months)	GAD (3+ months)	Anger attacks (6+)	Suicidality	Head injury	Bullied or hazed	Got into a fight
Logistic regression	Correlation	-	0.01	-	-	-	-	-
	Lasso	-	-	-	-	-	-	-
	All	-	-	-	-	-	-	-
Elastic net (MPP= 0)	Correlation	0.24	0.20	-	0.03	0.06		0.54
	Lasso	-	-	-	-	-	-	-
	All	-	-	-	-	-	-	-
Elastic net (MPP=0.1)	Correlation	-	-	-	-	-	-	-
	Lasso	-	-	-	-	-	-	-
	All	-	-	0.32	-	0.09	0.18	-
Elastic net (MPP=0.3)	Correlation	-	-	-	-	-	-	-
	Lasso	-	-	-	-	-	-	-
	All	-	-	-	-	-	-	-
Elastic net (MPP=0.5)	Correlation	0.11	0.17	-	-	-	-	-
	Lasso	-	-	-	-	-	-	-
	All	-	-	-	-	-	-	-
Elastic net (MPP=0.7)	Correlation	-	-	-	-	-	-	-
	Lasso	-	-	-	-	-	-	-
	All	-	-	-	0.11	-	-	-
Elastic net (MPP=0.9)	Correlation	-	-	-	-	-	-	-
	Lasso	-	-	-	-	-	-	-
	All	-	-	-	-	-		-
Adaptive splines	Correlation	0.08	0.02	0.04	-	0.06	-	-
	Lasso	0.03	-	0.03	-	-	0.11	-
	All	0.02	0.02	0.03	-	0.09	-	-
Adaptive polynomial splines	Correlation	-	-	0.04	-	0.05	-	0.02
	Lasso	0.18	-	0.08	0.03	-	-	-
	All	-	0.01	-	0.12	-	-	-
Random Forest[1]	Correlation	-	-	-	-	-	-	-
	Lasso	-	-	-	0.47	-	-	-
	All	-	-	-	0.06	-	-	-
Bayesian additive regression trees	Correlation	-	0.16	0.28	-	-	0.23	0.15
	Lasso	0.07	-	-	-	-	-	-
	All	0.16	0.10	-	0.08	0.05	0.31	0.28
Support vector machines[2]	Correlation	-	-	-	0.10	-	-	-
	Lasso	-	-	-	-	-	0.06	-

	All	-	-	-	-	-	-	-
Adaptive boosting	Correlation	-	0.31	-	-	0.55	0.10	-
	Lasso	-	-	-	-	-	-	-
	All	0.11	-	0.19	-	-	-	-
Neural nets	Correlation	-	-	-	-	-	-	-
	Lasso	-	-	-	-	0.02	-	-
	All	-	-	-	-	0.03	-	-

Abbreviations: MDE, major depressive episode; GAD, generalized anxiety disorder, MPP, mixing parameter penalty (i.e., alpha).
[1]The random forest model was tuned to have a maximum of eight terminal nodes, to reduce risk of model overfit.
[2]Support vector machines was implemented using a linear kernel.