The Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS)

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On behalf of the Army STARRS collaborators

Importance/Objective: Although the suicide rate in the U.S. Army has traditionally been below age-gender matched civilian rates, it has climbed steadily since the beginning of the Iraq and Afghanistan conflicts and since 2008 has exceeded the demographically matched civilian rate. The Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS) is a multicomponent epidemiological and neurobiological study designed to generate actionable evidence-based recommendations to reduce Army suicides and increase knowledge about risk and resilience factors for suicidality and its psychopathological correlates. This paper presents an overview of the Army STARRS component study designs and of recent findings.

Design/Setting/Participants/Intervention: Army STARRS includes six main component studies: (1) the Historical Administrative Data Study (HADS) of Army and Department of Defense (DoD) administrative data systems (including records of suicidal behaviors) for all soldiers on active duty 2004–2009 aimed at finding administrative record predictors of suicides; (2) retrospective case-control studies of fatal and nonfatal suicidal behaviors (each planned to have n = 150 cases and n = 300 controls); (3) a study of new soldiers (n = 50,765 completed surveys) assessed just before beginning basic combat training (BCT) with self-administered questionnaires (SAQ), neurocognitive tests, and blood samples; (4) a cross-sectional study of approximately 35,000 (completed SAQs) soldiers representative of all other (i.e., exclusive of BCT) active duty soldiers; (5) a pre-post deployment study (with blood samples) of soldiers in brigade combat teams about to deploy to Afghanistan (n = 9,421 completed baseline surveys), with sub-samples assessed again one, three, and nine months after returning from deployment; and (6) a pilot study to follow-up SAQ respondents transitioning to civilian life. Army/DoD administrative data are being linked prospectively to the large-scale survey samples to examine predictors of subsequent suicidality and related mental health outcomes.

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Main outcome measures: Measures (self-report and administratively recorded) of suicidal behaviors and their psychopathological correlates.
Results: Component study cooperation rates are comparatively high. Sample biases are relatively small. Inefficiencies introduced into parameter estimates by using nonresponse adjustment weights and time-space clustering are small. Initial findings show that the suicide death rate, which rose over 2004–2009, increased for those deployed, those never deployed, and those previously deployed. Analyses of administrative records show that those deployed or previously deployed were at greater suicide risk. Receiving a waiver to enter the Army was not associated with increased risk. However, being demoted in the past two years was associated with increased risk. Time in current deployment, length of time since return from most recent deployment, total number of deployments, and time interval between most recent deployments (known as dwell time) were not associated with suicide risk. Initial analyses of survey data show that 13.9% of currently active non-deployed regular Army soldiers considered suicide at some point in their lifetime, while 5.3% had made a suicide plan, and 2.4% had attempted suicide. Importantly, 47–60% of these outcomes first occurred prior to enlistment. Prior mental disorders, in particular major depression and intermittent explosive disorder, were the strongest predictors of these self-reported suicidal behaviors. Most onsets of plans-attempts among ideators (58.3–63.3%) occurred within the year of onset of ideation. About 25.1% of non-deployed U.S. Army personnel met 30-day criteria for a *DSM-IV* anxiety, mood, disruptive behavior, or substance disorder (15.0% an internalizing disorder; 18.4% an externalizing disorder) and 11.1% for multiple disorders. Importantly, three-fourths of these disorders had pre-enlistment onsets.
Conclusions: Integration across component studies creates strengths going well beyond those in conventional applications of the same individual study designs. These design features create a strong methodological foundation from which Army STARRS can pursue its substantive research goals. The early findings reported here illustrate the importance of the study and its approach as a model of studying rare events particularly of national security concern. Continuing analyses of the data will inform suicide prevention for the U.S. Army.

INTRODUCTION

Although the suicide rate in the U.S. Army has traditionally been below age-gender matched civilian rates, it has climbed steadily since the beginning of the Iraq and Afghanistan conflicts and exceeded the rate for demographically matched civilians in 2008 (Kuehn, 2009; Nock et al., 2013). Textured research is needed to identify modifiable risk-resilience factors for Army suicides and to inform intervention efforts. The U.S. Army in 2008 entered into an agreement with the U.S. National Institute of Mental Health (NIMH) to fund the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS; www.armystarrs.org), a multicomponent epidemiological and neurobiological study of risk-resilience factors for suicidality and its psychopathological correlates among Army personnel. Army STARRS's goals are: to evaluate hypotheses about modifiable risk-resilience factors to help target preventive interventions for Army suicides; and to expand scientific knowledge of psychosocial and neurobiological risk-resilience factors for suicidal behaviors and their psychopathological

correlates. Army STARRS is funded as a Cooperative Agreement (U01) between NIMH and a multi-institutional team of scientific collaborators at the Uniformed Services University of the Health Sciences (USUHS; PI: Robert Ursano), the University of California San Diego (PI: Murray Stein), Harvard Medical School (Site PI: Ronald Kessler), and the University of Michigan (Site PI: Steven Heeringa) through the Henry M. Jackson Foundation. Additional U01 collaborating scientists and consultants come from the NIMH (Lisa Colpe and Michael Schoenbaum) and the Army (Kenneth Cox; Steven Cervosky). The Army STARRS includes a number of coordinated component studies designed to facilitate non-experimental hypothesis generation and testing, intervention targeting, and intervention evaluation. The current report presents a broad overview of these component studies.

THE RATIONALE FOR MULTICOMPONENT ASSESSMENT

The literature on risk-resilience factors for suicidality (Nock et al., 2008, 2013) makes it clear that suicidal behaviors develop through complex, multi-determined processes involving a large and diverse set of psychosocial and neurobiological factors. We concluded from this that Army STARRS needed a multicomponent design (see Table 1) with detailed assessment batteries. However, constraints on time provided by the Army to access soldiers led to the need for difficult decisions to be made regarding the constructs to assess and the necessarily short and efficient batteries to use in these assessments. Further, given that large samples were needed to test key hypotheses powerfully, large-scale group administration was needed to collect self-report data. Expert judgment was used to rank risk-resilience factors in order of expected importance, with particular attention to potentially modifiable factors that could be intervention targets. Literature reviews were used to select instruments to assess these constructs efficiently. Pilot studies were carried out to evaluate psychometric properties and develop short forms of selected instruments and to adapt neurocognitive test batteries for group self-administration. A number of methodological reports have either been published (Kessler, Santiago et al., 2013; Thomas et al., 2013) or are in preparation to describe these pilot studies and the psychometric properties of final instruments. We carefully considered the use of computer adaptive testing (CAT; Wainer, 2000) to shorten self-report batteries, but ended up not doing so due to lack of sufficiently large pilot studies to obtain stable parameter estimates for CAT branching.

ARMY STARRS COMPONENT STUDIES

The Historical Administrative Data Study (HADS)

The Army and Department of Defense (DoD) maintain a great many administrative data systems dealing with such diverse issues as training certification (Army Training and Requirements Resource System [ATRRS]), medical records (the Medical Data Repository [MDR] system), casualty reporting (Defense Manpower Data Center [DMDC/CASUALTY]), and, importantly for our purposes, suicidal behaviors (the DoD Suicide Event Report [DoDSER] system). The Army STARRS *Historical Administrative Data Study* (HADS) created an integrated individual-level dataset from 38 such systems to examine associations of administrative data with subsequent suicides and other adverse outcomes (e.g., sexual assault, other violent crime, accidental death). The HADS contains information on all the roughly 1.6 million soldiers on active duty at some time during calendar years 2004–2009. Planned analyses

TABLE 1. Army Starrs Component Studies

Historical Administrative Data Study (HADS)
Soldier Health Outcomes Studies A and B (SHOS-A/B)
New Soldier Study (NSS)
All Army Study (AAS)
Pre-Post Deployment Study (PPDS)
Pre-Post Separation Study (PPSS)

of the HADS data include an examination of trends in suicide and other types of death; correlates of non-fatal injuries (suicidal and others); and studies of a wide range of predictors of these and related outcomes.

Soldier Health Outcomes Studies A and B (SHOS-A/B)

The *Soldier Health Outcome Studies* are retrospective case-control studies of non-fatal suicide attempts (SHOS-A) and suicide deaths (SHOS-B) designed to provide rapid assessment of potentially important risk-resilience factors (Schlesselman, 1982). SHOS-A cases are psychiatric inpatients admitted for suicide attempts in selected military hospitals. These cases complete the same self-report surveys as in the Army STARRS All-Army Study (AAS; described below), allowing case-control analyses using AAS respondents as controls. A propensity score weight (Rosenbaum & Rubin, 1983) developed from AAS data for cases versus controls was used to select group-matched AAS respondents as controls for more in-depth assessments (web and telephone surveys, neuropsychological tests, blood samples). In addition, qualitative interviews with cases based on the principles of *reason analysis* (Strauss, 1987) are being used to examine critical junctures in the progression to suicide attempts. We anticipate a final SHOS-A sample of 150 cases and 300 matched controls. SHOS-B cases are selected from administrative data records of all Army suicides. As with SHOS-A, controls are selected from the AAS using propensity scores (Rosenbaum & Rubin, 1983), but in this case based on historical administrative data record variables. Telephone surveys are being carried out with next of kin and Army supervisors of SHOS-B cases and controls. As in SHOS-A, qualitative interviews are examining critical junctures in the progression to suicide. We anticipate a final SHOS-B sample of 150 cases and 300 controls.

The New Soldier Study (NSS)

With the main exception of those entering as officers, all 140,000–190,000 new soldiers entering the Army annually begin with basic combat training (BCT). The *New Soldier Study* (NSS) attempted to assess over 57,000 of these new soldiers in quarterly replicates in 2011–2012. Respondents completed a self-administered questionnaire (SAQ), took computer-administered neurocognitive tests, and starting in late 2011 provided blood samples while in reception battalion (RECBN) status. RECBN is where new soldiers go during their first few days of active duty to be processed (e.g., physical exams, immunizations, fitness tests, issuance of uniforms) before beginning BCT. A new RECBN cohort typically enters each week throughout the year. An Army STARRS sample was selected from each RECBN cohort on each of three BCT installations throughout 2011–2012. More details on NSS sampling and field procedures are presented elsewhere (Heeringa et al., 2013; Kessler, Colpe et al., 2013).

Army STARRS was assigned an auditorium holding 200–300 people at each RECBN installation. An Army point of con-

tact (POC) selected a sample of new soldiers equal to the number of seats in the auditorium to attend the weekly informed consent session. Army STARRS staff worked with the POCs to prevent systematic bias in selection procedures. Thirty-minute informed consent sessions explained study purposes, procedures, and protections (separation of identifying information from self-report data; assignment of a study ID to identifying information maintained securely by the data collection team; contractual agreement not to provide identifying information to the Army; protocols to coarsen de-identified public use datasets), emphasized the voluntary nature of participation, and answered questions before seeking informed consent.

Written informed consent was obtained from study volunteers. NSS respondents were additionally asked for consent to link their administrative data records to their self-reports and to participate in to-be-determined longitudinal follow-up data collections. Personally identifying information (name, birthday, SSN for record linkage; telephone number, email, secondary contact information for longitudinal follow-up) was collected separately and never merged with de-identified self-report data. These recruitment, consent, and data protection procedures 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 implementing all Army STARRS surveys), and all other collaborating organizations.

SAQ and neurocognitive test data were obtained in two 90-minute group-administered sessions over successive days. Beginning in the last quarter of 2011 (due to a delay in institutional review board [IRB] approval of blood collection), blood samples were also provided. A total of 50,765 respondents completed the SAQs (88.8% cooperation rate), 39,132 of whom also agreed to administrative data linkage (74.2% cooperation rate), while 33,088 completed the SAQ and provided blood samples (80.1% cooperation rate among soldiers interviewed after blood collection began) and 27,807 provided complete data (i.e., SAQ, administrative data, and blood; 67.3% cooperation rate).

The All Army Study (AAS)

The *All Army Study* (AAS) is a cross-sectional SAQ survey carried out throughout 2011–2012 in quarterly samples of active duty Army personnel exclusive of those in BCT. The total target sample was approximately 50,000. Unlike NSS, no neurocognitive tests or blood were collected in AAS. The SAQ was also considerably shorter than in the NSS (one 90-minute SAQ compared to two in NSS). Each quarterly AAS replicate consisted of a stratified (by Army Command and location) probability sample of Army units (or, for large units, sub-units) selected without replacement with probabilities proportional to authorized unit strength to yield a representative time-space sample. The sample also excluded units of fewer than 30 soldiers (which contain less than 2% of all active duty Army personnel). More details on AAS sampling and field procedures are presented elsewhere (Heeringa, et al., 2013; Kessler, Colpe et al., 2013). The AAS was subsequently augmented in two ways to increase coverage. First, it was administered in Q2–3 2012 to a probability sample of soldiers stationed in Afghanistan by holding group-administered sessions while soldiers were in Kuwait leaving for or returning from mid-tour leave. (Mid-tour leave occurred at random times between the second and second-to-last months of deployment, guaranteeing SAQ administration at relatively random times other than at the very beginning or very end of deployment.) Second, the AAS was administered Q3 2012 through Q1 2013 to a supplemental sample of activated USAR and USANG units in the continental United States, either just before or just after deployment to Afghanistan.

All personnel in each selected AAS unit (or sub-unit) were ordered to report to a group informed consent session similar to NSS, while AAS respondents from Afghanistan were selected individually for group consent sessions. As in NSS, AAS respondents were additionally asked for consent to link Army and DoD administrative records to their SAQs and to participate in to-be-determined longitudinal follow-up studies. These procedures were approved by the Human Subjects Committee of all collaborating organizations. A projected 35,372 respondents provided complete SAQ data (a projected 94.1% cooperation rate among soldiers attending the consent session), although final tabulations are not yet available. A projected 24,266 AAS SAQ respondents also agreed to administrative data linkage (a projected 65.1% cooperation rate). The projected AAS cooperation rate is a good deal higher than in some other major military surveys in comparable samples (Bray et al., 2006; Ryan et al., 2007).

The Pre-Post Deployment Study (PPDS)

While a number of targeted Army STARRS follow-up surveys are planned for the future, only two are currently being implemented. The larger one is the *Pre-Post Deployment Study* (PPDS), a four-wave panel survey collecting baseline data (T0; SAQ and blood samples suitable for analysis of DNA, RNA, and plasma analyses) in Q1 2012 from 9,421 soldiers in three Combat Brigade Teams shortly before deployment to Afghanistan (97.9% SAQ cooperation rate, 77.2% also including linkage to administrative records, 82.4% SAQ and blood and 67.9% SAQ, administrative data linkage and blood). Follow-up data collections occur within one month of return from deployment (T1; SAQ and blood), two months later (T2; SAQ), and six months after T2 (T3; SAQ). The baseline SAQ was group administrated using recruitment-consent and administration procedures comparable to NSS and AAS. A mixed-mode web-telephone survey design will be used, in comparison, at T3.

The Pre-Post Separation Study (PPSS) Platform

The number of soldiers leaving the Army and returning to civilian life each year, although roughly comparable to the number joining, will increase as the Army downsizes with the end of the Afghanistan war. The transition from military to civilian life is known to be stressful (Hoge, 2010; Wolpert, 2000) and will presumably become more so with an increase in the number of soldiers who want to remain in the Army but must return to civilian life instead. Recognizing that up to 1,500 PPDS respondents will be civilians within nine months of returning from deployment, the T3 PPDS uses methods to track soldiers who have left the Army and includes a number of questions about this transition. Based on concerns about the mental health of new veterans (Conner et al., 2013; Ilgen et al., 2012; Kaplan, Huguet, McFarland, & Newsom, 2007), a *Pre-Post Separation Study* (PPSS) platform was incorporated into Army STARRS building on this T3 PPDS experience. This platform will use the same tracking and data collection methods developed for T3 PPDS to track and follow up soldiers who have left active duty after participating in Army STARRS component studies. This pre-post separation platform will play a more prominent role in future Army STARRS data collections as the number of respondents returning to civilian life increases.

DATA ADJUSTMENTS

Two case-level weights are being used to adjust for non-response in the large-scale Army STARRS surveys. The first (WT1) adjusts for differences between SAQ respon-

dents who did versus did not consent to administrative data linkage. The second adjusts for differences between weighted (WT1) estimates of SAQ respondent characteristics and population distributions for selected administrative data variables. Both weights are based on iterative stepwise logistic regression analysis. WT1 is the inverse of the probability of agreement to link administrative data with SAQ data among SAQ completers. WT2 is the inverse of the joint probability of SAQ completion and administrative data linkage. The WT1 logistic regression analysis found that soldiers with self-reported mental disorders were somewhat more likely than others to agree to administrative record linkage. The WT2 logistic regression analysis found a number of substantively modest differences between respondents and the population in administrative record variables. Consolidated weights (i.e., WT1 × WT2) had a relatively narrow range and were fairly symmetric in distribution. More details on these weights are presented elsewhere (Kessler, Colpe et al., 2013).

Conventional methods of estimating statistical significance assume a simple random sample and do not take into consideration the imprecision introduced by weighting or by the time-space clustering used in Army STARRS sampling. A convenient way to characterize the effects of weighting and clustering on estimates is the *design effect* (DE; Kish, 1965): the square of the ratio of the design-based standard error (SE) of a descriptive statistic divided by the simple random sample SE. Efficiency of the Army STARRS survey designs was examined by calculating DE for prevalence estimates of a number of SAQ outcomes (self-reported suicide ideation and various *DSM-IV* mental disorders). DEs were all quite low (1.0–1.9), meaning that the Army STARRS complex sample designs are nearly as efficient as simple random samples for estimating prevalence of key Army STARRS measures (Kessler, Colpe et al., 2013).

RECENT FINDINGS

In the HADS, the Army STARRS team recently examined the suicide and accident death rates in relation to basic sociodemographic and Army experience factors in the 975,057 Regular Army soldiers who served between January 1, 2004 and December 31, 2009. Importantly, the suicide rate, which rose over this time period, increased for those deployed, those never deployed, and those previously deployed (Schoenbaum et al., 2014). Those deployed or previously deployed were at greater risk, while the accident death rate during this same time period decreased for those deployed, trended upward for those never deployed, and was unchanged for those previously deployed. The rate of suicide deaths was lower for females than males as is also seen in civilian populations. However, this usual gender difference narrowed substantially during deployment. Receiving a waiver to enter the Army was not associated with increased risk of suicide. However, being demoted in the past two years increased risk among those who were deployed, previously deployed, and never deployed. Interestingly the individual level sociodemographic and Army career predictors of accidents were very similar. Currently and previously deployed soldiers in their first four years in service had a higher rate of suicide than those who had never deployed. Perhaps unexpectedly, time in the current deployment, length of time since return from the most recent deployment, total number of deployments, and interval between the two most recent deployments (known as dwell time) were not associated with suicide risk (Gilman et al., 2014).

In the AAS, Army STARRS recently reported on a representative sample of more than 5,000 non-deployed soldiers to assess lifetime suicidal behavior in non-deployed soldiers (Nock, Stein et al., 2014). About 13.9% of soldiers had considered suicide at

some point in their lifetime, 5.3% had made a suicide plan, and 2.4% had attempted suicide. Importantly, 47–60% of these outcomes first occurred prior to enlistment. More than one-third (38.5%) of ideators developed suicide plans and 17.1% made an attempt. Roughly one-third (34.4%) of ideators with a plan went on to make attempts compared to 6.3% of ideators without a plan, resulting in roughly 80% of first attempts being planned. Analyses using age of onset indicated the importance of the past year in suicide thoughts plans and attempts: 62.4% of transitions from ideation to plans and 58.3% from ideation to attempts occurred within one year of onset of ideation, while 63.3% of transitions from plans to attempts occurred within one year of onset of plans.

Prior mental disorders, in particular major depression and intermittent explosive disorder, were the strongest predictors of these suicidal behaviors. Five mental disorders were associated with post-enlistment first suicide attempts after controlling for all mental disorders simultaneously. Interestingly pre-enlistment panic disorder and PTSD were associated with a lower risk of post-enlistment first suicide attempts, while post-enlistment depression and both pre- and post-enlistment intermittent explosive disorder were associated with increased risk of post-enlistment first suicide attempt. Intermittent explosive disorder was noted to be the strongest predictor and of special importance because it is the only disorder that predicted going on to make a suicide attempt among those with suicidal thoughts. The findings have important implications for screening and prevention, since they highlight that it is not only depression and PTSD but also uncontrollable anger attacks that predict suicide attempts.

Given the importance of mental disorders to suicide risk, Army STARRS has done detailed analyses of mental disorder onset and risk in the U.S. Army using the same sample as above (Kessler, Heeringa et al., 2014). About 25.1% of non-deployed U.S. Army personnel met 30-day criteria for a *DSM-IV* anxiety, mood, disruptive behavior, or substance disorder (15.0% an internalizing disorder; 18.4% an externalizing disorder) and 11.1% for multiple disorders. Importantly, three-fourths of these disorders had pre-enlistment onsets. Pre-enlistment onset disorders were not only more common but also more impairing than disorders with post-enlistment onsets, highlighting the importance of early identification and resilience/prevention interventions. Current mental disorders are much more common among non-deployed U.S. Army soldiers than sociodemographically matched civilians (25.1% vs. 11.6%). The vast majority (76.6%) of such soldiers say their disorders started before enlistment. Nearly 60% of reported soldier suicide attempts were associated with these disorders.

Some of the differences in disorder rates between U.S. Army and a comparable civilian sample from the National Comorbidity Study Replication were substantial. The rate of major depression was five times as high among soldiers as civilians; intermittent explosive disorder was six times as high; and PTSD nearly 15 times as high. Further study of these findings is needed. The most common disorders in the Army STARRS survey were attention-deficit hyperactivity disorder (ADHD) and intermittent explosive disorder (IED; which is characterized by recurrent and uncontrollable anger attacks).

Comparisons of disorder onset ages reported by Army STARRS survey respondents with disorder onset ages reported by respondents in the comparison civilian survey suggested that soldiers did not have higher rates of "internalizing" disorders (anxiety disorders and depression) than civilians before enlistment, but rather developed significant rates of these disorders after they enlisted in the Army. The situation was different for "externalizing/behavioral disorders" (ADHD, IED, and substance abuse), which were much more common among young people who had enlisted in the Army prior to their enlistment than the comparison group and increased after enlistment. Nearly

half of current soldier internalizing disorders and 80% of externalizing/behavioral disorders started before enlistment

DISCUSSION

As noted above, the Army STARRS component studies were designed to create a coordinated whole to facilitate non-experimental hypothesis generation and testing, intervention targeting, and intervention evaluation. The individual study designs are for the most part conventional, but their coordination creates unique strengths and opportunities to address findings across the component parts of the study. This is illustrated in SHOS-A/B study designs. While a number of retrospective case-control studies have previously studied risk-resilience for suicidal behaviors (Bridge et al., 2012; Cavanagh, Carson, Sharpe, & Lawrie, 2003; Dumais et al., 2005; Nock et al., 2010), the integration of SHOS-A/B with the AAS creates a unique opportunity to address the problem of suboptimal control group selection that has plagued previous studies. Specifically, while it is well known that conclusions about risk-resilience factors depend critically on the control group selected in case-control studies (Brent et al., 1988; Brent et al., 1993; Schlesselman, 1982), most previous case-control studies of suicidal behaviors used inefficient control groups of healthy people randomly selected from the general population (but not matched on widely known risk factors such as the presence of a mental disorder) or biased samples of psychiatric patients selected in an effort to control for the presence of a mental disorder (but not representative of the broader population of those at risk, many of whom commit suicide without ever seeking professional treatment for their emotional problems). This weakness was addressed in SHOS-A/B by using propensity score methods (Rosenbaum & Rubin, 1983) to select probability samples of AAS respondents as controls, allowing for much more sensitive and unbiased case-control comparisons than previous studies (Li, Shen, Wu, & Li, 2011).

Similarly, SHOS-A/B and Army STARRS survey data are enriched by being linked with a vast assortment of administrative records as well as biospecimens suitable for genomic and other biological analyses. Links to prospective administrative data records are of special importance in this regard, as they facilitate a wide range of investigations otherwise impossible in cross-sectional studies. For example, we are currently analyzing NSS data linked to prospective administrative data to determine the extent to which risk-resilience factors assessed at the very beginning of active duty can help pinpoint new soldiers at high risk of suicidal behaviors and other serious adverse outcomes during initial years of Army service.

It is noteworthy that even though the Army STARRS primary data are *de-identified*, they are *not anonymous*. As anonymity can influence survey reports of embarrassing behaviors (Gadermann et al., 2012; Turner et al., 1998), a strategic design decision was made to allow Army STARRS survey respondents to provide completely anonymous SAQs and to ask separately for identifying information to link self-report data to administrative data records. An important methodological finding was that the AAS and PPDS SAQ cooperation rates (94.1–97.9%) were similar to those in anonymous surveys of comparable military samples (Bray et al., 2009; Hoge et al., 2004). This was true even though the proportions of eligible respondents attending the Army STARRS survey consent sessions were higher than in previous military surveys, suggesting that less self-selection of cooperative soldiers occurred in Army STARRS and making it all the more striking that the AAS and PPDS SAQ cooperation rates were comparable to earlier military surveys.

The ability to compare SAQ reports of survey respondents who consented to administrative record linkage with those of SAQ respondents who did not consent to re-

cord linkage is a unique feature of the Army STARRS design that allows examination of bias associated with obtaining this consent. Based on previous research (Kessler, Little, & Groves, 1995), we expected that SAQ respondents who consented to linkage would have lower rates of self-reported mental disorder than those who did not consent. The fact that the opposite was the case is striking. This finding demonstrates that it was important to weight the SAQ data to correct for bias, but that the over-representation of soldiers with the outcomes of interest (i.e., suicidality and mental disorders) improved efficiency in estimating prevalence and correlates of these outcomes. The methodological characteristics built into Army STARRS will aid in its success toward achieving its substantive goals.

Overall the recent study results provide important information and indicate the rich data and valuable information that Army STARRS is already generating (Friedman, 2014). The study design is a model for research on rare events, particularly ones of national security importance. Present results have dispelled some widely held assumptions on the causes of the increased rates of suicide in the U.S. Army and indicate new areas for intervention. The importance of the stressors of U.S. Army from deployment to demotion, the risk of suicide in the U.S. Army associated with mental disorders (in particular externalizing disorders), and the importance of identifying those at risk at various stages of the career cycle are highlighted in these studies. Identifying algorithms to predict risk, target groups at increased risk, and developing interventions/resilience building for those at early career entry are important opportunities.

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Additional Contributions: The Army STARRS team consists of co-principal investigators: Robert J. Ursano, M.D. (Uniformed Services University of the Health Sciences) and Murray B. Stein, M.D., MPH (University of California San Diego and VA San Diego Healthcare System); site principal investigators: Steven Heeringa, Ph.D. (University of Michigan) and Ronald C. Kessler, Ph.D. (Harvard Medical School); NIMH collaborating scientists: Lisa J. Colpe, Ph.D., MPH and Michael Schoenbaum, Ph.D.; Army liaisons/consultants: Col. Steven Cersovsky, M.D., MPH (USAPHC) and Kenneth Cox, M.D., MPH (USAPHC). Other team members: Pablo A. Aliaga, M.A. (Uniformed Services University of the Health Sciences); Col. David M. Benedek, M.D. (Uniformed Services University of the Health

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