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Prevalence and Risk Factors Associated With Suicides of Army Soldiers 2001–2009

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Prevalence and risk factors associated with soldiers' suicides 2001–2009 (N = 874) were examined. Army suicide rates increased from 9 per 100,000 in 2001 to 22 per 100,000 in 2009. Soldier suicides were lower than civilians from 2001 to 2007, but higher than civilians after 2007. Army suicides were disproportionately higher for men, deployment experience, and a history of a mental health diagnosis/treatment; and lower for African Americans. Many involved planning (38%), communication (21%), alcohol (19%), or drugs (8%). Many had legal problems (31%), high stress loads (90%), a history of self-injury (10%), and other contributing factors prior to entry into the Army (31%). Implications for understanding suicide among military personnel are discussed.

Contemporary research on suicide in the general population has shown that biological, psychosocial, and environmental factors interact to influence suicide-related deaths each year (Brown, 2006; Ellis, 2007; Leenaars, 2008; Lester,

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2004; Lester, 2008; Schneidman, 1996). Research on biological risk factors suggests that genetic vulnerability to mental disorders, serotonin insufficiency, and serious physical illness or injury are particularly linked to suicide-related deaths (Heeringen, 2001; Mann, 2002; Mann, 2003; Moscicki, 2001; Roy, Rylander, & Sarchiapone, 1997). Similarly, research on psychological risk factors has also linked mood, anxiety, and personality-related disorders, as well as alcohol and substance disorders, with suicide-related deaths (Conner, Duberstein, Conwell, Seidlitz, & Caine, 2001; Harris & Barraclough, 1997; Nock et al., 2009; Simon, 2006), while other research has linked suicidal behavior with hopelessness, impulsivity, aggression, a history of trauma or abuse, and any previous suicide attempt (Beck, Brown, Berchick, & Stewart, 1990; Brown, 2006; Brown, Jeglic, Henriques, & Beck, 2006; Linehan, 1993; Martin, Ghahramanlou-Holloway, Lou, & Tucciarone; 2009; Schneidman, 1996).

Research on sociocultural risk factors suggests that race/ethnicity, marital status, lack of social support, a sense of isolation or not belonging, social losses, financial difficulties, stigma associated with help-seeking, and suicide as a noble or acceptable resolution of a personal dilemma associated with cultural or religious beliefs are correlated with suicide-related deaths (Clarke, Bannon, & Denihan, 2003; Kerkhof & Arensman, 2001; Kõlves, Ide, & De Leo, 2010; Kposowa, 2000; Leenaars, 2008; Lester, 2008; Mann et al., 2005; Sartorius, 2007). Moreover, research on environmental risk factors indicates that access to lethal weapons and barriers to health care contribute to suicide-related deaths (Martin et al., 2009; Simon, 2006). Studies on the prevalence and risk factors associated with suicide-related deaths in military personnel have reported similar results. Specifically, mental disorders, substance abuse, physical illness, stigma, family separation, occupational difficulties, and relationship losses have been linked to suicide-related deaths among military personnel (Cox, Edison, Stewart, Dorson, & Ritchie, 2006; Ritchie, Keppler, & Rothberg, 2003).

This research has advanced our understanding of the prevalence and correlates of suicide-related deaths among military personnel. However, it is worth noting that little of this research has examined specific risk factors in relation to trends in Army suicides, particularly over the past decade, that is, 2001–2009. Examining the prevalence and risk factors associated with suicide-related deaths among Army personnel is particularly important given increasing operational demands associated with ongoing operations in Afghanistan and Iraq. In fact, research indicates that stress associated with deployment, combat intensity, and the potential shame of failure or weakness—all of which are known to increase the risk for mood disorders, anxiety disorders, post-traumatic stress disorder (PTSD), and substance-related disorders—have been linked to suicide-related deaths among military personnel (Allen, Cross, & Swanner, 2005; Bodner, Ben-Artzi, & Kaplan, 2006; Hill, Johnson, & Barton, 2006; Hoge et al., 2008; Rand Center for Military

Health Policy Research, 2008). Moreover, it is worth noting that many of these risk factors may be accompanied by increased availability of firearms within the military as compared to civilian society (Marzuk et al., 1992).

Additionally, certain risk factors may differentially impact military personnel. For example, the loss of friends, particularly those assigned to the same unit, can have a deep impact, whether in combat or not (Kang & Bullman, 2008). Stress may be greater in the Army population because of increased dependence on social support provided by friends and coworkers in the military environment (Mahon, Tobin, Cusack, Kelleher, & Malone, 2005). Externalized psychopathology (drug and particularly alcohol abuse or dependence) may be more evident in the military due to greater cultural acceptability of these behaviors (Hills, Afifi, Cox, Bienvenu, & Sareen, 2009). Stigma associated with help-seeking behavior or treatment may also be more prevalent in the military, because mental illness is often viewed as a manifestation of weakness or malingering, as well as a threat to one's career (Hoge et al., 2008; Rand Center, 2008).

In the present study, we examine the prevalence and risk factors associated with suicide-related death among Army soldiers from 2001 to 2009. Specifically, we describe the epidemiology of Army suicides with regards to sociocultural and military risk factors, as well as psychological and environmental risk factors. Additionally, drawing on the stress-diathesis model suggested by Mann and colleagues (Mann, 2002; Mann, 2003; Mann et al., 2005), and the distal-proximal model proposed by Moscicki (2001), which emphasize the synergistic effects of stress and psychopathology on the genetic-biological underpinnings of suicide, we examine the synergistic effect of multiple risk factors (termed stress-load) on suicide-related deaths among Army soldiers. Specifically, we expect that as the number of stressors increase, there will be a corresponding increase on stress-load, which will influence suicide (Beck et al., 1990; Brown et al., 2006; Heeringen, 2001; Institute of Medicine, 2007; Schniedman, 1996). Studying the effects of stress-load on suicide is particularly relevant in the Army, where stress-load may increase more rapidly, with less time for coping and adjustment. This stress may not simply be the result of increased op tempo but may be due to guilt, anger, or humiliation that can accompany the stress of a relationship breakup, legal problems, or poor work performance (Mahon et al., 2005).

METHOD

Data and Procedures

Data from 874 suicide cases were used for analyses in the present study. These data were selected from the Army Behavioral Health Integrated Data Environment (ABHIDE), which maintains records on all suicide cases involving U.S. Army

soldiers from 2001 to 2009. Data included information on sociocultural and military risk factors, psychological and environmental risk factors, and suicide event characteristics described below. Army-wide comparison data were obtained from the Defense Medical Surveillance System database (DMSS) and the Armed Forces Medical Examiner System of the Armed Forces Institute of Pathology.

Measures

Sociocultural and military risk factors. Data on sociocultural and military risk factors included data on gender (male-female), age, race/ethnicity (Caucasian-White, African American, Hispanics/Others), marital status (single-never married, married, and divorced, separated, or widowed), rank (junior-senior enlisted, junior-senior officer), component status (regular, reserve/National Guard) and deployment history (never deployed vs. ever deployed) obtained from the Department of Defense Manpower Data Center (DMDC).

Psychological risk factors. Data on psychological risk factors included mental health history for both inpatient and outpatient encounters obtained from the Defense Medical Surveillance System database (DMSS). Data included mental health diagnoses on mood-related disorders (e.g., major depression, bipolar disorder, dysthymia, depressive disorder NOS), adjustment reaction disorder, anxiety disorders, post-traumatic stress disorder, acute stress disorder, personality disorders, schizophrenia, and paranoid disorders, as well as substance-related disorders. All diagnoses were based on ICD-9 codes from *Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death* (9th ed; World Health Organization, 1977). Previous suicide attempts were assessed with ICD-9 E-codes, and previous suicidal ideations were assessed with ICD-9 V-codes. Up to eight diagnoses were recorded for inpatient encounters, and up to four diagnoses were recorded for outpatient encounters. Individuals could be diagnosed with multiple disorders; thus, suicides were categorized as having any diagnosis of a mental disorder and having more than one disorder.

Suicide event characteristics and environmental stressors. Data on suicide event characteristics and environmental stressors were obtained from the Department of Defense Suicide Event Reports database (DoDSER). Data on suicide event characteristics included alcohol or drug involvement; evidence of planning, communication prior to event, and prior self-injury; evidence of childhood contributing factors (e.g., abuse, history of familial suicide, history of mental health disorders prior to joining the Army); whether or not the soldier had received suicide prevention training; and whether the suicidal act was deployment-related (prior to, during, or subsequent to a deployment). Data on environmental stressors

included history of legal problems (e.g., an Article 15, a court martial, administrative separation, nonselection for promotion, medical board, being absent without leave, or civil legal problems) as well as history of personal problems (e.g., relationship problems; physical health problems for either the soldier or a family member; the death or suicide of a spouse, family member, or friend; financial problems; military or work stress; being the victim of abuse; being the perpetrator of abuse; use of the Family Advocacy Program; or use of substance abuse services). Cause of death information was obtained from the Defense Casualty Information Processing System (DCIPS).

Stress load. Stress load for each case was computed by summing across risk factors identified within each case. We considered mental health diagnoses, current or previous deployment, and individual legal problems, as well as the number of personal stressors associated with each suicide.

RESULTS

We examined prevalence rates and risk factors associated with suicides of Army soldiers from 2001 to 2009. Specifically, we examined sociocultural and military risk factors, as well as psychological risk factors and suicide event characteristics for all Army suicides (n = 874) and compared them to available data for Army personnel over the same time period (i.e., 2001–2009). We also examined environmental stressors associated with Army suicides with data from 82% of cases, which included information on environmental stressors.[1] Mortality rates and relative risks (RR) were calculated for selected variables within each of the three types of risk factor we examined. We employed χ^2 tests with the Yates correction for continuity and logistic regression to evaluate the relative importance of each of the factors available in the data. All analyses were conducted with SAS Version 9.2 (SAS Institute, Inc., 2009).

Prevalence of Suicide Among Army Soldiers 2001–2009

Table 1 shows the number and rates of suicides for Army soldiers from 2001 to 2009. As can be seen from Table 1, suicide rates more than doubled from 9.0 per 100,000 in 2001 to almost 22 per 100,000 in 2009. This pattern of results was evident across all Army components, including active duty as well as the reserve and National Guard. Most of these suicides occurred within the U.S. (75%), 20% occurred in combat theater, and less than 5% occurred elsewhere.

[1]A total of 557 cases of the 682 Army suicides from 2004 to 2009 had DoDSER data on environmental stressors.

TABLE 1
Number and Rate per 100,000 Person-Years of Suicides Involving U.S. Army Soldiers

Suicides	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*
Army suicides									
Total	52	70	79	67	87	102	115	140	162
Active duty	47	55	62	54	63	88	93	119	146
Reserve/National Guard	5	15	17	13	24	14	22	21	16
Army suicide rate per 100,000									
Total	9.0	11.5	11.4	9.6	12.7	15.3	16.8	20.2	21.9
Active duty Army	9.8	11.3	12.4	10.8	12.8	17.2	18.1	22.2	—
Reserve/National Guard	5.3	12.4	8.7	6.4	12.4	9.3	14.4	13.6	—
Civilian adjusted rate by age & gender	18.4	18.5	18.2	18.4	18.1	18.0	18.2	—	—

Note. Data obtained from Army G-1 and National Vital Statistics System. (—) = rate not available.

The most common method of suicide involved gunshot wounds (66%) and hanging or asphyxiation (20%). Men were somewhat more likely to die by gunshot wounds, whereas women were somewhat more likely to die from drug overdoses.

To further examine these data, we compared Army suicide rates against those found in comparable data for U.S. civilians from 1990 to 2009. As shown in Figure 1, suicide rates among Army soldiers and U.S. civilians were declining from 1990 to 2004. However, there was a sharp increase in Army suicide rates in 2004 and no comparable increase among U.S. civilians. In fact, from 2001 to 2007 (the latest year national statistics were available), the adjusted suicide rates of U.S. civilians were fairly stable, ranging from 18.0 to 18.5 per 100,000, and the Army rate was lower than the civilian rate. However, Army suicide rates exceeded age- and race-adjusted U.S. civilian rates in 2008 (Centers for Disease Control and Prevention, 2010; Nock et al., 2008). In 2008, the Army rate (20.2 per 100,000) exceeded the expected rate for civilians and climbed even higher in 2009 (21.9 per 100,000). Analysis of the trend over time indicates that the rates increased significantly over the 9-year period (Kendall tau = 0.824, $p < .001$). Increases observed from 2005 to 2009 may be associated with increased deployments as a result of Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom in Iraq (see Figure 1).

Sociocultural and Military Risk Factors Associated With Suicides Among Army Soldiers

Table 2 presents analyses of sociocultural and military risk factors associated with suicides of Army soldiers from 2001 to 2009. As can be seen in Table 2, more men committed suicides then women, 94.6% vs. 5.4%, respectively. The rate

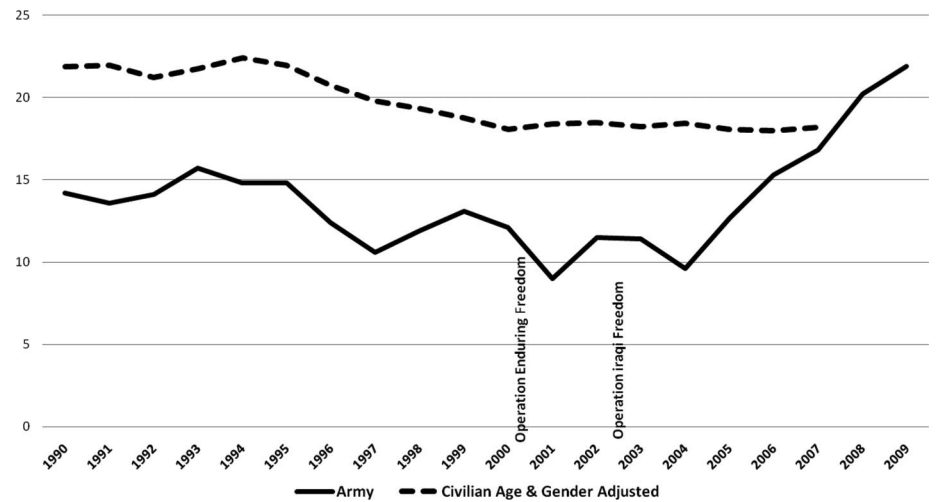

FIGURE 1 Civilian and Army suicide rates for 1990–2009.

SOURCE: CDC/NCHS, National Vital Statistics System (Comparable civilian rates only available from 1990–2007) and US ARMY G-1.

TABLE 2
Sociocultural and Military Risk Factors Associated With Suicide of Army Soldiers

	2001–2009		*ARMY*		*Mortality Rate*	*Risk*
Risk Factor	*N*	*%*	*N*	*%*	*Per 100,000*	*Relative*
Sociocultural Risk Factors						
Gender						
Women	47	5.4	897,204	20.5	5.24	*RG*
Men	827	94.6	3,479,400	79.5	23.77	4.54*
Average age[a]	28			25*		
Aged 18–24	392	44.8	2,118,276	48.4	18.51	*RG*
Aged 25–34	310	35.5	1,518,682	34.7	20.41	1.10
Aged 35–60	172	19.7	739,646	16.9	23.30	1.26
Race/ethnicity						
Caucasian/White	655	74.9	3,168,661	72.4	20.67	*RG*
African American	110	12.6	774,659	17.7	14.20	0.69*
Hispanic and other	109	12.5	433,284	9.9	25.16	1.22
Marital status						
Single	406	46.5	2,026,368	46.3	20.04	*RG*
Married	411	47	2,070,134	47.3	19.85	0.99
Div./sep./widowed	57	6.5	280,103	6.4	20.35	1.02
Military Risk Factors						
Rank						
E1-E4	502	57.4	2,538,430	58.0	19.78	0.98
E5-E9	290	33.2	1,413,643	32.3	20.51	1.01
O1-O3/W1-W3	51	5.8	271,349	6.2	18.79	0.93
O4-O9/W4-W5	31	3.6	153,181	3.5	20.24	*RG*
Component						
Active duty	732	83.8	3,571,309	81.6	20.50	1.16
Reserve/National Guard	142	16.2	805,295	18.4	17.63	*RG*
Deployment status						
Never deployed	311	35.6	1,798,784	41.1	17.29	*RG*
Ever deployed	563	64.4	2,577,820	58.9	21.84	1.26*

Note. (RG) = Reference Group. (a) $t = 1964.7$, $p < .001$. (*) $p < .001$.

for men was considerably higher than their population representation rate in the Army ($\chi^2[1, N = 4{,}377{,}478] = 121.70$, $p < .001$). In fact, the relative risk rate was 4.54% higher for men than women (95% CI = 3.38–6.22). Army suicides were significantly older on average than the overall Army, though comparable proportions fell into each age category in comparison to the overall Army. The largest proportion of suicides involved soldiers aged 18 to 24, which was 45%. The distribution of suicides across racial-ethnic groups or marital status did not significantly differ from the overall Army; however, African Americans were at lower risk for suicide than Caucasians ($\chi^2[2, N = 4{,}377{,}478] = 13.11.70$, $p < .001$). The

relative risk rate was .69% lower for African Americans than for Caucasian/White Soldiers (95% CI = 0.56–0.84).

With regard to military risk factors, a substantial proportion of suicides involved active duty soldiers (84%), with an additional 5% and 11% of suicides involving reserve and National Guard soldiers respectively. The highest proportion of suicides involved junior enlisted soldiers (57%), followed by senior enlisted soldiers (33%), with substantively smaller rates for both junior and senior Army officers, 5.8% and 3.6% respectively. Suicide rates for component and rank were proportional to their population representation rates for the Army during the same time period. We also found that individuals with deployment histories were at elevated risk for suicide as compared with individuals who never deployed, 64.4% vs. 35.6%, respectively, $\chi^2(1, N = 4{,}377{,}478) = 10.76$, $p < .001$. The relative risk rate was 1.26 higher among individuals with some deployment when compared to those who never deployed (95% CI = 1.10–1.46).

Psychological Risk Factors Associated With Suicides of Army Soldiers

Table 3 presents analyses of psychological risk factors associated with suicides of Army soldiers from 2001 to 2009. Approximately 54% of suicides were not reported to have a mental health (MH) diagnosis, whereas 46% had received a diagnosis involving an MH diagnosis and 31% had received more than one MH diagnosis (see Table 3). The relative risk rates for soldiers with a history of an MH diagnosis was 4.7% higher than for soldiers without any history of an MH diagnosis, $\chi^2(1, N = 4{,}377{,}478) = 631.45$, $p < .001$. A similar pattern of results was also observed when comparing soldiers with an MH diagnosis who sought inpatient vs. outpatient care. Specifically, the relative risk rate for soldiers with a history of inpatient care for any MH diagnosis was 19.82% higher than for soldiers with no history of MH diagnosis, $\chi^2(1, N = 3{,}754{,}768) = 1933.64$, $p < .001$; the relative risk for suicide among soldiers with a history of outpatient care for any MH disorder was 4.65% higher than for soldiers with no history of MH Diagnosis, $\chi^2(1, N = 4{,}377{,}054) = 615.88$, $p < .001$.

As shown in Table 3, approximately 20% of suicides were diagnosed with a mood disorder. Soldiers diagnosed with any mood disorder were at higher risk for suicide than those without any history of an MH diagnosis, $\chi^2(1, N = 3{,}876{,}388) = 761.39$, $p < .001$. Relative risk rates were particularly elevated for soldiers with a history of major depression, $\chi^2(1, N = 3{,}748{,}579) = 661.04$, $p < .001$; depressive disorder, NOS $\chi^2(1, N = 3{,}781{,}085) = 1087.69$, $p < .001$; dysthymia, $\chi^2(1, N = 3{,}722{,}510) = 484.03$, $p < .001$; and bipolar disorder, $\chi^2(1, N = 3{,}712{,}541) = 291.37$, $p < .001$, as compared with those without any history of an MH diagnosis (see Table 3). Moreover, 25% of suicides were diagnosed with adjustment disorder, 13%

TABLE 3
Psychological Risk Factors Associated With Suicides of Army Soldiers

	2001–2009		Army		Mortality Rate	Relative	
Psychological Risk Factor	*N*	*%*	*N*	*%*	*Per 100,000*	*Risk*	*95% CI*
Mental health status							
No MH disorder	469	53.7	369,7674	84.5	12.7	*RG*	
Any MH disorder	405	46.3	678,930	15.5	59.7	4.70	4.12–5.37
More than one MH disorder	270	30.6	—	—	—	—	—
Mental health care							
Inpatient care for MH	142	16.2	56,483	1.3	251.4	19.82	16.43–23.91
Outpatient care for MH	400	45.8	678,511	15.5	59.0	4.65	4.17–5.31
Any mood disorder	177	20.3	178,068	4.1	99.4	7.84	6.59–9.32
Major depressive disorder	77	8.8	50,359	1.2	152.9	12.05	9.47–15.34
Bipolar disorder	26	3.0	1,4372	0.3	180.9	14.26	9.61–21.16
Dysthymia	44	5.0	2,4323	0.6	180.9	14.26	10.47–19.40
Depressive disorder NOS	132	15.1	8,2810	1.9	159.4	12.57	10.36–15.24
Other mood disorder	16	1.8	6,911	0.2	231.5	18.25	11.30–30.03
Adjustment disorder	222	25.4	196,634	4.5	112.9	8.90	7.59–10.44
Anxiety-related disorders							
Any anxiety disorder–excluding PTSD	115	13.2	61,596	1.4	186.7	14.72	12.01–18.05
Post-traumatic stress disorder	62	7.1	38,774	0.9	159.9	12.61	9.68–16.43
Acute stress disorder	28	3.2	20,618	0.5	135.8	10.71	7.31–15.67
Personality disorders	52	5.9	14,933	0.3	348.2	27.45	20.63–36.55
Schiz./paranoid disorders	22	2.5	2,637	0.1	834.3	65.78	42.97–100.70
Substance-related disorders	152	17.4	165,217	3.8	92.0	7.25	6.04–8.71
Previous suicide attempt[a]	40	4.6	—	—	—	—	—
Previous ideation[b]	35	4.0	—	—	—	—	—

Note. (RG) = Reference Group. (—) = rate not available. (a) Based on ICD-9 E Codes. (b) Based on ICD-V Codes.

with anxiety disorders, 7% with PTSD, 3% with acute stress disorder, 6% with personality disorders, 2.5% with schizophrenia or paranoid disorders, and 17% with substance-related disorders. Relative risk rates were higher for soldiers with a history of any of these disorders relative to those with no MH diagnosis—adjustment disorder, $\chi^2(1, N = 3{,}894{,}999) = 1051.33$, $p < .001$; anxiety disorders, $\chi^2(1, N = 3.759.854) = 1170.01$, $p < .001$;

PTSD, $\chi^2(1, N = 3{,}736{,}979) = 574.95$, $p < .001$; acute stress disorder, $\chi^2(1, N = 3{,}718{,}789) = 223.44$, $p < .001$; personality disorders, $\chi^2(1, N = 3{,}713{,}128) = 1169.6$, $p < .001$; schizophrenia or paranoid disorders, $\chi^2(1, N = 3{,}700.802) = 1279.49$, $p < .001$; substance-related disorders, $\chi^2(1, N = 3{,}863{,}512) = 614.07$, $p < .001$. Importantly, 4.6% of suicides had an E-code for prior suicide attempt and 4.0% had a V-code for prior ideation. Though not shown in the table, soldiers aged 25 and older were generally more likely to have been diagnosed with any of these disorders, and soldiers who had a history of deployment were more likely to have a diagnosis of PTSD.

Event Characteristics and Environmental Stressors Associated With Suicides of Army Soldiers

Table 4 presents analyses involving event characteristics associated with suicides of Army soldiers for 2004 to 2009. As shown in Table 4, 38% of suicides had evidence of planning, and in 21% of suicides the individual communicated thoughts prior to the event. Ten percent of suicides had histories of self-injury, 19% of suicides involved alcohol, and only 8% involved drugs. Approximately 19% of suicide events were reportedly related to deployment. Almost one third had evidence of contributing factors from childhood or other time periods prior to entry into the Army. With regard to environmental stressors, about 31% of the Army suicides had a history of legal problems, with the most common problems involving Article 15s and civil legal problems. About 79% of the suicides had evidence of personal stressors, with the most common stressors involving relationship problems, military or work-related stress, and physical health issues. Over 83% evidenced any of the environmental stressors, with 60% evidencing three or more stressors at the time of the suicide.

Stress-load. Almost 90% of the 557 Army suicides that occurred between 2004 and 2009 had evidence of some level of stress-load; 26% were known to have at least one or two reported stressors, 24% had at least three to four stressors, and 40% had five or more stressors in evidence. The average number of stressors significantly increased from less than two in 2004 to six in 2008 and 2009 (though this may be in part due to improved information gathering).

DISCUSSION

In the present study we sought to describe the epidemiology of Army suicides with regards to sociocultural and military risk factors, as well as psychological and

TABLE 4
Event Characteristics and Stressors Associated With Suicides of Army Soldiers 2004–2009

Characteristic and Stressor	*N*	*%*
Event characteristic		
Planning & communication		
Evidence of planning	213	38.2
Communicated thoughts prior to event	117	21.0
Historical factors		
History of self-injury	59	10.6
Contributing factors prior to service	174	31.2
Alcohol & drug use		
Event involved alcohol	110	19.8
Event involved drugs	45	8.1
Suicide prevention training (2007–2009)	92	16.5
Event was deployment related	104	18.7
Pre-deployment	11	2.0
Current deployment	70	12.6
Post-deployment	23	4.1
Environmental stressor		
Legal history	170	30.5
Article 15	75	13.5
Courts martial	16	2.9
Admin separation	31	5.6
Medical Board	27	4.9
Non-selection	17	3.2
AWOL	31	5.6
Civil legal problems	63	11.3
Personal stressor	440	79.0
Relationship problem	283	50.8
Physical health problem	101	18.1
Family/spouse health problem	25	4.5
Spousal/family/friend death	65	11.7
Spousal/family/friend suicide	22	4.0
Financial stress	47	8.4
Military/work stress	257	46.1
Victim of abuse	64	11.5
Perpetrator of abuse	55	9.9
Family Advocacy Program use	35	6.3
Substance Abuse Services use	88	15.8
Any environmental stressor	465	83.5
1–2 stressors	132	23.7
3–4 stressors	129	23.2
5–7 stressors	126	22.6
8+ stressors	78	14.0

(*Continued*)

TABLE 4
(Continued)

Characteristic and Stressor	*N*	*%*
Stress-load* any	500	89.8
1–2	144	25.8
3–4	133	23.9
5–7	134	24.1
8+	89	16.0
Average stress-load	5	

Note. N=557. (*) = Total of environmental stressors and mental health disorders.

environmental risk factors. Additionally, drawing on the stress-diathesis model (Mann, 2002; Mann, 2003; Mann et al., 2005) and the distal-proximal model (Moscicki, 2001), we proposed to examine the synergistic effect of multiple risk factors (termed stress-load) on suicide-related deaths among Army soldiers. Analyses revealed that suicide rates increased from 9 to nearly 22 per 100,000 from 2001 to 2009. However, comparison of trends in these figures with those of civilians suggests that suicide rates for soldiers were lower than for civilians from 2001 to 2007 but higher after 2007. Examination of risk factors associated with these suicides revealed that gender, race, deployment experience, mental health status and treatment, and personal and environmental stress were associated with elevated suicide risk. To our knowledge, this study is the first to examine the distribution and association of risk factors with active-duty Army suicides from 2001 through 2009. The findings support the idea that suicide is not attributable to any single risk factor or experience; rather, Army suicides appear to be strongly associated with a broad range of dispositional and environmental factors.

Our findings suggest that sociocultural, psychological, environmental, and military factors appear to influence Army suicides over the 9-year period. The most prevalent factors, psychopathology and the accumulation of stressors, not only fit with many of the leading theories of suicide, but are also those most amenable to treatment or intervention. Our findings align well with the diathesis-stress model proposed by Mann (2002, 2003, 2005) as well as the proximal-distal model proposed by Moscicki (2001), and the gene-environment interaction model proposed by Caspi and colleagues (2003). These models suggest that psychopathology and biological factors predispose an individual to suicide, while the interaction of environmental stressors increases the proximal risk for suicide (Nock et al., 2008).

The associations of most risk factors for suicide among soldiers were comparable to associations found in the general population (Bernal et al., 2007; Moscicki, 2001). The four-fold increase in risk for suicide among males as compared to female Army suicides is similar to differences seen in the general population (McLean, Maxwell, Platt, Harris, & Jepson, 2008; Oquendo et al., 2007; Simon,

2006), as is the lower risk evidenced for African Americans in comparison to Caucasians (Joe, Baser, Breeden, Neighbors, & Jackson, 2006; Oquendo et al., 2001). Marriage, however, was not found to be a protective factor among soldiers, as is often seen in the civilian population (Kposowa, 2000).

The associations of mental health disorders with Army suicide were also similar to associations reported for the general public (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Hills et al., 2009; Simon, 2006). Having any MH diagnosis, but particularly affective disorders such as major depression, dysthymia, and bipolar disorder is often associated with suicide (Beck et al., 1990; Connor et al., 2001; Oquendo et al., 2007). Suicide has also been associated with anxiety disorders, post-traumatic stress disorder, schizophrenia, and paranoid disorders (Goldsmith, Pellmar, Kleinman, & Bunney, 2002; Gradus et al., 2010; Nock et al., 2009; Pompili et al., 2007; Sareen et al., 2008), as have substance abuse and dependency (Center for Substance Abuse Treatment, 2008; Hor & Taylor, 2010; Mukamal, Kawachi, Miller, & Rimm, 2007). Outpatient and, particularly, inpatient care for mental disorders were also strongly associated with suicide, as has been seen in the civilian population (Goldsmith et al., 2002).

One interesting finding is the strong association between adjustment disorder and suicide in the Army, which has received limited attention in the literature. One reason for this may be the greater likelihood of receiving a diagnosis for the disorder in the military as compared to civilian life (Casey & Bailey, 2011; Gradus et al., 2010). Whether it is a risk factor in and of itself or an early marker of subsequent affective or anxiety disorders, a diagnosis of adjustment disorder may serve as another indicator of heightened vulnerability to suicide in the Army.

Importantly, stress-load was clearly evident among suicides in the Army—90% of suicides had at least one stressor, and 64% had evidence of three or more stressors, including personal stressors and mental disorders. Similar levels of stressors have been reported for the general population (Heeringen, 2001; Martin et al., 2009; Simon, 2006).

Suicide is a rare event; however, it may be possible to identify portions of the population at elevated risk. In terms of the present study's findings, the key question is what specific prevention strategy would best intervene upon the path to suicide among soldiers. Appropriate interventions would best focus on the accumulation of stressors and psychopathology, rather than individual risk factors. Risk reduction would require population-level interventions aimed at prompt identification of high-risk groups, rather than individuals, an approach that has long been shown to be more effective than targeting individuals at high risk for other health conditions, such as heart disease and vehicular injuries (Cooney et al., 2009; Graham, 1993; Rose, 1993); however, clinicians should also be encouraged to assess and provide treatment for multiple risk factors, whenever possible. This approach would involve preventive strategies that include enhanced treatment of mental health problems, improved identification and treatment of

substance abuse, reduction or elimination of stigma, optimal functioning of assistive efforts and programs, and increased availability of adequately trained behavioral health personnel, both at home and in the combat theater (Witkiewitz & Estrada, 2011).

The present study is limited in that no nonsuicide controls were available for analyses; thus, statements of impact or casual relationships cannot be made. Further studies will need to examine these influences in greater detail. Another important limitation is the lack of key factors that may elevate the risk for suicide, including hopelessness, impulsivity, genetic vulnerability, serotonin insufficiency, social support, stigma associated with mental illness, and combat experiences and intensity. Among the barriers to adequate health care for mental illness in the military, for example, the perception of stigma has been found to be particularly influential (Kang & Bullman, 2008; Kim, Britt, Klocko, Riviere, & Adler, 2011; Witkiewitz & Estrada, 2011). Soldiers with acknowledged mental health problems are sometimes belittled and viewed as weak by peers and leadership and as a result are less inclined to seek help (Rae-Olmsted et al., 2011; Rand Center, 2008; Sartorius, 2007; Witkiewitz & Estrada, 2011).

The study is also limited with regards to gender differences—the relatively low number of women among the suicides could only provide estimates that were considerably less stable than those of the men. In addition, completed DoDSERs were available for only about 84% of the soldiers who died by suicide from 2004 through 2009, so results may be underestimates of actual associations. Data on inpatient and outpatient encounters among National Guard and Army Reserve members are limited to care received while on active duty; thus, the present results may under-represent the burden of diagnosed mental disorders in these two groups. In addition, many of the youngest suicides may not have served long enough to have received a mental health diagnosis. The present study also lacked measures of severity for many of the risk factors, such as relationship problems, legal issues, or combat experience.

Despite these limitations, the findings of this study have important implications for the Army, as well as the general population. Our results suggest the need to assess a broad range of both dispositional and environmental risk factors in screening and identification of soldiers at heightened risk for suicide. Findings also indicate that a number of soldiers who committed suicide *did not* have evidence of a history of psychopathology; thus, identification efforts need to extend beyond screening only for mental health disorders. This is particularly important given the potential for imitative effects of exposure to suicide (Mercy et al., 2001). The present study did not assess clustering of suicides or exposure to the suicidal behaviors of other soldiers; however, Army suicides have received increasing attention in both the press and throughout the Army, particularly after 2008. The majority of soldiers on active duty are well aware of the increased numbers of suicides in recent years, many of which occurred in their own commands.

Our findings suggest that suicide in the Army is associated with a complex interaction of multiple factors, as has been suggested by other researchers. Nock and colleagues (2009), for example, highlight the importance of the broad range of mental health disorders and stressful events with regard to suicidal behaviors and indicate the need for more detailed studies of the impact of these various factors. Intervention for such a range of factors would require a broad, multifaceted approach. A recent White Paper published by SAMHSA (Center for Substance Abuse Treatment, 2008) clearly encourages a public health approach to the reduction and prevention of suicide. In that the public health model combines biological, psychological, social, cultural, and environmental facets by focusing on reduction of risk factors at the population level, early identification of groups at high risk, and early intervention and treatment, this approach would facilitate the reduction of a wide spectrum of negative outcomes in addition to suicide. Additional focus on alleviating the proximal risk factors for suicide (e.g., stress and psychopathology) could enhance this reduction.

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