American Psychological Association

Journal of Abnormal Psychology

0021-843X/18/$12.00

2018, Vol. 127, No. 7, 650–658
http://dx.doi.org/10.1037/abn0000379

Patterns and Predictors of Persistence of Suicide Ideation: Results From the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)

Matthew K. Nock
Harvard University

Georges Han
Medical College of Wisconsin

Alexander J. Millner
Harvard University

Peter M. Gutierrez
Denver Veterans Affairs Medical Center, Rocky Mountain Mental Illness Research, Education, and Clinical Center, Denver, Colorado

Thomas E. Joiner
Florida State University

Irving Hwang and Andrew King
Harvard Medical School

James A. Naifeh
Uniformed Services University of the Health Sciences

Nancy A. Sampson and Alan M. Zaslavsky
Harvard Medical School

Murray B. Stein
University of California, San Diego, and VA San Diego Healthcare System, San Diego, California

Robert J. Ursano
Uniformed Services University of the Health Sciences

Ronald C. Kessler
Harvard Medical School

Persistent suicide ideation (SI) is known to be a risk factor for subsequent suicidal behaviors. Reducing SI persistence among people with a history of SI consequently might be a useful target for preventive intervention; however, basic information is lacking about patterns and predictors of SI persistence. We report preliminary retrospective data on annual SI persistence in a representative sample of 3,501 U.S. Army soldiers with lifetime SI from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). Reports about age-of-onset and number of years with SI were used to estimate two definitions of persistence: persistence beyond year-of-onset and proportional annual persistence (i.e., percentage of years with SI since year-of-onset). Results revealed that for 47.8% of respondents with lifetime SI, their SI did not persist beyond the year-of-onset. For the 52.2% whose SI did persist beyond

Matthew K. Nock, Department of Psychology, Harvard University; Georges Han, Department of Neurosurgery, Medical College of Wisconsin; Alexander J. Millner, Department of Psychology, Harvard University; Peter M. Gutierrez, Denver Veterans Affairs Medical Center, Rocky Mountain Mental Illness Research, Education, and Clinical Center, Denver, Colorado; Thomas E. Joiner, Department of Psychology, Florida State University; Irving Hwang and Andrew King, Department of Health Care Policy, Harvard Medical School; James A. Naifeh, Center for the Study of Traumatic Stress, Department of Psychiatry, Uniformed Services University of the Health Sciences; Nancy A. Sampson and Alan M. Zaslavsky, Department of Health Care Policy, Harvard Medical School; Murray B. Stein, Departments of Psychiatry and Family and Preventive Medicine, University of California, San Diego, and VA San Diego Healthcare System, San Diego, California; Robert J. Ursano, Center for the Study of Traumatic Stress, Department of Psychiatry, Uniformed Services University of the Health Sciences; Ronald C. Kessler, Department of Health Care Policy, Harvard Medical School.

The Army STARRS Team consists of Co-Principal Investigators: Robert J. Ursano, MD (Uniformed Services University of the Health Sciences) and Murray B. Stein, MD, MPH (University of California San Diego and VA San Diego Healthcare System); Site Principal Investigators: Steven Heeringa, PhD (University of Michigan), James Wagner, PhD (University of Michigan), and Ronald C. Kessler, PhD (Harvard Medical School); Army liaison/consultant: Kenneth Cox, MD, MPH (USAPHC (Provisional)). Other team members: Pablo A. Aliaga, MA (Uniformed Services University of the Health Sciences); COL David M. Benedek, MD (Uniformed Services University of the Health Sciences); Laura Campbell-Sills, PhD

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the year-of-onset, the median (interquartile range) proportional annual persistence was 33% (17–67%). Significant predictors of increased persistence were different for respondents with preenlistment SI onset (prior histories of attention-deficit/hyperactivity disorder [ADHD], bipolar disorder, and panic disorder) and postenlistment SI onset (male, combat support military occupation specialty, prior histories of ADHD, panic disorder, and posttraumatic stress disorder). These predictors of persistence are different from the predictors of SI onset, suggesting that secondary preventive interventions to reduce SI persistence may need to focus on different factors than primary preventive interventions to reduce SI onset.

General Scientific Summary

Suicide is a leading cause of death worldwide. Most research on this topic has focused on the prediction of presence of suicidal thoughts and behaviors; however, surprisingly little is known about the persistence of suicidal thoughts. In this study we documented the patterns and predictors of the persistence of suicidal thoughts in a large representative sample of people with thoughts of suicide.

Keywords: Army, military, persistence, suicidal ideation, suicide

Supplemental materials: http://dx.doi.org/10.1037/abn0000379.supp

Suicide is one of the leading causes of death worldwide (World Health Organization, 2017), and beginning in 2009, the suicide rate among U.S. Army personnel surpassed that of the general population (Nock et al., 2013). One response of the Army to this trend was to fund a major epidemiological-neurobiological study of risk and protective factors for suicide, the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; Ursano et al., 2014). Army STARRS aims to help target interventions to prevent suicide deaths among Army personnel. Although a great deal of research has been carried out on risk factors for suicide deaths (Franklin et al., 2017), disaggregation shows that most documented predictors are much more strongly predictive of suicide ideation (SI) in the total population than of attempts among ideators (Nock, Alonso, et al., 2012; Nock et al., 2016).

Primary preventive interventions for SI are challenging because of the wide SI age-of-onset distribution and, in the case of the Army, the fact that the majority of soldiers with SI had onsets prior to enlistment (Millner et al., 2017a), meaning that by the time that many soldiers enlist, it is already too late to prevent SI onset. Secondary preventive interventions focused on SI persistence may be much more realistic, as risk of future suicide is substantially higher among people with than without SI (Simon et al., 2016) and particularly so among individuals with SI that persists across weeks and months (Nock et al., 2018; Simon et al., 2017). Notably, however, studies that have examined the persistence of SI over a period of years suggest that risk of suicide attempt is highest in the first year of SI onset, and decreases with periods of SI persistence that last many years with no suicide attempt (Nock et al., 2008).

Despite the potential importance of SI persistence in the understanding and prediction of suicidal behavior, surprisingly little is known about the basic patterns or predictors of SI persistence. This information is needed to better understand the

(University of California San Diego); Chia-Yen Chen DSc (Harvard Medical School); Carol S. Fullerton, PhD (Uniformed Services University of the Health Sciences); Nancy Gebler, MA (University of Michigan); Joel Gelernter (Yale University); Robert K. Gifford, PhD (Uniformed Services University of the Health Sciences); Paul E. Hurwitz, MPH (Uniformed Services University of the Health Sciences); Sonia Jain, PhD (University of California San Diego); Tzu-Cheg Kao, PhD (Uniformed Services University of the Health Sciences); Lisa Lewandowski-Romps, PhD (University of Michigan); Holly Herberman Mash, PhD (Uniformed Services University of the Health Sciences); James E. McCarroll, PhD, MPH (Uniformed Services University of the Health Sciences); James A. Naifeh, PhD (Uniformed Services University of the Health Sciences); Tsz Hin Hinz Ng, MPH (Uniformed Services University of the Health Sciences); Matthew K. Nock, PhD (Harvard University); Nancy A. Sampson, BA (Harvard Medical School); CDR Patcho Santiago, MD, MPH (Uniformed Services University of the Health Sciences); Jordan W. Smoller, MD, ScD (Harvard Medical School); and Alan M. Zaslavsky, PhD (Harvard Medical School). Army STARRS was sponsored by the Department of the Army and funded under cooperative agreement number U01MH087981 (2009–2015) with the U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Mental Health (NIH/NIMH). Subsequently, STARRS-LS was sponsored and funded by the Department of Defense (USUHS Grant HU0001-15-2-0004). The contents are solely the responsibility of the authors and do not necessarily represent the views of the Department of Health and Human Services, NIMH, the Department of the Army, the Department of Veterans Affairs, or the Department of Defense. A complete list of Army STARRS publications can be found at http://www.STARRS-LS.org. Murray B. Stein has in the past three years been a consultant for Actelion, Dart Neuroscience, Healthcare Management Technologies, Janssen, Oxeia Biopharmaceuticals, Pfizer, Resilience Therapeutics, and Tonix Pharmaceuticals. In the past 3 years, Ronald C. Kessler has received support for his epidemiological studies from Sanofi Aventis; was a consultant for Johnson & Johnson Wellness and Prevention, Sage, Shire, Takeda; and served on an advisory board for the Johnson & Johnson Services Inc. Lake Nona Life Project. Kessler is a co-owner of DataStat, Inc., a market research firm that carries out healthcare research.

Correspondence concerning this article should be addressed to Matthew K. Nock, Department of Psychology, Harvard University, 33 Kirkland Street, Cambridge, MA 02138. E-mail: nock@wjh.harvard.edu

associations between SI persistence and suicide attempt. The few studies that have considered the issue have reported substantial variation in SI persistence. The largest such study was carried out in the World Mental Health Surveys, where annual SI persistence was examined retrospectively among more than 10,000 respondents with a lifetime history of SI across 21 countries (Kessler et al., 2012). SI did not persist beyond the year of onset for approximately half (47–55% across countries) of lifetime cases but was highly persistent among many of the remaining cases. Prospective studies with varying follow-up intervals reported similar results, finding that only about half of people with suicide ideation in a baseline assessment continued to have ideation one year later (Hintikka et al., 2001) and approximately one third continued to have ideation between two (ten Have et al., 2009) and 10 (Borges, Angst, Nock, Ruscio, & Kessler, 2008) years later. We are aware of only one study that examined SI persistence among U.S. Army soldiers (Bryan, Clemans, Leeson, & Rudd, 2015). That study focused on a small ($n = 54$) sample of suicidal soldiers in treatment and found that baseline chronic stressors were significantly associated with SI persistence over a 6-month follow-up period.

In an effort to advance the understanding of this understudied aspect of suicidality, we present data in the current report on patterns and predictors of SI persistence among U.S. Army soldiers. Data come from the 3,501 respondents in the Army STARRS Consolidated All-Army Survey (AAS) with a lifetime history of SI. Several prior reports from this sample examined prevalence, age-of-onset, and correlates of lifetime SI (Millner et al., 2017a, 2017b; Nock et al., 2017), but persistence was not considered in those prior reports. Given that these prior studies, as well as many others (Nock et al., 2008; Nock, Hwang, Sampson, & Kessler, 2010), have shown that sociodemographic factors (e.g., age, sex, education level) and mental disorders (e.g., mood, anxiety, and substance use disorders) predict SI onset, here we tested whether these factors also predict SI persistence.

Method

Sample

The consolidated AAS is a combination of three separate cross-sectional self-report surveys that collectively assessed representative samples of all U.S. Army soldiers exclusive of those in Basic Combat Training who were on active duty during the years 2011 and 2012. The first of the three component surveys, the main AAS, was based on a probability sample of Army units stratified by Command and location selected with probabilities proportional to authorized unit strength, excluding units with fewer than 30 soldiers (which comprise less than 2% of Army personnel) and units in Afghanistan. All personnel other than those with conflicting duties (20.2%) in these units attended an informed consent session where they learned about study purpose, confidentiality, and voluntary participation. Written informed consent was then obtained for a self-administered questionnaire (SAQ). A total of 17,462 respondents both completed the SAQ and consented to administrative data linkage, for a survey completion-successful record linkage rate of 58.3% and a response rate of 46.5% (see COOP1 and RR1 calculation methods, American Association for Public Opinion Research, 2016).

As the main AAS excluded soldiers deployed to a combat theater, a second sample was selected of soldiers stationed in Afghanistan who were in Kuwait in transit to or from their middeployment leave. Individual soldiers rather than units were sampled. Recruitment, consent, and data collection procedures were otherwise the same as in the main AAS. A total of 3,987 respondents provided full SAQ data and administrative data linkage for a survey completion-successful record linkage rate of 38.9%. A response rate was not calculated because we did not record the number of soldiers invited to informed consent sessions for this supplemental survey.

As soon-to-deploy units were underrepresented in the main AAS sample, the consolidated AAS included a third sample: the baseline from a prospective pre–post deployment survey (PPDS) made up of personnel from three Brigade Combat Teams surveyed just before deployment to Afghanistan. Recruitment, consent, and data collection procedures were identical to those in the main AAS. A total of 8,558 respondents provided full SAQ data and administrative data linkage. The survey completion-successful record linkage rate was 89.0% and the response rate was 86.1%.

The recruitment, consent, and data protection procedures in the above surveys were approved by the human subjects committees of Harvard University (Harvard University Area IRB #F18173; Harvard Medical School IRB #M18189) and all other collaborating organizations. SAQ responses were weighted to adjust for differences in survey responses between respondents who did versus did not agree to record linkage (Weight 1) and for discrepancies between the weighted sample who agreed to record linkage and the population in multivariate administrative record profiles (Weight 2). Weight 2 adjusted the sample to be representative of all active duty soldiers during the years 2011–2012 on the cross-classification of sociodemographics, command, occupation, rank, and deployment status-history variables that differentiated the three component samples. These Doubly weighted data make up the Consolidated AAS. More detailed descriptions of Consolidated AAS design (Kessler, Colpe, et al., 2013), field procedures (Heeringa et al., 2013), and weighting (Kessler, Heeringa, et al., 2013) are presented elsewhere.

Measures

Suicide ideation. A modified version of the Columbia Suicide Severity Rating Scale (Posner et al., 2011) was administered to assess suicidal behaviors. The variables used in the current report are those that asked about lifetime occurrence and age-at-onset (AAO) and recency of either active SI (*ever have thoughts of killing yourself*) or passive SI (*ever wish you were dead or would go to sleep and never wake up*) and number of years with SI regardless of history of suicide attempts (*about how many years did you have these thoughts*). Whereas information on suicide attempts also was collected, this information is not considered in this initial report on course of SI. SI persistence was defined in two ways: (a) persistence beyond year-of-onset, and (b) proportional annual persistence. Proportional persistence of SI was calculated as $(n_i - 1)/(\text{AAI} - \text{AAO})$, where n_i = number of years with

ideation.[1] Proportional persistence values were top-coded at 1.0, which applied to 3.9% of the sample. Time-since-onset of SI was defined as age-at-interview (AAI) minus AAO.

Mental disorders. The survey assessed lifetime prevalence and AAO of five *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM–IV*) internalizing disorders and three externalizing disorders. The internalizing disorders were broadly defined bipolar disorder (BPD), generalized anxiety disorder (GAD), major depressive episode (MDE), panic disorder (PD), and posttraumatic stress disorder (PTSD). The externalizing disorders were attention-deficit/hyperactivity disorder (ADHD), intermittent explosive disorder (IED), and substance use disorder (SUD; alcohol or drug abuse or dependence). We used screening scales from the Composite International Diagnostic Interview (CIDI; Kessler & Ustün, 2004) to assess lifetime BPD, IED, and PD and ADHD in the 6 months prior to survey. The BPD assessment included BP-I, BP-II, and subthreshold BPD (hypomania without history of major depression or subthreshold hypomania as defined in Merikangas et al., 2011). The remaining lifetime disorders were assessed with a revised self-report version of the Family History Screen (FHS; Weissman et al., 2000) modified to assess personal rather than family history of psychiatric disorders. Both the CIDI (Kessler, Santiago, et al., 2013) and the FHS (Weissman et al., 2000) have been shown to have acceptable concordance with clinical diagnoses. However, as the FHS items in the AAS yielded implausibly high prevalence estimates, diagnoses based on these items should be interpreted as encompassing both threshold and subthreshold cases. AAO of each lifetime disorder other than ADHD was assessed using retrospective reports. ADHD was assumed to have been present since childhood.

Sociodemographic and Army career variables. The sociodemographic variables considered here included sex, race/ethnicity (Non-Hispanic Black, Non-Hispanic White, Hispanic, Other), marital history (never, previously, currently married), and education (high school or less, some college, college graduate). The Army career variables considered here included age-at-enlistment, component (Regular Army vs. Reserve Component), Military Occupational Specialty (MOS; combat arms, combat support, combat service support), rank (junior enlisted E1-E4, senior enlisted E5-E9, officers [both Warrant and Commissioned officers]), and deployment history (never deployed to a combat theater, previously deployed, currently deployed).

Analysis Method

Because the data were cross-sectional, inferences were based on retrospective reports about persistence. We did not want to make strong assumptions about underlying recurrence process distributions (e.g., Shen & Cook, 2014; Yamaguchi, 2003) because of the uncertainties introduced by our use of retrospective reports. We consequently estimated a model for SI proportional persistence (i.e., number of years of persistence/number of years since onset) among respondents whose SI age-of-onset was at least two years before age-at-interview. The predictors were based on information reported retrospectively by respondents as having been true as of SI age-of-onset. These same predictors were used in earlier reports on the predictors of SI onset (Millner et al., 2017a, 2017b; Nock et al., 2018) with the addition of the age of SI onset being used as a predictor in the current report. As these earlier analyses found that the majority of soldiers with lifetime SI had preenlistment onsets (Millner et al., 2017b), our persistence models were estimated separately for respondents with preenlistment and postenlistment SI onsets.

Nested logistic regression was used to identify predictors of SI proportional persistence coded into deciles (i.e., 11 categories: 0%, 1–10%, 11–20%, etc.). This involved defining 10 dichotomous transitions across the 11 categories (i.e., proportional persistence greater than 0% in the total sample, greater than 10% among respondents whose proportional persistence was greater than 0%, greater than 20% among respondents whose proportional persistence was greater than 10%, etc.), stacking these 10 data sets into a single consolidated data file in which a dichotomous outcome variable was defined for whether or not the higher level of the outcome was achieved, and estimating a single pooled logistic regression equation in this stacked dataset that included 9 dummy variables to distinguish among the 10 transitions. The logic of this approach is identical to that of discrete-time survival analysis (Singer & Willett, 2003). We began by examining univariate predictors and then estimated multivariate models that included all significant predictors from the univariate models. Interaction tests were then used to determine if the logistic coefficients varied significantly across levels of proportional persistence. Given the lumpiness of the distribution of proportional persistence, these interactions were evaluated in a single model for the transitions from 0% to 1%+ and 0–10% to 11%+ proportional persistence and continuously across the range between 21 and 30 and 91–100% proportional persistence.

Missing data, which were for the most part uncommon, were recoded to medians for all variables other than SI age-of-onset (4.7% missing) and SI proportional persistence (11.0% missing). Data for these two variables were not missing completely at random and were less likely to be missing for those with active (vs. passive) SI, regular Army (vs. guard/reserve), and those with diagnoses of MDD, GAD, PTSD, or ADHD (detailed results available upon request). Because of the higher proportions of missing values on these two variables, the missing values were imputed with the method of multiple imputation (MI; Little & Rubin, 2002) using SAS *proc MI* (SAS Institute Inc., 2010), which takes this missingness into account. Standard errors of proportions and logistic regression coefficients were estimated using the MI-adjusted design-based Taylor series linearization method (Wolter, 1985) with a customized SAS macro. Multivariate significance

[1] Number of years with SI and SI age of recency were assessed directly in the survey, whereas the reported range of years between SI onset and recency ages was only indirectly used in the calculation of SI persistence as a top-coding procedure for estimates of "years with suicidal thoughts" that exceeded maximum possible values. To illustrate, for a given reported SI onset and recency ages of 18 and 20, respectively, if a respondent then reported having 10 years with suicidal thoughts, we did not use that value of 10, but instead a value of 3 years with suicidal thoughts was used to calculate SI persistence. However, if 2 years with suicidal thoughts were reported, then a value of 2 years with suicidal thoughts was used to calculate SI persistence, because this reported value fell within the range of possible values as defined by SI onset and recency ages. The majority of respondents who reported lifetime SI did not report current SI at the time of survey. Approximately 12.0% of lifetime SI cases also occurred in the past 30 days before interview and another 26.0% or lifetime SI cases occurred in the past 12 months before interview (i.e. current or prior ages to time-of-interview).

tests for the joint predictive effects of multiple predictors were evaluated with MI-adjusted design-based *F* tests. The latter were evaluated with total degrees of freedom equal to the difference between the number of sampling error calculation units (SECUs) with observed cases of SI minus the number of primary sampling units (PSUs) from which these SECUs came, noting that each PSU contained exactly two SECUs by design. Logistic regression coefficients and their MI-adjusted design-based 95% confidence intervals (i.e., estimates ± 2 standard errors) were exponentiated and are reported here as odds-ratios (*OR*s) with 95% confidence intervals (95% CIs).

Results

Basic Patterns of Persistence

Lifetime SI was reported by 3,915 respondents (13.7% of the total sample). For 47.8% of respondents with lifetime SI, their SI did not persist beyond the year-of-onset. The proportion of lifetime cases whose SI persisted beyond age-of-onset was positively associated with time-since-onset among the 3,501 respondents whose SI age-of-onset was at least two years before the survey, the subsample that is the focus of analysis in this report.[2] This proportion ranged from a low of 31.0% when time-since-onset was 2–4 years to a high of 61.1% when time-since-onset was 16 + years, and an average of 52.2% across all respondents (see Table 1). This association is expected given the fact that number of years of potential SI increases with time-since-onset. No consistent pattern existed for this proportion to be different depending on whether SI onset occurred prior to or after enlistment (Supplemental Table 1). Among respondents with persistence greater than 0%, median (interquartile) range proportional persistence was 33% (17–67%) overall, 29% (15–57%) for respondents with preenlistment SI onset, and 50% (25–80%) for respondents with postenlistment SI onset. As a result of these patterns, most soldiers with prevalent SI were persistent cases. Specifically, more than 50% of soldiers with SI in the year of interview reported SI age-of-onset more than 5 years ago and close to 25% more than 10 years ago.

Predictors of SI Proportional Persistence Among Soldiers With Preenlistment Onsets

Among respondents whose SI began prior to age-at-enlistment, proportional persistence was significantly and inversely related to AAO (meaning those with earlier AAO had more years of SI), and significantly and positively associated with the presence of active (vs. passive) SI, race-ethnicity (with generally lower odds for those who are Hispanic and higher odds for those who are Non-Hispanic Black and Other [relative to Non-Hispanic White]), and numerous prior lifetime mental disorders (see Table 2). In a multivariate model that included all predictors simultaneously, only AAO, race, and a reduced set of mental disorders (ADHD, bipolar, panic, and substance use [with an inverse effect]) remained significant predictors of proportional persistence. The interaction of age-of-onset with level of proportional persistence was nonsignificant ($F_3 = 0.9$, $p = .45$). Interactions of race-ethnicity and mental disorders with level of proportional persistence were nonsignificant as a set ($F_{18} = 0.7$, $p = .80$; Supplemental Table 2).

Predictors of SI Proportional Persistence Among Soldiers With Postenlistment Onsets

Among respondents whose SI began after age-at-enlistment, proportional persistence was significantly higher among soldiers whose military occupation specialty at the time of SI onset was a combat support occupation than combat service support (*OR* = 1.6), significantly lower among women than men (*OR* = 0.7), and positively associated with a range of prior lifetime mental disorders (see Table 3). Two of the three mental disorders that remained significant in a multivariate model that included the other significant predictors were the same as in the preenlistment model: ADHD (*OR* = 1.7) and panic disorder (*OR* = 1.4), with PTSD being the other significant disorder (*OR* = 1.6). The interaction of age-of-onset with level of proportional persistence was nonsignificant ($F_3 = 1.8$, $p = .14$). Interactions of military occupation specialty, sex, and mental disorders with level of proportional persistence were nonsignificant at a set ($F_{18} = 1.4$, $p = .14$; Supplemental Table 3). Notably, as a set, the predictors of SI persistence were significantly different for pre-versus postenlistment onset of SI ($F_{14} = 4.4$, $p < .001$; Supplemental Table 4).

Discussion

This paper provides new information about the patterns and predictors of the persistence of SI. There are two key findings that warrant additional comment. First, regarding the patterns of SI persistence, 47.8% of respondents with a history of SI reported that their SI never persisted beyond their age-of-onset. This finding, as well as the finding of an inverse association between time-since-onset and persistence, is consistent with earlier reports of the persistence of SI in the World Mental Health (WMH) Surveys (Kessler et al., 2012). Novel to the current study, we also observed that among the 52.2% who had more persistent SI (i.e., that lasted beyond the first year of onset), the median proportion of subsequent years with SI was 33%. On one hand, it is encouraging to learn that for approximately half of those who experience SI, such thoughts will not persist beyond the initial year during which they are experienced. On the other hand, the fact that such thoughts will persist for the other half of those with SI, and will do so for so many years, is cause for concern.

Prior studies suggest that whereas the persistence of SI over many years in the absence of any suicide attempt is associated with lower odds of ever making an attempt, persistence of SI over periods of days, weeks, and months is associated with higher odds of suicide attempt (Kleiman et al., 2018; Nock et al., 2018; Simon et al., 2017). These differing findings regarding the association between SI persistence and occurrence of suicide attempts highlight the need to better understand SI persistence. The current study provides more detailed information than prior studies regarding the long-term (i.e., across years) patterns of SI persistence. Future studies are needed to provide

[2] The selection of the subsample of respondents whose SI age-of-onset was at least two years before age-at-interview was based on the denominator of the calculation for SI persistence, which was the difference between age at interview and age at onset. A difference of one year would result in a denominator of 0 and thus an undefined value for SI persistence. Because this study examined SI persistence in units measured by years, rather than seasons, months, or days, the subsample with a difference of at least two years from SI onset to interview was the most inclusive subsample for study of SI persistence.

Table 1
Distribution of Suicidal Ideation Proportional Persistence by Years Since Ideation Onset Relative to Interview (n = 3,501)

Proportion of years with suicidal thoughts	Ideation onset (relative to age at survey)											
	2–4		5–7		8–10		11–15		16+		Total	
	%	*SE*	%	*SE*	%	*SE*	%	*SE*	%	*SE*	%	*SE*
0	69.0	2.6	47.7	2.4	43.6	3.2	44.8	3.1	38.9	3.0	47.8	1.2
1–10	0.0	—	0.0	—	4.2	1.2	11.1	1.6	12.9	1.9	6.5	0.6
11–20	0.0	—	15.1	1.6	11.1	1.8	10.6	1.8	13.6	2.0	10.4	0.8
21–30	5.3	1.6	2.7	0.9	9.4	2.6	7.7	1.7	11.4	1.3	7.6	0.7
31–40	4.4	1.0	6.8	1.7	5.5	1.8	8.1	2.0	5.3	1.3	6.1	0.7
41–50	6.8	1.6	4.0	1.4	7.9	2.4	3.6	0.9	2.9	0.8	4.8	0.6
51–60	0.0	—	5.5	1.2	1.5	0.7	2.0	0.8	3.1	1.0	2.5	0.4
61–70	3.2	0.7	0.8	0.5	3.1	1.2	3.2	1.3	1.6	0.6	2.3	0.4
71–80	4.1	2.0	4.6	1.0	3.6	1.3	2.3	0.6	0.9	0.3	2.9	0.4
81–90	0.0	—	6.3	1.3	6.8	1.5	1.9	0.6	2.0	0.6	3.2	0.4
91–100	7.2	1.6	6.5	1.6	3.3	1.1	4.8	1.0	7.3	0.8	5.9	0.6
Total, median/IQR[a]	50	(33–100)	43	(20–80)	40	(20–70)	27	(14–55)	24	(11–50)	33	(17–67)
(*n*)	(*n* = 675)		(*n* = 681)		(*n* = 689)		(*n* = 698)		(*n* = 758)		(*n* = 3,501)	

Note. Estimates reflect weighted data.
[a] Estimates represent median and interquartile range (IQR) values of the proportion of years with suicidal thoughts among lifetime ideators with greater than 0% of years with suicidal thoughts.

a more fine-grained assessment of SI over long periods of time. For instance, the current study was not able to carefully assess periodic fluctuations in SI presence or severity over time. Adding more frequent assessments of SI presence and severity (e.g., via monthly or yearly surveys) would shed further light on how SI varies over time, and whether such variations might help to better predict episodes of suicidal behavior.

Second, we found that the predictors of SI proportional persistence (i.e., proportion of years with SI) are quite different from the predictors of SI onset found in earlier analyses, even those using the same

Table 2
Predictors of Lifetime Suicide Ideation Proportional Persistence Among Respondents With a Preenlistment Onset That Began at Least 2 Years Before Interview (n = 2,577)

Predictor	Prevalence[a]		Univariate models[b,c]		Multivariate model[c]	
	% (Mean)	*SE*	*OR*	95% CI	*OR*	95% CI
Ideation onset (in decades)	1.5	0.0	0.6*	[0.5, 0.8]	0.6*	[0.5, 0.8]
Active ideation (vs. passive)	86.3	2.1	1.3*	[1.0, 1.6]	1.2	[0.9, 1.5]
Demographics, as of ideation onset						
Sex: Female (vs. male)	21.8	1.3	1.0	[0.8, 1.2]		
Race: Non-Hispanic Black (vs. Non-Hispanic White)	13.3	1.2	1.1	[0.8, 1.4]	1.1	[0.8, 1.4]
Race: Hispanic (vs. Non-Hispanic White)	9.4	1.2	0.8	[0.6, 1.0]	0.8	[0.6, 1.0]
Race: Other (vs. Non-Hispanic White)	6.9	0.7	1.2	[0.9, 1.7]	1.2	[1.0, 1.7]
F_3			3.4*	0.017	3.0*	0.028
Education: Student (vs. some college or more)	84.7	1.3	1.1	[0.7, 1.8]		
Education: HS or less (vs. some college or more)	13.1	1.2	2.2	[0.8, 2.1]		
F_2			0.7	0.52		
Mental disorders, as of ideation onset						
Attention-deficit/hyperactivity disorder	6.0	0.6	1.5*	[1.2, 1.9]	1.5*	[1.1, 2.0]
Bipolar disorder	2.9	0.4	1.6*	[1.2, 2.2]	1.6*	[1.0, 2.4]
Generalized anxiety disorder	21.1	1.1	1.2*	[1.0, 1.4]	1.1	[0.9, 1.5]
Intermittent explosive disorder	28.3	1.9	1.1	[1.0, 1.3]	1.1	[0.9, 1.4]
Major depressive episode	42.5	1.8	1.2*	[1.0, 1.4]	1.1	[0.9, 1.5]
Panic disorder	3.4	0.6	1.5*	[1.0, 2.1]	1.6*	[1.0, 2.6]
Posttraumatic stress disorder	22.6	1.6	1.1	[0.9, 1.4]	1.0	[0.7, 1.3]
Substance abuse or dependence	6.2	0.6	0.8	[0.5, 1.4]	0.7*	[0.4, 1.0]
$F_{8/4}$					4.0*	<.001

[a] Prevalence estimates were computed from a person-level dataset and measured at the year of ideation onset per respondent. Prevalence estimates reflect weighted data. [b] Univariate models controlled for ideation onset, years between onset and current age, and data stacks. The 10 predictor *OR*s for the nine dummy variables for the nine transitions and for the one single continuous variable for years since onset are not shown in the table. [c] Model estimates reflect weighted and multiply imputed data.
* Significant at the .05 level, two-sided test.

Table 3
Predictors of Lifetime Suicide Ideation Persistence Among Respondents With a Postenlistment Onset That Began at Least 2 Years Before Interview (n = 924)

Predictor	Prevalence[a]		Univariate models[b,c]		Multivariate model[c]	
	% (Mean)	*SE*	*OR*	95% CI	*OR*	95% CI
Ideation onset (in decades)	2.6	0.0	1.2	[1.0, 1.5]	1.2	[1.0, 1.5]
Active ideation (vs. passive)	76.9	2.4	1.4	[1.0, 1.9]		
Army characteristics, as of ideation onset						
Current years of service (in decades)	0.6	0.1	1.2	[0.7, 1.9]		
Component: regular army vs. guard-reserve	80.5	2.0	1.3	[1.0, 1.8]		
MOS: Combat arms (vs. combat service support)	30.7	2.5	1.2	[1.0, 1.5]	1.0	[0.8, 1.3]
MOS: Combat support (vs. combat service support)	25.2	2.1	1.7*	[1.2, 2.2]	1.7*	[1.3, 2.2]
F_2			6.8*	0.001	8.1*	<0.001
Rank: Junior (vs. officer)	49.2	1.9	1.1	[0.7, 1.6]		
Rank: Senior (vs. officer)	35.0	1.9	1.0	[0.7, 1.5]		
F_2			0.1	0.90		
Deployment: Currently (vs. never)	36.5	2.5	1.3*	[1.0, 1.6]		
Deployment: Previously (vs. never)	16.5	2.2	1.0	[.06, 1.5]		
F_2			2.8	0.06		
Demographics, as of ideation onset						
Sex: Female (vs. male)	14.8	1.8	0.7*	[0.5, 0.9]	0.7*	[0.5, 1.0]
Race: Non-Hispanic Black (vs. Non-Hispanic White)	19.1	1.9	0.8	[0.6, 1.0]		
Race: Hispanic (vs. Non-Hispanic White)	12.6	1.7	0.7	[0.5, 1.1]		
Race: Other (vs. Non-Hispanic White)	7.6	1.6	0.8	[0.5, 1.3]		
F_3			1.5	0.20		
Marital history: Previously (vs. currently)	5.7	0.9	0.9	[0.6, 1.4]		
Marital history: Never (vs. currently)	47.7	2.4	0.8	[0.6, 1.0]		
F_2			1.6	0.21		
Mental disorders, as of ideation onset						
Attention-deficit/hyperactivity disorder	14.3	2.1	2.1*	[1.6, 2.7]	1.8*	[1.4, 2.3]
Bipolar disorder	9.0	1.5	1.6*	[1.1, 2.5]	1.1	[0.8, 1.7]
Generalized anxiety disorder	47.0	3.0	1.3	[1.0, 1.7]	0.9	[0.6, 1.2]
Intermittent explosive disorder	36.4	2.4	1.4*	[1.1, 1.7]	1.1	[0.9, 1.4]
Major depressive episode	57.3	2.2	1.3*	[1.1, 1.7]	1.1	[0.9, 1.4]
Panic disorder	10.2	1.4	1.6*	[1.2, 2.2]	1.4*	[1.0, 2.0]
Posttraumatic stress disorder	47.4	2.6	1.7*	[1.4, 2.1]	1.6*	[1.3, 2.1]
Substance abuse or dependence	20.8	2.1	1.3	[0.9, 1.8]	1.1	[0.8, 1.5]
$F_{8/3}$					9.8*	<0.001

[a] Prevalence estimates were computed from a person-level dataset and measured at the year of ideation onset per respondent. Prevalence estimates reflect weighted data. [b] Univariate models controlled for ideation onset, years between onset and current age, and data stacks. The 10 predictor *OR*s for the nine dummy variables for the nine transitions and for the one single continuous variable for years since onset are not shown in the table. [c] Model estimates reflect weighted and multiply imputed data.
* Significant at the .05 level, two-sided test.

dataset. With regard to sociodemographics and Army career variables as predictors: whereas previously married, junior enlisted soldiers, and women were found in previous analyses to have significantly elevated lifetime presence of SI (Millner et al., 2017a, 2017b), we found here that marital status is not significantly associated with either type of persistence, that officers have SI persistence comparable with that of enlisted soldiers despite their comparatively low risk of SI onset, that sex is unrelated to SI proportional persistence among soldiers with SI preenlistment onset, and that women have significantly lower proportional persistence than men of SI with postenlistment onset. Soldiers with combat support occupations, who operate behind the scenes to support combat troops in areas such as engineering, intelligence, and communications, have significantly higher persistence than soldiers in combat arms (e.g., infantry) or combat service support (e.g., supply, transportation, maintenance) occupations, even though SI onset is highest among soldiers in combat arms.

Although active (vs. passive) SI had a small positive association with SI persistence in a univariate model, after controlling for other predictors, this association was no longer significant. This was surprising and suggests that passive SI can persist over time in the same way that active SI can. With regard to temporally primary lifetime mental disorders as predictors: Previous analyses have reported that a range of different mental disorders ae associated with significantly elevated risk of subsequent SI onset, with major depression being a considerably stronger predictor than other disorders (Millner et al., 2017a; Nock et al., 2008, 2010). In the current report, in comparison, only ADHD and panic disorder were consistently (i.e., in models for both preenlistment and postenlistment SI onsets) associated with SI persistence. Panic disorder, although not ADHD, has been linked with SI persistence in studies in the general population (Nock, Deming, et al., 2012). However, it is not clear why panic disorder or ADHD are associated with SI persistence. Both disorders have been linked with SI onset and can have a relatively chronic course, which may represent one reason for the observed association with SI persistence. However, this explanation is speculative and the observed associations in this study between panic and ADHD and SI persistence, although replicated across pre- and postenlistment onsets, could be spurious and may not replicate in future studies. Obtaining a clearer

understanding of the predictors of SI persistence represents another important direction for future research.

These differences between the predictors of SI onset and SI persistence are broadly reminiscent of evidence from a number of prior studies that the predictors of SI onset are quite different from the predictors of progression from SI to suicide plans and attempts (Bruffaerts et al., 2010; Nock et al., 2008, 2016; Stein et al., 2010). These differences in predictors of SI persistence versus onset signify that efforts to target secondary interventions for soldiers at highest risk of SI persistence may need to focus on different factors than those to target primary interventions aimed at preventing SI onset. Planned analyses of in-progress Army STARRS follow-up surveys will give us an opportunity to explore these distinct associations prospectively. Similar efforts among civilian samples are needed to test whether the patterns and predictors of SI persistence observed here are seen in people more generally.

The current findings should be viewed in the context of several key limitations. First, our ability to study persistence was limited in the AAS because we relied on retrospective reports with only a handful of questions about course of SI. This assessment did not include information about long-term fluctuations in SI, did not allow us to measure the persistence of passive and active SI for each respondent, and did not include a method for testing the reliability of the reports of SI persistence given by respondents. Second, and related, we also used retrospective self-reports of putative predictors of SI persistence, which in the case of mental disorders also involved the use of screening scales for some disorders. The use of self-reports of mental disorders may have led to underreporting in some respondents because of concerns about stigma and confidentiality, whereas the use of screening scales may have led to overestimates for some disorders. Although prior reports on Army STARRS have supported the validity of the assessment of mental disorders used in this study (i.e., via good agreement with semistructured clinical interviews; Kessler, Santiago, et al., 2013), these potential sources of bias remain an important consideration. Third, as we know that a positive association exists between psychopathology and early attrition from service (Lancaster et al., 2013; Niebuhr et al., 2013), informative right censoring of the SI persistence distribution might have led to an underestimation of proportional persistence in the sample and/or to bias in estimates of the predictors of proportional persistence even in the absence of recall bias. Future STARRS analyses of in-progress follow-up surveys with baseline AAS respondents, including those who left service, will be able to address the possibility of recall bias as well as loss to follow-up. Fourth, this initial report examined the patterns and predictors of SI persistence; however, we did not report here on the association between SI persistence and subsequent suicide attempts and suicide death. We are carrying out a National Death index search of deceased AAS respondents that will provide additional information on this association, as well as additional information about loss to follow-up.

These limitations notwithstanding, the current study provides previously unavailable information about the patterns and persistence of SI. We are hopeful that future studies will incorporate assessments of SI persistence over time, and that in turn a better understanding of SI persistence will help to advance the understanding, prediction, and ultimate prevention of suicidal behavior.

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Received December 11, 2017
Revision received June 21, 2018
Accepted June 25, 2018 ■