


Prior Mental Disorders and Lifetime Suicidal Behaviors Among US Army Soldiers in the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)

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We report on associations of retrospectively reported temporally prior mental disorders and Army career characteristics with subsequent first onset of suicidal behaviors in a large, representative sample of US Army soldiers who participated in the Consolidated All-Army Survey of the Army Study to Assess Risk and Resilience in Servicemembers ($N = 29,982$). Results reveal that among men and women, all self-reported lifetime disorders measured (some assessed with screening scales) are associated with subsequent onset of suicide ideation. Among men, three disorders characterized by agitation and impulsiveness (intermittent explosive disorder, panic disorder, and substance disorders) predict the transition from suicide ideation to attempt. For both men and women, being in the Regular Army (vs. National Guard or Army Reserve) predicts

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suicide attempts in the total sample. For men, a history of deployment and junior rank are predictors of suicide attempts after adjusting for preenlistment disorders but not accounting for pre- and postenlistment disorders, suggesting that postenlistment disorders account for some of the increased suicide risk among these career characteristics. Overall, these results highlight associations between mental disorders and suicidal behaviors, but underscore limitations predicting which people with ideation attempt suicide.

Over the past decade, there has been a marked increase in the rate of suicide in the US Army (Kuehn, 2009). A number of studies have examined potential risk factors for suicide among Army soldiers using electronic records maintained by the Army (Bachynski et al., 2012; Black, Gallaway, Bell, & Ritchie, 2011; Bush et al., 2013; Hyman, Ireland, Frost, & Cottrell, 2012; Logan, Skopp, Karch, Reger, & Gahm, 2012). In an effort to identify a broader array of potential risk and protective factors for suicide and suicidal behavior, the Army initiated a large-scale, multicomponent epidemiological and neurobiological study known as the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; <http://starrs-ls.org>). One of the major components of Army STARRS is the All-Army Survey (AAS), a large, representative survey of active duty Army soldiers. A previous paper using early replicates of the AAS reported on the prevalence of non-lethal suicidal behaviors (i.e., suicide ideation, plans, and attempts) among Army soldiers and on demographic, Army career, and mental disorders as risk factors for these outcomes (Nock et al., 2014). However, those results were limited by the use of a relatively small sample size ($N = 5,428$) that excluded deployed soldiers and Army National Guard and Army Reserve (G/R) troops. To address these limitations, we combined the original AAS with two other Army STARRS surveys that included deployed soldiers and those in the G/R, which we refer to as the Consolidated AAS ($N = 29,982$).

In an initial paper describing this sample, we reported on the pre- and postenlistment prevalence of suicidal behaviors as well as their associations with Army career

characteristics (e.g., Regular Army versus G/R, rank, occupation; Millner et al., 2017). Here, we expand on that work by examining the role of both pre- and postenlistment mental disorders in predicting the subsequent onset of suicidal behaviors as of the time of the AAS survey. Consistent with the earlier report, we examine men and women separately due to the marked sex differences in nonlethal suicidal behavior rates (Nock et al., 2014; Ursano, Heeringa, et al., 2015; Ursano, Kessler, Stein et al., 2015). In addition, we examine which predictors of attempts also predict suicide ideation and the transition from suicide ideation to suicide attempts.

METHOD

Sample

Data are from the Consolidated AAS, a series of three Army STARRS surveys merged together. This report uses data from self-assessment questionnaires (SAQs) completed by active duty soldiers excluding servicemembers in basic training (BT), who, instead, were included in the New Soldier Survey, a separate component of Army STARRS (Ursano et al., 2014). The largest of the three surveys included in the Consolidated AAS was the AAS, a de-identified, cross-sectional survey administered quarterly in 2011–2012 and among G/R units in 2013. The AAS was completed by active duty soldiers, excluding soldiers in BT or deployed to a combat theater, drawn from probability samples, stratified by Army Command location, of units or subunits selected with probabilities proportional to authorized unit strength exclusive of units with less than

30 soldiers, which make up less than 2% of Army personnel. Except for those with conflicting duty assignments (20.2%), all personnel in selected units attended an informed consent session describing study purpose, confidentiality, and voluntary participation. They then were requested to provide written informed consent for a group administered SAQ to link SAQ responses to their administrative records and to provide permission to be recontacted for future data collections. Respondents were given 90 minutes to complete the survey and most incomplete surveys were due to units arriving late or leaving the session early, although some respondents did not finish in the allotted time. Forms containing respondents' identifying information were kept in a separate secure file. See Table 1 for sample size and percentages of those who gave consent, completed the survey, and provided linkage as well as response rate and completion-successful-linkage cooperation rate.

The second of the three merged surveys making up the Consolidated AAS was the AAS administered to a special, supplemental sample of soldiers deployed in Afghanistan because the main AAS sample did not contain soldiers currently deployed to a combat zone. Constraints on our ability to collect data in Afghanistan caused us to administer surveys to soldiers who were in Kuwait waiting to be processed for transit to and from mid-deployment leave. Aside from having to use an alternative location for survey administration, recruitment, consent, and data collection procedures were the same as those for the main AAS (Table 1).

In addition to data from the main AAS and Kuwait AAS samples, the Consolidated AAS also contains data from a prospective pre/postdeployment survey (PPDS) of personnel in three Brigade Combat Teams. The PPDS was administered first just before soldiers deployed to Afghanistan and then again three times after returning from deployment. The Consolidated AAS only contains the baseline PPDS data, which is a valuable addition because soon-to-deploy units were

underrepresented in the main AAS sample due to logistical complications. The recruitment, consent, and data collection procedures for the PPDS were identical to those in the main AAS (Table 1).

All procedures regarding recruitment, informed consent, and data protection for the surveys were approved by the Human Subjects Committees of the Uniformed Services University of the Health Sciences for the Henry M. Jackson Foundation (the primary grantee), the Institute for Social Research at the University of Michigan (the organization collecting the data), and all other collaborating organizations. SAQ responses from soldiers who provided consent for administrative data linkage were doubly weighted before combining to adjust for inconsistencies between the sample and population. The first weight (W1) adjusted for differences in survey responses between the respondents who did and did not provide record linkage. The second weight (W2) adjusted for differences in multivariate administrative record profiles between weighted (W1) survey completers that provided record linkage and the target population. Specifically, this latter weight adjusted the sample to be representative of all active duty soldiers during the years 2011–2012 on the cross-classification of sociodemographics (age, sex, race–ethnicity, education, marital status), command (e.g., Forces Command, Training and Doctrine Command, Reserve Command [Army Reserve, Army National Guard], Component Commands), occupation (Combat Arms, Combat Support, Combat Service Support), rank (E1–E4, E5–E9, W1–W4, O1–O10), and deployment status history (never deployed, currently deployed [the Kuwait supplemental sample], previously deployed). The doubly weighted (W1xW2) data were combined to create the Consolidated AAS. A more detailed description of AAS weighting is presented elsewhere (Kessler, Heeringa, et al., 2013). Finally, all participants that had unknown survey dates ($n = 25$) were dropped from the final analytic sample.

TABLE 1
Percentage of Soldiers that Provided Informed Consent, Completed the Survey, and Provided Record Linkage as Well as Response Rate and Completion-Successful-Linkage Cooperation Rates Among the Surveys Making Up the Consolidated All-Army Survey

Survey name	Sample characteristics	Attendees that provided consent (%)	Consenters that completed the survey (%)	Completers that provided linkage (%)	Sample size	Completion-successful-linkage cooperation rate (%) ^a	Response Rate (%) ^a
All-Army Survey (AAS)	Active duty (excluding those is basic training or deployed)	95.0	97.3	63.1	17,462	58.3	46.5
Supplemental AAS	Soldiers deployed in Afghanistan	80.9	86.5	55.6	3,987	38.9	N/A ^b
Prospective pre-postdeployment survey (PPDS)	Just before soldiers deployed to Afghanistan	98.7	99.2	90.9	8,558	89.0	86.1

^aBased on the American Association of Public Opinion Research COOP1 and RRI calculation methods (American Association for Public Opinion Research, 2009).

^bResponse rate could not be calculated because the denominator for this rate (the number of soldiers invited to the sessions) was not recorded.

Measures

Suicidal Behaviors. Suicidal behaviors were assessed using a modified version of the Columbia Suicidal Severity Rating Scale (C-SSRS; Posner et al., 2011) that assessed lifetime occurrence of suicide ideation (*Did you ever in your life have thoughts of killing yourself or Did you ever wish you were dead or would go to sleep and never wake up?*) and, among respondents who reported lifetime ideation, suicide plans (*Did you ever have any intention to act [on these thoughts/on that wish]?* and, if so, *Did you ever think about how you might kill yourself [e.g., taking pills, shooting yourself] or work out a plan of how to kill yourself?*) and attempts (*Did you ever make a suicide attempt [i.e., purposefully hurt yourself with at least some intention to die]?*). Age-of-onset (AOO) was also assessed for those who endorsed suicide ideation, plans, or attempts. In the current analysis, we focus on lifetime attempts as the primary outcome of interest and decompose this outcome into four intermediate outcomes: lifetime ideation, lifetime plans among ideators, lifetime attempts among ideators with a plan, and lifetime attempts among ideators without a plan.

Mental Disorders. Lifetime prevalence of eight common lifetime mental disorders was estimated in the surveys using diagnostic screening scales. We screened for five internalizing disorders (major depressive episode [MDE], bipolar disorder [BPD], panic disorder [PD], generalized anxiety disorder [GAD], posttraumatic stress disorder [PTSD]) and three externalizing disorders (attention-deficit/hyperactivity disorder [ADHD], intermittent explosive disorder [IED], and substance use disorders [SUD] including alcohol and drug abuse and dependence). The BPD assessment included BP-I, BP-II, and subthreshold BPD (hypomania without history of major depression or subthreshold hypomania; Merikangas et al., 2011). To estimate prevalence of lifetime BPD, PD, and IED along with ADHD in the 6 months before SAQ completion, we assessed these disorders with screening scales from the Composite International Diagnostic Interview

(CIDI; Kessler & Üstün, 2004). To estimate the prevalence of the remaining disorders, we used a revised self-report version of the Family History Screen (FHS; Weissman et al., 2000), which was modified to assess personal rather than family history of these disorders. Respondents were asked to estimate AOO of each lifetime disorder. Recent ADHD was assumed to have been present since childhood based on prior validity studies (Kessler, Adler, et al., 2005; Kessler et al., 2007). The CIDI screening scales have good concordance with independent clinical diagnoses in the main AAS (area under the ROC curve of .69–.79 across diagnoses; Kessler et al., 2013). The FHS has been shown to have acceptable concordance with best-estimate clinical diagnoses (Weissman et al., 2000), although the items used in the AAS yielded implausibly high prevalence estimates. Therefore, diagnoses based on the FHS should consequently be considered combinations of threshold and subthreshold disorders. The implausibly high prevalence estimates also suggest that screening scales that have acceptable-to-good concordance with full diagnostic criteria may not provide accurate diagnoses or prevalence estimates, and therefore, rates of diagnoses assessed with screening scales should be interpreted in the context of this limitation. Unfortunately, it was not feasible to conduct full diagnostic interviews for all 29,982 participants.

Army Career Variables. We examined four main Army career variables: component (Regular Army versus Reserve Component [i.e., activated G/R]), Military Occupational Specialty (MOS), rank (junior enlisted E1–E4, senior enlisted E5–E9, and officers [combining Warrant officers and Commissioned officers]), and deployment status history (never deployed to a combat theater, currently deployed, previously deployed). Consistent with previous research examining variations in soldier health across different occupations (Gubata, Piccirillo, Packnett, & Cowan, 2013; Lindstrom et al., 2006; Niebuhr et al., 2011), we differentiated along three broad classes of occupations: *combat arms* occupations, which are involved directly in ground combat; *combat support*

occupations, which provide operational assistance to combat arms; and all other occupations, which are referred to collectively as *combat service support* occupations (Kirin & Winkler, 1992; Layne, Naftel, Thie, & Kawata, 2001). For more details regarding MOS coding in STARRS, see Kessler et al., 2015.

Analysis Methods

Discrete-time survival analysis with person-year as the unit of analysis, time-varying predictors, and a logistic link function (Efron, 1988) was used to examine associations of predictors with first lifetime onset of suicidal behavior. Both an additive model and a number of different nonadditive models were examined to characterize the joint associations of the eight temporally primary mental disorders with the subsequent onset of a suicide attempt. Comparative model fit was evaluated with the Akaike information criterion (Burnham & Anderson, 2002). The final specification was then used to estimate parallel models decomposing the associations of the disorders with suicide attempts through the prior onset of ideation, of plans among ideators, of attempts among planners, and of attempts among ideators without a plan.

We then examined the associations of Army career characteristics with suicide attempts. This was done initially in a model that did not control for mental disorders. We then estimated two additional models that controlled either all the prior lifetime mental disorders considered here or only the disorders with preenlistment onsets. Comparisons of the coefficients associated with Army career characteristics across these models are used to assess the roles of selection into these characteristics based on preenlistment disorders and the effects of postenlistment disorders.

Survival coefficients in all models were exponentiated to create odds ratios (ORs) with 95% confidence intervals. As the survey data are both clustered and weighted, the design-based Taylor series linearization

method was used to produce standard errors (Wolter, 1985). Multivariate significance was examined using design-based Wald F tests based on 210 strata and 420 sampling-error calculation units in the data.

RESULTS

Lifetime Prevalence of Suicidal Behaviors and Mental Disorders

As previously reported (Millner et al., 2017), lifetime prevalence of attempted suicide in the total sample is 2.5% among men and 5.1% among women, with 57.3%–64.3% (men–women) of these respondents reporting that their first suicide attempt occurred before they enlisted in the Army (Table 2). Decomposition shows that 41.8%–46.1% of men–women with suicide ideation develop a plan, 33.9%–38.3% of men–women with a plan make an attempt, and 9.2%–14.8% of men–women with suicide ideation but no plan make a suicide attempt. The majority of all five suicidal outcomes examined first occur prior to enlistment (55.1%–70.7%). Both the prevalence and the proportion with preenlistment onsets are higher among women than men across all five outcomes.

Lifetime prevalence estimates of mental disorders in the total sample range from highs of 31.7 (men) and 41.6% (women) for the PTSD screener to a low of 3.7% (identical for men and women) for broadly defined DSM-IV/CIDI BPD (Table 2). Prevalence estimates are significantly higher among women than men for four outcomes (screens for MDE, GAD, PTSD, and DSM-IV/CIDI PD), and higher among men than women for two (the screen for substance disorder and DSM-IV/CIDI IED). A clear majority of both men and women with IED reported onsets prior to enlistment (78.7%–71.6%), whereas small majorities reported preenlistment onsets of MDE (50.3%–54.1%) and, among women, PD (50.8%). Substantial minorities (31.1%–49.6%) reported preenlistment onsets of all other disorders.

TABLE 2
Lifetime II and III and Subheads should Match I Indent Prevalence of Suicidal Behaviors and Mental Disorders in the Consolidated AAS^a

	Prevalence				Preenlistment Proportion				Preenlistment Proportion			
	Men ^a		Women		Men				Women			
	%	SE	%	SE	%	SE	<i>n</i> _{denominator}	%	SE	<i>n</i> _{denominator}		
I. Suicidal Behaviors ^b												
Lifetime ideation among total sample	12.7	0.4	20.1	0.9	62.1	1.3	(3,344)	70.7	2.6	(575)		
Lifetime attempt among total sample	2.5	0.2	5.1	0.5	57.3	3.6	(635)	64.3	6.1	(170)		
Lifetime plan among ideators	41.8	1.6	46.1	3.2	57.0	2.0	(1,194)	69.3	3.9	(263)		
Lifetime attempt among ideators with a plan	33.9	1.9	38.3	4.4	58.1	4.2	(416)	65.7	7.8	(119)		
Lifetime attempt among ideators without a plan	9.2	0.9	14.8	2.4	55.1	5.7	(219)	61.4	10.6	(51)		
Mental Disorders												
II. Internalizing Disorders												
Major depressive episode (SC)	22.4	0.5	34.9	1.2	50.3	1.4	(5,306)	54.1	2.8	(963)		
Generalized anxiety disorder (SC)	28.8	0.6	40.4	1.5	39.8	1.5	(6,431)	45.4	2.3	(1,107)		
Posttraumatic stress disorder (SC)	31.7	0.6	41.6	1.3	31.1	2.0	(7,258)	42.4	2.0	(1,192)		
Bipolar disorder ^c	3.7	0.2	3.7	0.5	45.7	2.3	(1,129)	39.7	6.5	(121)		
Panic disorder	4.3	0.3	6.8	0.5	34.1	2.3	(1,170)	50.8	4.3	(203)		
III. Externalizing Disorders												
Intermittent explosive disorder	19.8	0.4	14.8	1.0	78.7	1.3	(5,456)	71.6	3.1	(479)		
Attention-deficit/hyperactivity disorder	5.6	0.3	5.8	0.5	49.6	2.6	(1,657)	49.5	4.7	(185)		
Substance use disorders (SC)	14.4	0.5	11.0	0.9	44.3	1.8	(4,503)	43.6	3.8	(351)		

^a*n* = 26,927 men; *n* = 3,055 women. The disorders assessed with screening questions are designated by "(SC)," while the other disorders were assessed with the Composite International Diagnostic Interview (Kessler & Üstün, 2004). See the text for more detail.

^bThe pre- and postenlistment proportions shown here differ slightly from those presented in a prior paper using these data (Millner et al., 2017) because age of enlistment was amended in this paper to reflect administrative data when the age at survey did not coincide with the birth date in Army records. The resulting changes are minimal as they involved only: *n* = 14 attempts (1.7% of total attempts), *n* = 84 ideators (2.1% of total ideators), *n* = 38 planners (2.6% of total planners), *n* = 11 planned attempts (2.1% of total planned attempts), *n* = 3 unplanned attempts (1.1% of total unplanned attempts).

^cThe assessment of bipolar disorder included bipolar disorder I, II, and subthreshold BPD. See the text for more detail.

*Associations of Temporally Primary
Mental Disorders with Subsequent Onset
of Suicidal Behaviors*

As noted in the section on analysis methods, a number of multivariate models were estimated for the joint associations of temporally primary mental disorders with the subsequent first occurrence of suicide attempts over the lifetime, including both preenlistment and postenlistment onsets (detailed results are available on request). The best-fitting specification was one that included main effects of each of the eight disorders considered here along with a single composite interaction term for number of comorbid disorders. The latter variable was coded zero for respondents with either none or exactly one disorder and between two and eight for respondents with between two and eight disorders. The OR for this comorbidity variable can be interpreted as the proportional difference in the odds of the outcome associated with the multivariate combination of comorbid disorders versus the odds predicted from the main effects.

Odd ratios for individual disorders predicting suicide attempts in this total lifetime assessment are consistently elevated and significant for both men and women (Table 3). The highest OR for both men and women is associated with the screen for MDE (OR = 36.3 and 36.2, respectively), with the other disorder-specific ORs in the range 1.9–5.4 among men and 3.2–11.3 among women. The OR associated with the comorbidity variable, in comparison, is significantly less than 1.0 among both men and women (OR = 0.5–0.3), indicating the existence of subadditive interactions among comorbid conditions in predicting attempted suicide. For example, given ORs of 36.3 and 4.3 for MDE and PTSD, respectively among men, a respondent with both of these disorders would have a predicted odds of subsequent attempted suicide under the model of 78.1 (i.e., $36.3 \times 4.3 \times 0.5$) compared to a respondent with no lifetime disorder.

The decomposition models using the same specification as the model to predict

attempted suicides show that the significant associations of mental disorders with subsequent suicide attempts are due largely to intervening associations with ideation. That is, temporally primary mental disorders predict the subsequent onset of suicide ideation in the total sample, with all eight disorders having significantly elevated ORs among both men (OR = 2.3–26.9) and women (OR = 2.7–33.3), but only one or two of the ORs are significant among men and none among women in predicting any of the later outcomes (i.e., plans among ideators, attempts among planners, attempts among ideators without a plan). The subadditive interaction term for comorbid disorders is also significant in predicting ideation in the total sample (OR = 0.5–0.3), but not in any of the models for subsequent outcomes.

As noted the results in Table 3 include both suicide attempts that occurred in the years prior to enlistment and those that occurred in the years subsequent to enlistment. As shown in Table 2, 57.3% of men and 64.3% of women who made a suicide attempt engaged in their first attempt prior to enlistment. When the models are estimated separately in each of these two time periods, results are quite similar for attempts that occurred prior to enlistment as in the total sample. That is, ORs for specific disorders predicting attempted suicides are consistently elevated and statistically significant for both men and women, with the highest ORs associated with the screen for MDE, and the OR associated with comorbid disorders consistently negative and significant. Disaggregation through ideation and plans shows that the significant predictors of attempts are largely mediated by ideation, with far fewer significant predictors of plans among ideators, attempts among planners, or attempts among ideators without a plan (detailed results are available on request).

Associations are more complex in predicting suicide attempts that occurred after enlistment due to the fact that we consider the possibility of different associations involving mental disorders with preenlistment and postenlistment onsets. Among

TABLE 3
Associations of Prior Mental Disorders with Suicidal Behaviors in the Consolidated AAS^a

	In the total sample						Among ideators with a plan		Among ideators without a plan	
	Lifetime ideators			Lifetime attempt			Lifetime attempt		Lifetime attempt	
	OR	95% CI		OR	95% CI		OR	95% CI	OR	95% CI
Men										
Internalizing disorders										
MDE (SC)	26.9*	(21.2–34.2)		36.3*	(25.9–50.9)		1.5*	(1.0–2.1)	1.6	(0.7–3.3)
GAD (SC)	2.9*	(1.9–4.3)		2.3*	(1.3–3.9)		0.9	(0.6–1.5)	1.2	(0.4–3.2)
PTSD (SC)	4.3*	(3.4–5.6)		4.3*	(2.4–7.6)		1.4	(0.8–2.5)	1.6	(0.7–3.7)
Bipolar disorder ^b	2.9*	(2.0–4.4)		2.9*	(1.8–4.8)		1.2	(0.6–2.4)	1.0	(0.5–2.2)
Panic disorder	2.3*	(1.5–3.7)		3.1*	(1.7–5.8)		1.1	(0.6–1.9)	1.8	(0.8–4.1)
Externalizing disorders										
IED	5.6*	(4.4–7.0)		5.4*	(3.4–8.5)		0.9	(0.7–1.2)	2.0*	(0.3–1.9)
ADHD ^c	3.0*	(1.8–5.0)		1.9*	(1.1–3.0)		0.9	(0.5–1.4)	1.1	(0.5–2.4)
SUD (SC)	2.4*	(1.6–3.7)		3.7*	(2.2–6.4)		1.3	(0.9–1.8)	2.2*	(0.5–2.7)
$F_{8,204}$	133.7*	<.001		58.6*	<.001		3.0*	0.003	1.2	0.31
Total number of mental disorders (values = 0, 0, 2–8)	0.5*	(0.4–0.6)		0.5*	(0.4–0.7)		1.0	(0.7–1.4)	1.0	(0.6–1.6)
Women										
Internalizing disorders										
MDE (SC)	33.3*	(23.2–47.7)		36.2*	(21.7–60.3)		2.1	(1.0–4.4)	0.7	(0.2–2.2)
GAD (SC)	4.5*	(2.8–7.2)		3.4*	(1.2–9.9)		1.2	(0.5–2.6)	0.4	(0.1–1.9)
PTSD (SC)	7.2*	(4.4–11.7)		7.9*	(3.3–18.6)		0.5	(0.2–1.0)	1.0	(0.3–4.1)
Bipolar disorder ^b	2.7*	(1.2–6.2)		3.2*	(1.1–9.6)		1.4	(0.4–4.9)	1.2	(0.4–4.2)
Panic disorder	5.0*	(3.1–8.1)		7.7*	(2.8–21.4)		0.6	(0.3–1.3)	2.0	(0.4–9.5)
Externalizing disorders										
IED	8.0*	(5.0–12.8)		11.3*	(3.5–36.2)		1.4	(0.70–2.71)	1.0	(0.3–3.9)
ADHD ^c	6.4*	(3.6–11.4)		3.9*	(1.4–11.4)		0.9	(0.38–1.97)	0.4	(0.1–2.4)
SUD (SC)	4.4*	(2.3–8.5)		11.3*	(4.4–29.4)		0.9	(0.35–2.42)	1.8	(0.5–6.0)

(continued)

TABLE 3
(continued)

	In the total sample		Among ideators		Among ideators with a plan		Among ideators without a plan	
	Lifetime ideators		Lifetime attempt		Lifetime plan		Lifetime attempt	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
$F_{8,204}$	42.5*	<.001	23.4*	<.001	2.8*	0.006	1.0	0.41
Total number of mental disorders (values = 0, 0, 2–8)	0.3*	(0.2–0.4)	0.3*	(0.2–0.6)	1.3	(0.8–2.3)	1.6	(0.6–4.2)
							0.6	(0.2–1.6)

^aMajor depressive episode (MDE); generalized anxiety disorder (GAD); posttraumatic stress disorder (PTSD); intermittent explosive disorder (IED); substance use disorder (SUD). The disorders assessed with screening questions are designated by “(SC),” while the other disorders were assessed with the Composite International Diagnostic Interview (Kessler & Üstün, 2004). See the text for more detail. Models controlled for time-varying demographic characteristics (person-year interval, race, education, marital status) and time-varying army characteristics (pre/postenlistment, component (Regular Army vs. Army Reserves/National Guard), military occupational specialty (MOS), rank, and deployment status). Race did not vary across person-years.

^bThe assessment of bipolar disorder included bipolar disorder I, II, and subthreshold BPD. See the text for more detail.

^cAttention-deficit/hyperactivity disorder (ADHD) was assessed at 6 months instead of at the lifetime level.

* $p < .05$.

men, six of the eight preenlistment onset disorders (all other than GAD and ADHD) and five of the postenlistment onset disorders (all other than GAD, panic disorder, and ADHD) have significantly elevated ORs predicting postenlistment suicide attempts. The screen for MDE has the highest OR in both models (OR = 25.0–58.1), with the other significant ORs in the range 2.1–4.3. Only two of the eight pairs of pre- versus postenlistment ORs are significantly different from each other, one involving a higher OR for the postenlistment than preenlistment MDE screen (OR = 58.1 vs. 25.0, $F_{1,209} = 6.7$, $p = .01$) and the other a higher OR for pre- than postenlistment panic disorder (OR = 3.6 vs. 1.4; $F_{1,209} = 4.8$, $p = .029$). The ORs for preenlistment and postenlistment comorbidity are both negative and significant (OR = 0.6–0.8). Disaggregation again shows that the associations of temporally primary mental disorders with postenlistment suicide attempts are mediated largely through ideation (detailed results are available on request).

The situation is different among women, where only three preenlistment disorders (the MDE, substance screens, and IED) and three mostly similar postenlistment disorders (the MDE, PTSD, and substance screens) are significant predictors of postenlistment suicide attempts. As with men, the ORs for the MDE screen are highest (OR = 12.5–29.5, with other significant ORs in the range 2.7–4.9). The ORs for preenlistment comorbidity and postenlistment comorbidity, in comparison, are nonsignificant, with the exception of odds lower than 1.0 for preenlistment suicide ideation. Disaggregation showed that, as with men, the associations of temporally primary mental disorders with postenlistment suicide attempts are mediated largely through ideation (detailed results are available on request).

Associations of Demographic Variables with Postenlistment Attempts

Differences in race and marital status emerged as the two demographic variables

associated with postenlistment suicide attempts. More specifically, odds of postenlistment suicide attempt are significantly lower for Black male soldiers (OR = 0.4) relative to White male soldiers (Table 4, Model 1). Compared with their currently married counterparts, previously married men have higher odds (OR = 2.1), whereas never-married women have lower odds of postenlistment suicide attempts (OR = 0.4).

All three associations remain significant after accounting for preenlistment mental disorders (Table 4, Model 2), and two of the three associations are still significant after accounting for both preenlistment and postenlistment mental disorders (Table 4, Model 3). Specifically, Black male soldiers continue to have significantly lower odds of postenlistment suicide attempt after controlling for preenlistment mental disorders (OR = 0.4) and after controlling for mental disorders with either a preenlistment or postenlistment onset (OR = 0.6). Among men, the higher OR associated with being previously married remains significant after controlling for preenlistment disorders (OR = 2.1), but is no longer significant after taking into account preenlistment and postenlistment disorders (OR = 1.4). Odds of postenlistment suicide attempts among never-married women remain significantly lower compared with currently married women after introducing controls for preenlistment disorders (OR = 0.4) and controls for both preenlistment and postenlistment disorders (OR = 0.4).

Associations of Army Career Variables with Postenlistment Attempts

Consistent with previous STARRS reports (Millner et al., 2017), odds of postenlistment suicide attempts in models that do not control for mental disorders are significantly higher for Regular Army than activated National Guard or Army Reserve soldiers among both men and women (OR = 3.4–3.8) and unrelated to the broad MOS categories considered here (Table 4, Model 1). Among men, junior enlisted soldiers have elevated odds of suicide attempt

TABLE 4
Time-Varying Demographic and Career Predictors of Lifetime Suicide Attempt in the Consolidated AAS

	Men						Women									
	Variable distribution		Multivariate 1		Multivariate 2 ^b		Multivariate 3 ^c		Variable distribution		Multivariate 1		Multivariate 2 ^b		Multivariate 3 ^c	
	%	SE	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	%	SE	OR	95% CI	OR	95% CI
Demographics ^a																
Race: Black	18.5	0.9	0.4*	(0.3–0.7)	0.4*	(0.3–0.8)	0.6*	(0.3–1.0)	34.6	2.0	–	–	–	–	–	–
Race: Hispanic	11.2	0.6	0.7	(0.4–1.3)	0.7	(0.4–1.4)	0.7	(0.4–1.4)	13.5	1.4	–	–	–	–	–	–
Race: Other	6.9	0.4	1.0	(0.6–1.9)	1.0	(0.5–2.0)	1.1	(0.6–2.0)	9.9	1.0	–	–	–	–	–	–
Race: White (reference)	63.4	1.3	–	–	–	–	–	–	42.0	2.0	2.1	(0.8–5.3)	2.0	(0.8–4.9)	1.7	(0.7–4.0)
<i>F</i> _{3,208}			3.5*	0.017	3.0*	0.033	1.4	0.23								
Previously married	4.9	0.2	2.1*	(1.0–4.3)	2.1*	(1.0–4.2)	1.4	(0.7–2.9)	9.1	0.8	0.9	(0.2–3.7)	0.9	(0.2–4.2)	0.9	(0.2–3.6)
Never married	36.4	0.7	0.7	(0.4–1.1)	0.7	(0.4–1.2)	0.8	(0.5–1.3)	50.5	1.5	0.4*	(0.2–0.8)	0.4*	(0.2–0.8)	0.4*	(0.2–1.0)
Currently married (reference)	58.7	0.6	–	–	–	–	–	–	40.4	1.3	–	–	–	–	–	–
<i>F</i> _{2,209}			2.8	0.06	2.6	0.08	0.7	0.50			3.3*	0.038	2.9	0.06	1.8	0.16
Postenlist., before 2000	83.1	0.6	0.6	(0.2–1.5)	0.6	(0.2–1.5)	0.5	(0.2–1.5)	86.6	0.8	5.1	(0.6–44.8)	4.7	(0.5–40.9)	4.4*	(0.5–41.4)
Postenlist., after 2000 (reference)	16.9	0.6	–	–	–	–	–	–	13.4	0.8	–	–	–	–	–	–
Army characteristics																
Regular Army	83.6	0.9	3.4*	(1.9–6.3)	3.3*	(1.8–6.1)	2.6*	(1.3–5.0)	83.4	1.4	3.8*	(1.1–13.1)	3.3	(1.0–11.4)	2.4	(0.7–8.2)
Guard–Reserve (reference)	16.4	0.7	–	–	–	–	–	–	16.6	1.4	–	–	–	–	–	–
MOS: combat arms ^d	38.0	1.5	0.8	(0.5–1.2)	0.8	(0.5–1.2)	0.8	(0.5–1.2)	5.3	0.6	1.2	(0.3–5.1)	1.4	(0.3–6.1)	0.8	(0.1–4.6)
MOS: combat support	26.3	1.1	0.7	(0.4–1.1)	0.6	(0.4–1.0)	0.7	(0.4–1.1)	22.0	1.6	1.3	(0.5–3.5)	1.3	(0.6–3.3)	1.4	(0.5–3.3)

(continued)

TABLE 4
(continued)

	Men						Women					
	Variable distribution		Multivariate 1		Multivariate 2 ^b		Multivariate 1		Multivariate 2 ^b		Multivariate 3 ^c	
			OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
	%	SE										
MOS: combat service support (reference)	35.7	1.2	–	–	–	–	72.7	1.6	–	–	–	–
$F_{2,209}$												
Rank: junior	41.3	0.9	2.0	0.14	2.1	0.12	1.6	0.21	0.1	0.88	0.2	0.80
Rank: senior	38.2	0.8	3.9*	(1.6–9.4)	3.6*	(1.5–8.7)	2.0	(0.8–5.0)	2.2	(0.8–6.0)	1.8	(0.7–5.1)
Rank: officer	20.5	1.0	1.7	(0.7–4.4)	1.6	(0.6–4.2)	1.1	(0.4–2.9)	2.0	(0.5–7.2)	1.5	(0.4–5.5)
(reference)			–	–	–	–	–	–	–	–	–	–
$F_{2,209}$												
Currently deployed ^e	34.0	0.4	9.2*	<.001	7.4*	0.001	4.0*	0.020	1.1	0.34	0.6	0.54
Previously deployed			1.9*	(1.3–2.9)	1.9*	(1.3–2.9)	1.3	(0.9–2.0)	0.6	(0.2–1.8)	0.6	(0.2–1.6)
Never deployed (reference)			2.4*	(1.5–3.9)	2.3*	(1.4–3.8)	1.2	(0.7–2.1)	1.4	(0.5–4.3)	1.4	(0.5–4.0)
$F_{2,209}$												
	42.2	0.5	–	–	–	–	–	–	54.3	1.0	–	–
			6.3*	0.002	6.0*	0.003	0.8	0.44	1.8	0.17	1.7	0.2
											1.2	0.31

^aRace did not change over person-years.^bMultivariate model 2 included the same predictors as multivariate model 1, but controlled for the 8 mental disorders only if age-of-onset was before year of Army enlistment.^cMultivariate model 3 included the same predictors as multivariate models 1 & 2, but controlled for 8 mental disorders, whether or not age-of-onset was before year of Army enlistment.^dDistributions reflect the frequencies for each variable category among the sample of all postenlistment person-years.^eDistributions reflect the frequencies for each variable category among the sample of postenlistment person-years after 2000 for men (83.1% of total) and for women (86.6% of total).* $p < .05$.

compared to officers ($OR = 3.9$) and currently deployed soldiers have elevated odds of first suicide attempts while deployed ($OR = 1.9$) compared to never-deployed men. Previously deployed soldiers have elevated odds of ever making a first suicide attempt after returning from deployment compared to never-deployed men ($OR = 2.4$). Among women, MOS, rank, and deployment status are unrelated to odds of suicide attempt.

Some of these significant associations change meaningfully when controls are introduced for preenlistment mental disorders (Table 4, Model 2) or for both preenlistment and postenlistment mental disorders (Table 4, Model 3). More specifically, the elevated OR associated with being in the Regular Army rather than the G/R ($OR = 3.4$) remains significant among men with controls for preenlistment mental disorders ($OR = 3.3$) and is attenuated, but also remains significant after controlling for both preenlistment and postenlistment disorders ($OR = 2.6$). The significant OR for Regular Army versus Guard-Reserve among women in the model without controls ($OR = 3.8$) becomes nonsignificant in the models with controls for preenlistment ($OR = 3.3$) and both preenlistment and postenlistment ($OR = 2.4$) disorders. Among men, the significant OR s for junior rank and current-prior deployment also become nonsignificant in the model that controls for both preenlistment and postenlistment disorders ($OR = 2.0, 1.3$ – 1.2), but remain significant in the model that controls only for preenlistment disorders ($OR = 3.6, 1.9$ – 2.3).

DISCUSSION

This study has five noteworthy limitations. First, the AAS response rate and linkage rate with administrative data were both relatively low. If relationships among the variables in the current study are markedly different among the omitted soldiers compared with the soldiers in the study, then the findings may not generalize across all soldiers. In order to improve the generalizability, we used poststratification to adjust for

differences between the sample and the population on administrative variables. Second, some respondents might have not reported current or past suicidal thoughts or behaviors due to stigma (Zinzow et al., 2013), fear of loss of confidentiality (Hamaguchi, 2014), or other reasons. If this nonreporting was systematically related to the predictors considered here (e.g., anxious suicidal soldiers fail to disclose suicidal behaviors more than nonanxious suicidal soldiers), it would introduce bias in tests of associations between predictors and outcomes. A similar bias would be introduced by systematic underreporting of mental disorders. Third, participants may have been biased in their retrospective recall of AOO of suicidal behaviors, which would introduce imprecision and perhaps bias into estimates of associations. Fourth, we examined only a limited set of mental disorders and used screening questions rather than full diagnostic assessments (Kessler et al., 2013). Although screening assessments have acceptable-to-good concordance with full diagnostic scales, they may have provided inaccurate diagnoses and prevalence estimates. Prevalence estimates for diagnoses measured with the screener with lower concordance rates (i.e., FHS) are doubtlessly inflated. Fifth, as this study focused only on active duty soldiers, we do not know whether the patterns documented here continue to hold after separation.

Within the context of these limitations, the study has seven notable findings. First, female soldiers generally have higher lifetime prevalence of internalizing disorders and male soldiers of externalizing disorders, with the exceptions of BPD and ADHD, which have similar prevalence across the sexes. This finding is consistent with much previous evidence (Kessler, Berglund, et al., 2005). Additionally, substantial percentages of soldiers experience the onset of suicide ideation, plans, and attempts as well as mental disorders, both before and after enlistment. Although prior reports have highlighted the noteworthy rates of preenlistment suicidal behaviors (Millner et al., 2017; Nock et al., 2014), it is also significant

to note that nearly one-third to almost one-half of suicidal thoughts and behaviors have their onset postenlistment. Furthermore, onsets of most mental disorders occur for more soldiers during postenlistment, compared with preenlistment. These results suggest that continued research into postenlistment risk factors is important for understanding and preventing suicidal behaviors and mental disorders in the Army.

Second, although all of the lifetime mental disorders considered here are related to subsequent suicide attempts, these associations are largely mediated by suicide ideation, with only three disorders (IED, panic disorder, and substance use disorder) predicting the transition from ideation to attempt among men and none among women. These results are consistent with prior work in both civilian and Army samples that consistently found that many mental disorders have significant gross associations with subsequent suicide attempts, with depression among the most important of these disorders, but that these associations were largely mediated by suicide ideation (Nock, Hwang, Sampson, & Kessler, 2010; Nock et al., 2009).

Third, we examined the associations of preenlistment onset disorders with postenlistment suicidal behaviors based on the practical question of whether early detection and treatment of preenlistment disorders after enlistment might be a useful approach to preventing subsequent onset of suicidal behaviors. The alternative is that only disorders with postenlistment onsets are associated with onset of suicidal behaviors during the years of enlistment. We found that a number of preenlistment disorders (MDE, PTSD, PD, IED, and substance use disorder) significantly predicted postenlistment suicide attempts among ideators. Although no preenlistment disorders predicted this transition among women, the small number of women included in that model reduced statistical power. These results suggest that it might be useful to target this subset of preenlistment disorders via screening for treatment services among new male soldiers.

Fourth, the only demographic factors associated with postenlistment suicide attempts were race and marital status. Among men, Black soldiers were at reduced risk of postenlistment suicide attempts compared with White soldiers. Consistent with this effect of race, Black servicemembers consistently show reduced risk of both suicide attempts and suicide death across studies in the Army (Black et al., 2011; Ursano, Heeringa, et al., 2015; Ursano, Kessler, Heeringa, et al., 2015; Ursano, Kessler, Stein, et al., 2015) and in the overall US military (Bachynski et al., 2012). Also among men, compared with married soldiers, previously married soldiers were at higher risk of postenlistment attempts. The effect of marriage was different for women, with never-married women showing lower odds of a suicide attempt compared with currently married women. The different associations of marital status with suicide attempt for men and women are new findings. Reports from other Army STARRS samples looking across all, predominantly male Army soldiers, found that being unmarried is generally associated with increased odds of suicide attempts (Ursano, Heeringa, et al., 2015; Ursano, Kessler, Heeringa, et al., 2015). The fact that the increased risk among previously married male soldiers remains after controlling for preenlistment disorders but not pre- and postenlistment disorders suggest that some combination of postenlistment Army experiences, onset of mental disorders, and divorce are associated with an incident suicide attempt. The reason for the lower odds of suicide attempts among never-married female soldiers is unclear and requires further study.

Fifth, among Army career characteristics, we found that, relative to those in the G/R, soldiers in the Regular Army are at increased risk of first suicide attempts while on active duty and that this is true for both men and women. For men, increased risk of incident suicide attempts among those in the Regular Army compared to the G/R is present even after controlling for lifetime mental disorders with both preenlistment

and postenlistment onsets, although the OR becomes less elevated with these controls. For women, in comparison, the increased risk of incident suicide attempt among those in the Regular Army compared to G/R is explained statistically by controls for postenlistment onset disorders, although the magnitudes of the ORs with and without controls are quite comparable for women and men. These results further clarify findings from a prior AAS report showing increased risk among Regular Army troops (Millner et al., 2017). However, it differs from results from a study among new soldiers in BT that found lower prevalence of suicide ideation and attempts among soldiers in the Regular Army compared with G/R (Ursano, Heeringa, et al., 2015). There are many differences between activated soldiers of all ages and new recruits that could account for these divergent findings. For example, new G/R recruits with a history of suicidal behaviors may drop out in higher numbers than their counterparts in the Regular Army, leading to comparatively lower prevalence of suicidal behaviors in the G/R among activated soldiers. Alternatively, G/R soldiers with a history of suicidal behaviors or mental health issues may still be in the G/R but not activated and therefore omitted from the AAS sample. Future longitudinal studies that follow new recruits from BT through activation and deployment could identify component differences that moderate risk and help to clarify these inconsistent results.

Sixth, for men having junior enlisted rank, compared to being an officer, is significantly associated with postenlistment suicide attempts, consistent with prior studies (Ursano, Kessler, Heeringa, et al., 2015). This relationship remains elevated when controlling for preenlistment but is attenuated and nonsignificant after controlling for both preenlistment and postenlistment mental disorders. This suggests that preenlistment disorders cannot account for the association of junior rank with postenlistment suicide attempts and raises the possibility that, instead, vulnerabilities associated with

experiences that occurred after enlistment might be involved in the elevated odds of suicide attempts among junior enlisted soldiers. Interestingly, senior enlisted soldiers do not have elevated odds of postenlistment attempts, either with or without controls for mental disorders. This difference between junior and senior enlisted soldiers suggests either that the mental disorders that occur to enlisted soldiers as of promotion to the senior enlisted ranks become less important in suicidality subsequent to these promotions or that selection factors involving the associations of these disorders with suicidality lead to selection out of promotion. This general pattern of association between rank and suicidality is consistent with prior studies (Hoge, Auchterlonie, & Milliken, 2006), but we are unaware of any attempt to unpack the association to determine why it exists.

Seventh and finally, being currently or previously deployed is associated with elevated risk of subsequent first postenlistment suicide attempt relative to the never deployed, but these associations attenuate with controls for lifetime disorders suggesting that Army deployment experiences may have contributed to increased risk of attempts. Inconsistent with this result, a prior Army STARRS study found that, among enlisted soldiers, those who were never deployed had the highest odds of an attempt (Ursano, Kessler, Stein, et al., 2015), although it is important to note that this other study included new soldiers in BT, while BT soldiers were explicitly omitted from the AAS. This is an important distinction given that this other study found that nonfatal suicide attempts are highly prevalent during BT. Yet another Army STARRS study found that soldiers in combat positions showed lower risk of suicide when deployed, but soldiers in other positions showed increased risk (Kessler et al., 2015). This is a complex area of investigation due to the existence of a *healthy warrior effect* that selects soldiers with mental disorders out of deployment (Wilson et al., 2009) and due to the fact that deployment consists of many different experiences, some of which may increase and others decrease risk of subsequent suicidal

behaviors. More fine-grained investigations are needed to clarify these inconsistent results.

In summary, this study provides new information about the prevalence of lifetime mental disorders in the Army as well as about the role of mental disorders, demographic characteristics, and Army career characteristics in the prediction of suicidal behaviors that begin during the years of Army service. Future studies using the Consolidated AAS will further examine potential risk and protective factors for suicidal behavior among Army soldiers and will focus on identifying risk factors for the transition from suicide ideation to suicide attempt. Taken together, these studies aim to improve the understanding, prediction, and prevention of suicidal behavior among Army soldiers.

AUTHOR CONTRIBUTIONS

Kessler had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Ursano and Kessler were involved in the conception and design of Army STARRS; Nock, Kessler, and Millner were involved in the conception and design of the data analysis plan for the current article; Ursano, Kessler, and Sampson were involved in acquisition of AAS data; Kessler, Millner, Nock, and Zaslavsky were involved in analysis and interpretation of data; Millner, Nock, and Kessler were involved in drafting of the manuscript; and all authors were involved in critical revision of the manuscript for important intellectual content. Hwang, King, Sampson, and Zaslavsky were involved in statistical analysis; Ursano, Stein, and Kessler were involved in obtaining funding; all authors were involved in administrative, technical, or material support; and Kessler, Nock, Sampson, and Zaslavsky were involved in supervision.

ROLE OF THE SPONSORS

The sponsors specified the topic in the RFP but had no role in the design of

the study. However, as a cooperative agreement, collaborating scientists appointed to the project by NIMH and Army liaisons/consultants participated in the refinement of the study protocol originally proposed by Ursano, Kessler, and the other initial Army STARRS collaborators. None of the Army or NIMH collaborators was involved in planning or supervising data analyses for this report, but they did read a draft and offered suggestions for revision. Although a draft of this manuscript was submitted to the Army and NIMH for review and comment prior to submission, this was with the understanding that comments would be no more than advisory. Other than for the above, the funding organization played no role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

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