



## ORIGINAL ARTICLE

# Social closeness and support are associated with lower risk of suicide among U.S. Army soldiers

Catherine L. Dempsey PhD, MPH<sup>1,2</sup>  | David M. Benedek MD<sup>1</sup> | Matthew K. Nock PhD<sup>3</sup> | Kelly L. Zuromski PhD<sup>3</sup> | David A. Brent MD<sup>4</sup> | Jingning Ao MPH<sup>2</sup> | Pablo A. Aliaga MS<sup>2</sup> | Steven G. Heeringa PhD<sup>5</sup> | Ronald C. Kessler PhD<sup>6</sup> | Murray B. Stein MD, MPH<sup>7,8</sup> | Robert J. Ursano MD<sup>1</sup> 

<sup>1</sup>Center for the Study of Traumatic Stress, Department of Psychiatry, Uniformed Services University, Bethesda, MD, USA

<sup>2</sup>Henry M. Jackson Foundation for the Advancement of Military Medicine, Bethesda, MD, USA

<sup>3</sup>Department of Psychology, Harvard University, Cambridge, MA, USA

<sup>4</sup>Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

<sup>5</sup>Institute for Social Research, University of Michigan, Ann Arbor, MI, USA

<sup>6</sup>Department of Health Care Policy, Harvard Medical School, Cambridge, MA, USA

<sup>7</sup>Department of Psychiatry and Family Medicine & Public Health, University of California San Diego, La Jolla, CA, USA

<sup>8</sup>VA San Diego Health Care System, San Diego, CA, USA

## Correspondence

Catherine L. Dempsey, Center for the Study of Traumatic Stress, Department of Psychiatry, Uniformed Services University, 6720 B Rockledge Drive Suite 550, Bethesda, MD 20814, USA.  
Email: catherine.dempsey.ctr@usuh.edu

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## Abstract

**Objective:** We tested the aspects of social support, unit cohesion, and religiosity hypothesized to be protective factors for suicide among U.S. service members.

**Methods:** This case–control study compared U.S. Army soldiers who died by suicide while on active duty ( $n = 135$ ) to controls of two types: those propensity score-matched on known sociodemographic risk factors ( $n = 128$ ); and those controls who had thought about, but not died by, suicide in the past year ( $n = 108$ ). Data included structured interviews of next of kin (NOK) and Army supervisors (SUP) for each case and control soldier. Logistic regression analyses were used to examine predictors of suicide.

**Results:** Perceived social closeness and seeking help from others were associated with decreased odds of suicide, as reported by SUP (OR = 0.2 [95% CI = 0.1, 0.5]) and NOK (OR = 0.4 [95% CI = 0.2, 0.8]). Novel reports by SUP informants of high levels of unit cohesion/morale decreased odds of suicide (OR = 0.1 [95% CI = 0.0, 0.2]). Contrary to study hypotheses, no religious affiliation was associated with lower odds of suicide (OR = 0.3 [95% CI = 0.2, 0.6]).

**Conclusions:** Perceived social closeness and unit/group cohesion are associated with lower odds of suicide. These results point toward social intervention strategies as testable components of suicide prevention programs.

## KEY WORDS

military, religiosity, social support, suicide, unit cohesion, psychological autopsy

## INTRODUCTION

The suicide rate among U.S. Army soldiers increased dramatically during the first decade of U.S. military involvement in the wars in Iraq and Afghanistan, peaked in 2012, and still exceeds the adjusted civilian rate (Department of Defense, 2019; Myers, 2019). Accordingly, there has been an increase in efforts to identify factors associated with an elevated risk of suicidal behavior (Chapman et al., 2013). However, less focus has been placed on identifying factors that might protect against the risk of suicidal behavior.<sup>1</sup> A recent meta-analysis of the past 50 years of research on risk and protective factors for suicide and suicidal behavior reveals that only approximately 13% of such studies focus on protective factors for these outcomes (Franklin et al., 2017). To address this gap, we examined potential protective factors against suicide among active duty U.S. Army soldiers from three domains that have been linked with lower rates of suicidal thoughts and behaviors (STBs) in prior studies: social support, unit cohesion, and religiosity (Dervic et al., 2004; Greening & Stoppelbein, 2002; Griffith, 2015; Mitchell et al., 2012; Tsai et al., 2015; Williams et al., 2016).

Prior studies have suggested that service members with greater social support, defined as perceived emotional and instrumental support, are less likely to experience suicidal thoughts. For instance, in a study of members of the active duty Air Force Security Forces, the availability of social support was associated with reduced severity of suicidal ideation (Bryan & Hernandez, 2013). Similarly, a study of active duty Army Special Operations personnel reported an interaction effect where high combat stress and PTSD were ameliorated by support from friends and unit morale (Russell et al., 2016).

Unit cohesion, defined as the extent to which a military work-specific group (or unit) of individuals has a shared identity and mutually supportive relations (Griffith, 2015), is another domain that may convey protective effects among military personnel against suicidal thoughts and behaviors (Brailey et al., 2007). Military personnel who feel valued and appreciated by their colleagues experience less suicidal ideation (Bryan & Hernandez, 2013). More recently, Rugo et al. (2020) found higher levels of perceived unit cohesion predicted lower levels of depression and suicidal ideation at the individual level and not the unit level in a National Guard Sample. Campbell-Sills et al. (2020) reported the important influence of horizontal (peer bonds) and vertical unit cohesion (leadership and subordinates bonds) as a buffer of stress and symptoms of PTSD, depression, and suicidal ideation (Campbell-Sills et al., 2020). The current study assesses unit cohesion, including individual (e.g., his/her morale) and unit morale (overall) among active duty U.S. Army soldiers from

the unique perspective of the suicide decedent's Army first-line supervisor (SUP) and next of kin (NOK) using a case-control study design.

Religiosity refers to the degree of conviction and devotion to a deity or divinity. It represents commitment to certain religious ideals and rituals, some of which may exceed the social norms of religion (Gallagher & Tierney, 2013). In this paper, we distinguish between religiosity, which refers to religious attendance, affiliation, and faith in a higher power or practice of religious beliefs and spirituality as the value one places on the spiritual aspects of life. Perceived burdensomeness or the belief that one is a burden on family members but not thwarted belongingness mediated the relationship between spiritual struggles, religion, and suicidal ideation in veterans (Raines et al., 2020). Veterans experiencing a spiritual struggle or negative religious coping were more likely to have suicidal ideation and attempts (Kopacz et al., 2016). Furthermore, veterans who frequently engaged in private and public religious practices were less likely to engage in suicidal behavior (Kopacz, Morley et al., 2016).

Overall, existing work has established the association between certain facets of social support, unit cohesion, and religiosity and both suicidal ideation and attempts. However, little work has focused on whether these factors may protect against suicide death. Further, many of these studies suffered from methodological limitations (e.g., small samples, low response rates, non-controlled trials, lack of standardized interviewer training, non-standardized assessments, and varying or non-specific definitions of religiosity). We sought to minimize such limitations and determine whether specific aspects of social support are associated with lower risk of suicide death among active duty U.S. Army soldiers. Our findings are novel as we report for the first time unit cohesion assessed by an informant in active duty service members. This is the fourth paper in a series focused on resilience factors and suicide risk (Dempsey et al., 2019; Nock et al., 2017; Zuromski et al., 2019). We hypothesized that factors that protect those at risk from dying by suicide will include the presence of strong social support, unit cohesion, and religiosity.

## METHODS

### Sample

Data are from a psychological autopsy component of the Army Study to Assess Risk and Resilience among Servicemembers (Army STARRS) (Ursano et al., 2014). This the largest psychological autopsy study ever conducted in a military population using structured interviews of two informants within a matched case-control design.

<sup>1</sup>Protective factors are not merely defined by the absence of a risk factor; rather, it is a third variable that modifies the strength or direction of the relation between a risk factor and the outcome (Kraemer et al., 1997).

## Cases

Suicide cases were U.S. Army soldiers ( $n = 135$ ) who died by suicide while on active duty between August 01, 2011, and November 01, 2013. This sample excluded soldiers in the Army Reserve and National Guard and soldiers who died while deployed, as these soldiers were excluded from the pool of control soldiers by the design of the Army STARRS (Kessler, Colpe et al., 2013; Kessler, Santiago et al., 2013). The next-of-kin eligibility criteria included at least 18 years of age, a family member (spouse, parent, grandparent, sibling) or someone very close to the soldier with knowledge of life experiences, and mastery of the English language. Supervisor eligibility criteria included confirmed status as the direct or immediate supervisor of the soldier for at least 60 days, must possess a military email address, and could not be deployed at time of contact.

The recruitment of NOK involved several contacts prior to participation and was more challenging than anticipated resulting in lower number of cases identified. The Army Casualty and Mortuary Affairs Operation Center (CMAOC) needed to make contact with the families of the suicide descendants within one to three months after the death of the soldier, and obtain consent. As a result, the CMAOC contacted 290 families of suicide decedents by letter to see whether they would be interested in being contacted by a member of the research team. Of the 290 families contacted, 101 next of kin were identified by CMAOC. Two were ineligible due to a language barrier or deceased. Of eligible next of kin ( $n = 99$ ), the majority ( $n = 61$ ; 61.6%) completed an interview; 13 (13.1%) refused to participate, and 25 (25.3%) could not be reached. The challenges recruiting supervisors were slightly different and involved identification of the correct supervisor, and contacting the supervisor to obtain consent. Among eligible supervisors ( $n = 154$ ), 107 (69.5%) completed an interview; seven (4.5%) refused to participate and 40 (26.0%) could not be reached.

## Controls

This case-control study used two types of controls: (1) propensity-matched controls and (2) controls who reported suicidal ideation in the past year. This approach provided an opportunity to examine which factors differ between soldiers who die by suicide and other soldiers in the U.S. Army, and also between those who think about suicide.

First, the controls were drawn from a large ( $N = 5428$ ) representative sample of soldiers who participated in the Army STARRS All Army Study (AAS) (Ursano et al., 2014). The majority ( $n = 236$ ; 80.5%) of eligible NOK controls ( $n = 293$ ) completed an interview. Of those eligible 236 NOK controls,

17 (5.8%) refused to participate, and 40 (13.7%) could not be reached or did not complete an interview. Of the 263 eligible supervisor controls, more than half ( $n = 153$ ; 58.25%) completed interviews, 25 (9.5%) refused to participate, and 92 (35.0%) could not be reached/located or did not complete an interview.

Second, we selected another set of controls who endorsed suicidal ideation in the past year<sup>2</sup> ( $n = 108$ ) as self-reported in their responses to the AAS. Neither group of controls differed from eligible AAS non-responder on sex, race/ethnicity, marital status, or age of entry into the Army; however, controls were slightly older, had more dependents, were higher rank, and had higher educational attainment, although these effects were small in magnitude ( $r_s = 0.09$ – $0.18$ ).

## Procedures

### Informants

The SUP was the person who had been the soldier's direct and immediate Army supervisor for a minimum of 60 days. SUP informants consisted of enlisted soldiers with a rank of E5 to E9 ( $n = 72$ ; 68%) and officers with a rank of O1 to O6 ( $n = 30$ ; 28%). A NOK was a close family member (e.g., usually the spouse or parent) who knew the soldier well and could answer questions about the soldier's lifetime experiences and events, with focus on events preceding the soldier's death (for case) or some period preceding the date of the NOK interview (for control).

### Interviewer training

To further ensure the validity and reliability of the structured interviews, professional lay interviewers from the Survey Research Center in the Institute for Social Research at the University of Michigan completed a General Interviewer Training course prior to the initiation of data collection and periodic refresher courses throughout data collection to prevent interviewer drift (Heeringa et al., 2013). Recruitment and data collection procedures were approved by the Humans Subjects Committees of the University of Michigan, Ann Arbor, MI; the Uniformed Services University, Bethesda, MD; and all other collaborating organizations.

<sup>2</sup>In the AAS, 12-month SI was assessed using two self-report items adapted from the Columbia-Suicide Severity Scale (C-SSRS) (Posner et al., 2011) as either 1) has thoughts of killing themselves at current age or 1 year before current age or 2) wished they were dead at current age or 1 year before current age.

## Measures

Development of the structured psychological autopsy interview is described elsewhere (Nock et al., 2017). The interview included 26 sections assessing a wide range of potential risk and protective factors for suicide. We used three sections of the interview in the current study: social support, unit cohesion, and religiosity. As described below, we examined tetrachoric item correlations, conducted exploratory factor analyses (EFA), and calculated Cronbach's  $\alpha$  for each of these sections.

### Social support

We assessed facets of social support using items from the World Health Organization Composite International Diagnostic Interview screening scales (CIDI-SC), along with items created for the purpose of the Army STARRS study (Kessler, Colpe et al., 2013; Kessler, Santiago et al., 2013; Kessler & Ustun, 2004). Perceived social support items consisted of questions about the number of people who were routinely available to provide social support to the target soldier (i.e., number of people to watch TV with, go out for a drink or a movie together, and people he/she felt really close to). Responses to these questions from three analytic categories (0–3, 4–5, 6 or more) were combined into two analytic categories: 0–5 people and 6 or more people. We identified the optimal cutoff point at 5 based on frequency distributions, and we looked at the bivariate association between response options of 0–3, 4–5, and 6+ and death by suicide and then grouped them together based on which associations were similar, and the conceptual meaning of the variable. Seeking help from others consisted of items asking who the soldiers would talk to or seek help from if there was a serious problem with personal relationships or emotions. We created a composite variable of help-seeking from at least one of the following: spouse/partner, any of his/her friends outside the Army, or a mental health counselor. Responses to these questions were dichotomized (yes/no). If the respondent indicated YES for the soldier seeking help for any of the three options above, then the variable was coded YES, otherwise NO. The social support items have good internal consistency and reliability (standardized Cronbach's  $\alpha = 0.69$  for NOK and 0.73 for SUP).

### Unit cohesion

Unit cohesion was assessed from items adapted from the Joint Mental Health Advisory Team 7 (J-MHAT 7) Operation Enduring Freedom 2010 (J-MHAT 7, 2011). Unit cohesion items included (a) could rely on other unit members, (b)

trusted leaders, (c) had confidence in military training, (d) maintained regular contact back home, (e) thought the members of unit were cooperative with each other, (f) thought the members of unit knew they could depend on each other, (g) thought the members of unit stood up for each other, (h) had real confidence in unit's ability to perform its mission, and (i) thought the members of unit would risk their lives for each other. Responses to these questions were dichotomized (yes/no). Other items assessed reflect unit experiences rather than cohesion specifically, such as supervisors were asked to rate (a) soldier's (his/her) morale and (b) morale in his/her unit. Here, a distinction is made between a supervisor's perceptions of the soldier's individual morale (his/her morale) as compared to the supervisor's assessment of the morale in the soldier's unit (overall morale in his/her unit), which has not been distinguished in the literature to date nor assessed by an informant. Three analytic categories were created for final analysis: low, medium, or high morale. The unit cohesion items have excellent internal consistency and reliability (standardized Cronbach's  $\alpha = 0.86$  for NOK and 0.84 for SUP).

### Religiosity

These variables were assessed with items adapted from the CIDI-SC, along with items created for the purpose of the Army STARRS study (Kessler, Colpe et al., 2013; Kessler, Santiago et al., 2013). We created a religious affiliation variable and collapsed these options into three categories: Christian, other religion, or no religion. Informants were also asked about soldier's attendance at religious services and faith in a higher power or practice or religious beliefs. Spirituality was assessed in terms of how much he/she values the spiritual aspect of life. A further assessment of religiosity was how they identified themselves: (a) born-again, (b) filled with the spirit, (c) fundamentalist, (d) evangelical, or (e) part of the charismatic movement, or (f) any of the above. Responses to these questions were dichotomized (yes/no). The religiosity items have good internal consistency and reliability (standardized Cronbach's  $\alpha = 0.78$  for NOK and 0.71 for SUP).

## Statistical procedures

### Sample weights

The cases were adjusted to match the population of all deaths in the Army from 2011 to 2013, while the controls were adjusted to match the AAS population from the same time period. The post-stratification weights were created using known population information gathered from the

Army snapshot data set (AFMETS) from 2011 to 2013. The controls were matched on 22 specific Army characteristics including number of months into current deployment and number of months since last deployment (Heeringa et al., 2013; Kessler, Colpe et al., 2013; Kessler, Santiago et al., 2013; Ursano et al., 2014). Because controls were selected using two different criteria: 12-month ideation or propensity score weights were separately calculated for method of selection. Thus, in total, three separate weights were created using the same methodology. The steps involved in creating post-stratification weights are described elsewhere (Kessler, Colpe et al., 2013; Kessler, Santiago et al., 2013).

## Data analysis

We compared cases and controls on sociodemographic and Army history variables using Wald's chi-square tests, also estimating odds ratios (ORs) and 95% confidence intervals (CIs). Variables that emerged as significantly different were retained as covariates in all subsequent analyses. Item-level missing data were handled in a two-step process described in the Army STARRS study design and methodology publication (Kessler, Colpe et al., 2013; Kessler, Santiago et al., 2013). We used (1) linkage to administrative data for missing demographics and Army characteristic variables, and (2) if data were not available from the administrative linkage, they were listed as missing and not included in the analyses.

Psychometric analyses included tetrachoric item correlations for cases and controls, to determine the extent to which the independent variables were related to one another and to the dependent variable and for data reduction. Variables were excluded due to overlap. EFA was used to identify latent constructs. The number of factors was determined based on eigenvalues  $\geq 1$  and scree plot examination. Cronbach's alphas measured internal consistency and reliability for all scales.

We used multivariate logistic regression analyses to predict the outcome of suicide case status (no/yes), controlling for significant demographics. Each of these potential protective factors (social support, unit cohesion, religiosity) was entered into the model to predict the outcome of suicide status. Coefficients were exponentiated in logistic models to create ORs with 95% CIs. To assess the significance of the association between the independent variables and the outcome variable, omnibus chi-square tests were performed when fitting each of the logistic regression models. All tests were significant at  $p \leq 0.05$  and were 2-sided. To correct for multiple comparisons, we used the false discovery rate (Benjamini & Hochberg, 1995). The false discovery rate was conducted using the *p.adjust* function in R, version 3.4.2 (R Foundation). False discovery rate-corrected values are reported in Tables 1–3. All other analyses were conducted using SAS, version 9.4 (SAS Institute, Inc.).

## RESULTS

Comparisons of cases and controls on sociodemographic and Army history variables revealed few differences for the NOK and SUP informant samples (Table S1). Tetrachoric item correlation analyses demonstrated strength of the association of items (Table S2a,b). EFA with promax rotation indicated two dimensions of social support: perceived social closeness and seeking help from others (Table S4a,b) and one dimension of unit cohesion: perceived unit support (Table S5a,b). There were significant differences in specific aspects of social support between suicide cases and propensity-matched controls as reported by SUP and NOK (Tables 1a and 1b). SUP reported revealed that propensity-matched control soldiers had more close relationships compared with cases (OR = 0.3 [95% CI = 0.2, 0.6];  $\chi^2 = 11.56$ ,  $p = 0.0021$ ). Similarly, SUP reported that propensity-matched controls were more likely to seek help for a serious problem from the following: spouse/partner (OR = 0.3 [95% CI = 0.2, 0.5];  $\chi^2 = 21.05$ ,  $p = 0.0001$ ), any of his/her friends outside of the Army (OR = 0.5 [95% CI = 0.3, 0.9];  $\chi^2 = 6.54$ ,  $p = 0.0254$ ), or a mental health counselor (OR = 0.3 [95% CI = 0.2, 0.5];  $\chi^2 = 17.36$ ,  $p = 0.0002$ ). SUP reported that controls were more likely to seek help from at least one of the above: spouse/partner, friends outside of the Army, or a mental health counselor compared with cases (OR = 0.2 [95% CI = 0.1, 0.5];  $\chi^2 = 13.28$ ,  $p = 0.0012$ ). NOK reported that controls were more likely to seek help from a chaplain or religious counselor (OR = 0.4 [95% CI = 0.2, 0.8];  $\chi^2 = 7.01$ ,  $p = 0.0488$ ). Similarly, NOK reported that controls were more likely to seek help from at least one of the above: spouse/partner, friends outside of the Army, or a mental health counselor compared with cases (OR = 0.4 [95% CI = 0.2, 0.8];  $\chi^2 = 7.14$ ,  $p = 0.0488$ ).

SUP but not NOK described significant differences in unit experiences but not unit cohesion between suicide cases and propensity-matched controls (Tables 2a and 2b). SUP reports of a service member's *individual* morale as high were found to be a significant protective factor (OR = 0.1 [95% CI = 0.1, 0.2];  $\chi^2 = 30.14$ ;  $p < 0.0001$ ). The overall unit morale variable failed to lead to significant differences between cases and controls.

NOK did not identify significant differences in religious preferences, attendance, or spirituality between cases and controls despite their presumed familiarity with the soldiers' religious practices and beliefs (Tables 3a and 3b). SUP identified significant differences in religious affiliation for propensity-matched controls compared with suicide cases (OR = 0.3 [95% CI = 0.2, 0.6];  $\chi^2 = 13.22$ ,  $p = 0.0117$ ) (see Table 3b). Finally, none of the hypothesized protective factors (e.g., social support, unit cohesion, and religiosity) distinguished suicide decedents from soldiers with suicide ideation in the past year, as per informant reports.

TABLE 1A Social support reported by supervisors

Characteristics	Supervisor						
	Cases	Controls (propensity)			Controls (12-month ideation)		
	(n = 107)	(n = 80)	OR <sup>a,b</sup>	(95% CI)	(n = 73)	OR <sup>a,b</sup>	(95% CI)
	%	%			%		
Had 6 or more people that he/she had in his/her personal life of the following sorts							
People he/she did things with, like watch TV together, go out for a drink or movie together, or play cards	35.34	48.65	0.6	(0.3,1.0)	46.19	0.7	(0.2,2.8)
$X^2, p_{fdr}^c$			4.35, 0.074			0.33, 0.8435	
People who he/she felt really close to	14.31	35.80	<b>0.3</b>	<b>(0.2,0.6)</b>	25.47	0.5	(0.1,2.7)
$X^2, p_{fdr}$			<b>11.56*</b> , <b>0.0021</b>			0.67, 0.8435	
People who really cared for him/her and would be there for him/her for help if he/she needed them	53.88	54.25	1.0	(0.6,1.8)	51.67	1.1	(0.3,4.6)
$X^2, p_{fdr}$			0.02, 0.8793			0.01, 0.9106	
Family of friends who needed him/her and relied on him/her for help when they needed it	24.87	30.53	0.8	(0.5,1.5)	41.88	0.5	(0.1,2.1)
$X^2, p_{fdr}$			0.46, 0.5437			0.99, 0.8435	
When he/she had a serious problem with personal relationships or emotions, he/she would talk to or seek help from each of the following people							
Spouse/partner	38.80	71.13	<b>0.3</b>	<b>(0.2,0.5)</b>	68.00	0.3	(0.1,1.5)
$X^2, p_{fdr}$			<b>21.05*</b> , <b>0.0001</b>			2.24, 0.8070	
Parents or other family members	60.21	70.86	0.7	(0.4,1.2)	66.79	0.8	(0.2,3.6)
$X^2, p_{fdr}$			2.11, 0.1949			0.11, 0.8435	
Anyone in his/her Army unit	83.88	63.07	0.6	(0.3,1.2)	88.11	0.7	(0.1,6.6)
$X^2, p_{fdr}$			2.17, 0.1949			0.08, 0.8435	
Any of his/her friends outside the Army	45.25	63.07	<b>0.5</b>	<b>(0.3,0.9)</b>	56.96	0.6	(0.1,2.8)
$X^2, p_{fdr}$			<b>6.54*</b> , <b>0.0254</b>			0.36, 0.8435	
A chaplain or religious counselor	38.91	46.07	0.8	(0.5,1.4)	54.69	0.5	(0.1,2.3)
$X^2, p_{fdr}$			0.59, 0.5297			0.69, 0.8435	
A mental health counselor	36.17	64.56	<b>0.3</b>	<b>(0.2,0.5)</b>	66.96	0.3	(0.1,1.3)
$X^2, p_{fdr}$			<b>17.36*</b> , <b>0.0002</b>			2.65, 0.8070	
Any of the above	92.93	98.66	0.2	(0.0,1.0)	97.54	0.3	(0.0,32.7)
$X^2, p_{fdr}$			3.93, 0.0811			0.21, 0.8435	
From at least one of the following: spouse/partner, any of his/her friends outside the Army, or a mental health counselor	72.99	92.92	<b>0.2</b>	<b>(0.1,0.5)</b>	86.67	0.4	(0.1,3.5)
$X^2, p_{fdr}$			<b>13.28*</b> , <b>0.0012</b>			0.62, 0.8435	

Abbreviations: FDR, false discovery rate; OR, oddsratio.

<sup>a</sup>OR statistics obtained from separate multivariate logistic regression models testing differences between cases and each control group.

<sup>b</sup>Each predictor was adjusted for deployment status (never, previously).

<sup>c</sup> $p$  values have been corrected using false discovery rate (fdr).  $p$  values were corrected among SUP for 12-month ideator and propensity score-matched comparisons, respectively.

\*Bold values are significant at  $p < 0.05$ .

## DISCUSSION

There are four key findings from this study. First, soldiers whose SUP and NOK reported that their family member or

supervisee had a network of individuals they could turn to for help or people they were close to were less likely to die by suicide compared with propensity-matched controls. Second, soldiers whose SUP reported their supervisee had high

TABLE 1B Social support reported by next of kin

Characteristics	Next of kin						
	Cases		Controls (propensity)		Controls (12-month ideation)		
	(n = 61)	(n = 128)	OR <sup>a,b</sup>	(95% CI)	(n = 108)	OR <sup>a,b</sup>	(95% CI)
Had 6 or more people that he/she had in his/her personal life of the following sorts							
People he/she did things with, like watch TV together, go out for a drink or movie together, or play cards	41.64	54.37	0.6	(0.3,1.1)	43.45	1.0	(0.3,3.7)
$X^2, p_{fdr}^c$			2.34, 0.3407			<0.01, 0.9831	
People who he/she felt really close to	30.04	38.46	0.7	(0.4,1.3)	37.06	0.7	(0.2,2.8)
$X^2, p_{fdr}$			1.32, 0.3407			0.20, 0.8698	
People who really cared for him/her and would be there for him/her for help if he/she needed them	59.53	67.90	0.7	(0.4,1.3)	62.51	0.9	(0.2,3.4)
$X^2, p_{fdr}$			1.17, 0.3407			0.03, 0.9592	
Family of friends who needed him/her and relied on him/her for help when they needed it	32.83	41.74	0.7	(0.4,1.3)	38.97	0.7	(0.2,2.7)
$X^2, p_{fdr}$			1.26, 0.3407			0.27, 0.8698	
If he/she had a serious problem with personal relationships or emotions, he/she would talk to or seek help from each of the following people							
Spouse/partner	41.95	45.57	0.7	(0.4,1.4)	50.23	0.6	(0.2,2.3)
$X^2, p_{fdr}$			0.98, 0.3507			0.45, 0.8606	
Parents or other family members	65.60	74.81	0.6	(0.3,1.2)	81.61	0.5	(0.1,2.4)
$X^2, p_{fdr}$			1.92, 0.3407			0.87, 0.8447	
Anyone in his/her Army unit	43.41	49.30	0.8	(0.5,1.5)	41.16	1.1	(0.3,4.0)
$X^2, p_{fdr}$			0.36, 0.5492			0.02, 0.9592	
Any of his/her friends outside the Army	52.23	62.32	0.7	(0.4,1.2)	69.60	0.5	(0.1,1.9)
$X^2, p_{fdr}$			1.78, 0.3407			1.16, 0.8447	
A chaplain or religious counselor	20.47	38.89	<b>0.4</b>	<b>(0.2,0.8)</b>	38.41	0.4	(0.1,1.7)
$X^2, p_{fdr}$			<b>7.01*</b> , <b>0.0488</b>			1.57, 0.8447	
A mental health counselor	30.71	36.43	0.7	(0.4,1.3)	43.52	0.5	(0.1,2.0)
$X^2, p_{fdr}$			1.15, 0.3407			0.93, 0.8447	
Any of the above	89.76	97.57	0.3	(0.1,0.9)	98.94	0.1	(0.0,31.4)
$X^2, p_{fdr}$			4.61, 0.1269			0.59, 0.8606	
From at least one of the following: Spouse/partner, any of his/her friends outside the Army, or a mental health counselor	72.70	86.43	<b>0.4</b>	<b>(0.2,0.8)</b>	90.59	0.3	(0.0,2.1)
$X^2, p_{fdr}$			<b>7.14*</b> , <b>0.0488</b>			1.57, 0.8447	

Abbreviations: FDR, false discovery rate; OR, oddsratio.

<sup>a</sup>OR statistics obtained from separate multivariate logistic regression models testing differences between cases and each control group.

<sup>b</sup>Each predictor was adjusted for deployment status (never, previously) and number of years of active service.

<sup>c</sup>*p* values have been corrected using false discovery rate (fdr). *p* values were corrected among SUP for 12-month ideator and propensity score-matched comparisons, respectively.

\*Bold values are significant at *p* < 0.05.

individual morale (e.g., his/her morale) were less likely to die by suicide compared with propensity-matched controls, consistent with a large body of literature on risk and protective

factors (Bryan & Hernandez, 2013; Joiner, 2007; Van Orden et al., 2010). Third, soldiers who were described as having no religious affiliation by their SUP were less likely to die by

TABLE 2A Unit cohesion items reported by supervisors

Characteristics	Supervisor						
	Cases	Controls (propensity)			Controls (12-month ideation)		
	(n = 107)	(n = 80)	OR <sup>a,b</sup>	(95% CI)	(n = 73)	OR <sup>a,b</sup>	(95% CI)
	%	%			%		
Soldier would have agreed with the following							
Could rely on other members of his/her unit	82.88	86.34	0.8	(0.4, 1.6)	79.40	1.3	(0.2,7.7)
$X^2, p_{fdr}^c$			0.40, 0.6422			0.07, 0.8804	
Trusted his/her leaders	67.17	76.85	0.6	(0.3,1.1)	75.96	0.6	(0.1,3.5)
$X^2, p_{fdr}$			2.94, 0.2378			0.26, 0.8804	
Had confidence in his/her military training	91.98	89.35	1.7	(0.7,4.2)	91.81	1.0	(0.1,14.3)
$X^2, p_{fdr}$			1.15, 0.5203			<0.01, 0.9850	
Maintained regular contact back home	69.03	77.58	0.7	(0.4,1.3)	77.71	0.7	(0.1,3.8)
$X^2, p_{fdr}$			1.23, 0.5203			0.20, 0.8804	
Thought the members of his/her unit were cooperative	70.44	64.85	1.3	(0.7,2.2)	62.64	1.4	(0.3,6.3)
$X^2, p_{fdr}$			0.79, 0.5883			0.18, 0.8804	
Thought the members of his/her unit knew they could depend on each other	79.30	69.09	1.7	(0.9,3.1)	74.09	1.4	(0.3,7.2)
$X^2, p_{fdr}$			2.97, 0.2378			0.13, 0.8804	
Thought the members of his/her unit stood up for each other	72.33	67.64	1.2	(0.7,2.2)	75.97	0.8	(0.1,4.4)
$X^2, p_{fdr}$			0.50, 0.6422			0.06, 0.8804	
Had real confidence in his/her unit's ability to perform its mission	80.80	71.15	1.8	(1.0,3.4)	73.39	1.6	(0.3,8.3)
$X^2, p_{fdr}$			3.37, 0.2378			0.29, 0.8804	
Thought the members of his/her unit would risk their lives for each other	64.16	65.88	0.9	(0.6,1.6)	72.63	0.7	(0.1,3.6)
$X^2, p_{fdr}$			0.04, 0.8428			0.18, 0.8804	
How would you rate the following in the last month of his/her life							
His/her morale medium vs. low	35.14	32.71	<b>0.2</b>	<b>(0.1,0.5)</b>	44.40	0.3	(0.0,2.5)
High vs. low	27.12	58.83	<b>0.1</b>	<b>(0.0,0.2)</b>	43.51	0.2	(0.0,2.1)
$X^2, p_{fdr}$			<b>30.14*</b>	<b>0.0001</b>		1.83, 0.8804	
Morale in his/her unit medium vs. low	42.80	49.07	0.8	(0.4,1.5)	64.88	0.4	(0.1,3.1)
High vs. low	32.69	29.37	1.0	(0.5,2.0)	19.01	1.1	(0.1,12.2)
$X^2, p_{fdr}$			0.75, 0.7551			1.39, 0.8804	

Abbreviations: FDR, false discovery rate; OR, oddsratio.

<sup>a</sup>OR statistics obtained from separate multivariate logistic regression models testing differences between cases and each control group.

<sup>b</sup>Each predictor was adjusted for deployment status (never, previously).

<sup>c</sup>*p* values have been corrected using false discovery rate (fdr). *p* values were corrected among SUP for 12-month ideator and propensity score-matched comparisons, respectively.

\*Bold values are significant at *p* < 0.05.

suicide compared with propensity-matched controls. Fourth, none of the potential protective factors examined distinguished soldiers who died by suicide from control soldiers who reported suicidal ideation in the past year. Each of these findings warrants additional comments.

SUP and NOK differed in their perceptions of the nature of social support. Our findings support earlier research demonstrating that social support is a protective factor against suicide (Nock et al., 2013; Van Orden et al., 2008). Although lack of social support has long been identified as a



TABLE 2B Unit cohesion reported by next of kin

Characteristics	Next of kin						
	Cases	Controls (propensity)			Controls (12-month ideation)		
	( <i>n</i> = 61)	( <i>n</i> = 128)	OR <sup>a,b</sup>	(95% CI)	( <i>n</i> = 108)	OR <sup>a,b</sup>	(95% CI)
	%	%			%		
Soldier would have agreed with the following							
Could rely on other members of his/her unit	65.80	66.29	1.0	(0.5,1.9)	70.38	0.9	(0.2,3.6)
$X^2, p_{fdr}^c$			<0.01, 0.9703			0.03, 0.9959	
Trusted his/her leaders	56.39	65.12	0.7	(0.4,1.3)	60.56	0.9	(0.2,3.3)
$X^2, p_{fdr}$			1.22, 0.6070			0.04, 0.9959	
Had confidence in his/her military training	89.41	97.71	0.2	(0.1,0.7)	96.59	0.3	(0.0,7.3)
$X^2, p_{fdr}$			6.49, 0.0977			0.59, 0.9959	
Maintained regular contact back home	86.63	92.37	0.5	(0.2,1.3)	88.84	0.9	(0.1,6.9)
$X^2, p_{fdr}$			2.11, 0.6070			0.01, 0.9959	
Thought the members of his/her unit were cooperative with each other	67.37	67.82	1.0	(0.5,1.9)	67.20	1.0	(0.3,3.9)
$X^2, p_{fdr}$			<0.01, 0.9703			<0.01, 0.9959	
Thought the members of his/her unit knew they could depend on each other	68.94	73.38	0.9	(0.5,1.8)	71.40	0.9	(0.2,3.8)
$X^2, p_{fdr}$			0.08, 0.9703			0.01, 0.9959	
Thought the members of his/her unit stood up for each other	60.47	62.32	0.9	(0.5,1.7)	60.26	1.1	(0.3,4.2)
$X^2, p_{fdr}$			0.08, 0.9703			0.02, 0.9959	
Had real confidence in his/her unit's ability to perform its mission	69.69	77.36	0.7	(0.4,1.5)	77.02	0.7	(0.1,3.4)
$X^2, p_{fdr}$			0.71, 0.7203			0.20, 0.9959	
Thought the members of his/her unit would risk their lives for each other	79.18	72.51	1.6	(0.8,3.3)	73.92	1.4	(0.3,6.1)
$X^2, p_{fdr}$			1.57, 0.6070			0.19, 0.9959	

Abbreviations: FDR, false discovery rate; OR, oddsratio.

<sup>a</sup>OR statistics obtained from separate multivariate logistic regression models testing differences between cases and each control group.

<sup>b</sup>Each predictor was adjusted for deployment status (never, previously) and number of years of active service.

<sup>c</sup>*p* values have been corrected using false discovery rate (fdr). *p* values were corrected among NOK for 12-month ideator and propensity score-matched comparisons, respectively.

risk factor for poor mental health outcomes, it is important to harness every available opportunity to increase social support and thus better protect soldiers against suicide. Our findings suggest that the observations of supervisors in these domains have potential implications for education and training of non-clinical personnel in the identification of risk at work or at home, such as training supervisors to monitor social support levels for their soldiers and to actively develop unit-level social support for those soldiers in need.

Interestingly, contrary to the literature, NOK failed to identify social closeness and unit cohesion as protective. The emotional and mental state of the informant may have influenced NOK informant responses and perceptions of social closeness. NOK may not have been as aware as SUP of the degree of social support a service member received from

his/her unit. Perhaps next of kin was reporting on lifetime observations of social connections, rather than those established in the service member's current military occupational environment. The latter may be more relevant for suicide risk and may be better observed by SUP. SUP may have hidden unit cohesion problems or under-reported concerns about the consequences of a subordinate's suicide; however, the range of responses for unit cohesion suggests the supervisors were candid in their responses. Furthermore, informed consent and confidentiality were provided to encourage the validity of responses.

SUP reports of soldiers' individual morale were also protective factors of suicide—those who experienced less negativity in their units (his/her morale) were less likely to die by suicide. While morale at the unit level may be an

**TABLE 3A** Religiosity reported by supervisors

Characteristics	Supervisor						
	Cases	Controls (propensity)			Controls (12-month ideation)		
	(n = 107)	(n = 80)	OR <sup>a,b</sup>	(95% CI)	(n = 73)	OR <sup>a,b</sup>	(95% CI)
	%	%			%		
Affiliation: What was [soldier's name]'s religious preference?							
Other religion vs. Christian	9.20	5.86	0.6	(0.2,1.9)	2.85	2.2	(0.0,177.3)
No religion vs. Christian	51.16	73.64	<b>0.3</b>	<b>(0.2,0.6)</b>	70.02	0.5	(0.1,2.4)
	$X^2, p_{fdr}^c$			<b>13.22*, 0.0117</b>	1.16, 0.9973		
Attendance: How often did he/she usually attend religious services when he/she could, for instance, when not deployed?							
At least once a week vs. never	8.86	4.16	2.5	(0.8,7.4)	14.48	0.6	(0.1,4.8)
At least once a month vs. never	9.49	3.73	3.1	(1.0,9.4)	5.71	1.6	(0.1,37.0)
Less than once a month vs. never	5.05	9.40	0.5	(0.2,1.6)	9.17	0.6	(0.0,7.8)
	$X^2, p_{fdr}$			7.78, 0.2286	0.56, 0.9973		
Religiosity: How religious did he/she consider himself/herself to be? Religious refers to his/her faith in a higher power or practice of religious beliefs							
Very vs. not at all	4.21	3.58	1.4	(0.4,5.5)	8.28	0.6	(0.0,10.3)
Moderately vs. not at all	22.02	26.42	0.9	(0.5,1.7)	16.37	1.6	(0.2,12.1)
Slightly vs. not at all	17.77	10.51	1.7	(0.8,3.8)	12.05	1.7	(0.2,15.8)
	$X^2, p_{fdr}$			2.61, 0.6824	0.55, 0.9973		
Spirituality: How spiritual did he/she consider himself/herself to be? Spiritual refers to his/her value of the spiritual aspect of life							
Very vs. not at all	6.74	3.73	1.9	(0.6,6.4)	9.86	0.8	(0.1,10.2)
Moderately vs. not at all	20.44	22.21	1.0	(0.5,1.9)	16.83	1.3	(0.2,10.0)
Slightly vs. not at all	15.68	17.00	0.8	(0.4,1.8)	13.56	1.2	(0.1,10.4)
	$X^2, p_{fdr}$			1.42, 0.7016	0.16, 0.9973		
He/she saw himself/herself as							
Born-again	8.02	10.86	0.8	(0.3,2.1)	4.58	2.0	(0.1,61.8)
	$X^2, p_{fdr}$			0.16, 0.7016	0.16, 0.9973		
Filled with the spirit	5.90	5.35	1.3	(0.4,4.0)	6.34	1.0	(0.1,20.2)
	$X^2, p_{fdr}$			0.20, 0.7016	<0.01, 0.9973		
Fundamentalist	2.53	6.24	0.4	(0.1,1.7)	7.74	0.3	(0.0,6.0)
	$X^2, p_{fdr}$			1.52, 0.6531	0.56, 0.9973		
Evangelical <sup>d</sup>	0.00	2.79	–	–	0.54	–	–
	$X^2, p_{fdr}$			–	–		
Part of the charismatic movement <sup>d</sup>	2.97	0.89	2.9	(0.3, 25.4)	0.00	–	–
	$X^2, p_{fdr}$			0.94, 0.6824	–		
Any of the above	13.52	18.66	0.7	(0.4,1.5)	14.08	1.0	(0.1,8.1)
	$X^2, p_{fdr}$			0.65, 0.6824	<0.01, 0.9973		

Abbreviations: FDR, false discovery rate; OR, oddsratio.

<sup>a</sup>OR statistics obtained from separate multivariate logistic regression models testing differences between cases and each control group.

<sup>b</sup>Each predictor was adjusted for deployment status (never, previously).

<sup>c</sup>*p* values have been corrected using false discovery rate (fdr). *p* values were corrected among SUP for 12-month ideator and propensity score-matched comparisons, respectively.

<sup>d</sup>Unstable estimates due to cell sizes *n* < 5.

\*Bold values are significant at *p* < 0.05.

TABLE 3B Religiosity reported by next of kin

Characteristics	Next of kin						
	Cases	Controls (propensity)			Controls (12-month ideation)		
	(n = 61)	(n = 128)	OR <sup>a,b</sup>	(95% CI)	(n = 108)	OR <sup>a,b</sup>	(95% CI)
	%	%			%		
Affiliation: What was [soldier's name]'s religious preference?							
Other religion vs. Christian	9.02	14.85	0.6	(0.2,1.8)	7.64	1.2	(0.1,13.5)
No religion vs. Christian	25.53	24.85	0.9	(0.4,1.8)	30.66	0.8	(0.2,3.3)
$X^2, p_{fdr}^c$			0.71, 0.7020			0.14, 0.9611	
Attendance: How often did he/she usually attend religious services when he/she could, for instance, when not deployed?							
At least once a week vs. never	15.77	15.19	0.9	(0.4,2.1)	16.06	0.8	(0.1,5.2)
At least once a month vs. never	10.78	18.36	0.4	(0.2,1.2)	15.21	0.6	(0.1,4.0)
Less than once a month vs. never	17.06	22.36	0.6	(0.3,1.4)	26.40	0.6	(0.1,2.9)
$X^2, p_{fdr}$			3.51, 0.5159			0.62, 0.9611	
Religiosity: How religious did he/she consider himself/herself to be? Religious refers to his/her faith in a higher power or practice of religious beliefs							
Very vs. not at all	16.12	18.52	0.9	(0.4,2.3)	22.57	0.6	(0.1,3.6)
Moderately vs. not at all	28.87	38.56	0.8	(0.4,1.7)	27.23	0.9	(0.2,4.8)
Slightly vs. not at all	20.47	10.48	1.8	(0.7,4.3)	20.64	0.7	(0.1,4.6)
$X^2, p_{fdr}$			3.18, 0.5159			0.38, 0.9611	
Spirituality: How spiritual did he/she consider himself/herself to be? (spiritual refers to his/her value of the spiritual aspect of life)							
Very vs. not at all	19.05	26.48	0.9	(0.4,2.0)	26.19	0.7	(0.1,4.2)
Moderately vs. not at all	25.53	27.64	1.1	(0.5,2.6)	28.30	1.1	(0.2,5.9)
Slightly vs. not at all	26.75	14.70	2.0	(0.9,4.5)	16.33	1.6	(0.2,10.8)
$X^2, p_{fdr}$			3.80, 0.5159			0.56, 0.9611	
He/she saw himself/herself as							
Born-again	31.26	25.42	1.6	(0.8,3.1)	23.73	1.4	(0.3,6.2)
$X^2, p_{fdr}$			1.97, 0.5159			0.22, 0.9611	
Filled with the spirit	17.88	21.53	0.7	(0.3,1.6)	24.49	0.7	(0.1,3.0)
$X^2, p_{fdr}$			0.67, 0.5159			0.29, 0.9611	
Fundamentalist	4.71	19.25	0.2	(0.0,0.7)	5.61	0.9	(0.1,15.7)
$X^2, p_{fdr}$			6.49, 0.1082			<0.01, 0.9611	
Evangelical	1.57	12.49	0.1	(0.0,0.9)	7.56	0.2	(0.0,4.2)
$X^2, p_{fdr}$			4.26, 0.1954			1.12, 0.9611	
Part of the charismatic movement	1.57	5.35	0.3	(0.0,2.7)	3.80	0.4	(0.0,17.2)
$X^2, p_{fdr}$			1.18, 0.5159			0.22, 0.9611	
Any of the above	34.40	40.30	0.8	(0.4, 1.5)	36.15	0.9	(0.2, 3.3)
$X^2, p_{fdr}$			0.43, 0.5685			0.03, 0.9611	

Abbreviations: FDR, false discovery rate; OR, oddsratio.

<sup>a</sup>OR statistics obtained from separate multivariate logistic regression models testing differences between cases and each control group.

<sup>b</sup>Each predictor was adjusted for deployment status (never, previously) and number of years of active service.

<sup>c</sup>*p* values have been corrected using false discovery rate (fdr). *p* values were corrected among NOK for 12-month ideator and propensity score-matched comparisons, respectively.

important element of mission success, it appears supervisor assessment of the individual service member may be of more importance in preventing suicide than assessment of the

overall unit's morale. Efforts to improve cohesion might take the form of unit social and recreational activities (beyond mission-specific training requirements) implemented by

supervisors during downtime. As Young (2019) notes, unit leaders should continuously develop pride by finding ways to spotlight accomplishments by individuals, teams, and the unit. Supervisors and leaders might then observe the impact of such activities on unit cohesion just as they observe the impact of training on mission capability.

In our study, having no religious preference (not being affiliated with or committed to any religion) appeared to be more protective than being Christian, at least as observed by SUP. In contrast, NOK reports of a service member's religious preference failed to reach statistical significance. Given contrasting reports, and our small sample size, the role of religious preference should be re-examined in larger samples. Contrary to current findings in the literature, religious service attendance—as reported by NOK and SUP—was not associated with STBs as a protective factor. This may be related to measurement and study methodology in that religious activities are a very personal endeavor and family and supervisors may simply not be fully aware of how devout (or not) a soldier is. Indeed, this could be especially the case with religious family members if the soldier is moving away from religion and feels they need to keep this from devout family members.

Our results for SUP on religious affiliation are unique and, if replicated, suggest that soldiers with no religious affiliation were less likely to engage in suicidal thoughts and attempts, as compared to those affiliated with Christianity. Nevertheless, service members requesting religious support should be provided access to chaplains and other religious advisors.

The findings of this study suggest that the assessment processes for suicide risk should also incorporate methods to identify people who lack a sense of belonging or social support, and those who report negativity in their units (e.g., morale). It is also noteworthy that those not having a religious affiliation may be at lower risk for suicide. Although the majority of our findings are consistent with previously identified contributors to risk and protection from suicide, they also suggest that third parties may be capable of identifying risk and could play a key role in assessments. These assessments may include recognizing warning signs of general distress and taking appropriate action. There is also support for encouraging the soldier to seek support from a medic or chaplain.

## Limitations

Our results need to be interpreted with certain limitations. First, psychological autopsy studies are limited by bias related to the informant's knowledge of the status of cases and controls. For example, informants may have been biased toward rating soldiers who died by suicide as less likely to seek help or to perceive social closeness. Despite widely held

preconceptions about the informant method of research, including bias, studies have shown informant data to be valid and reliable (Conner et al., 2012). This has been shown in comparison with self-reported data suggesting self-reported data and informant data are highly correlated (Lieberman et al., 2016) and also in post-mortem research of psychiatric symptoms (Thompson et al., 2013).

Second, the relatively small sample size limited the power to conduct analyses by gender; therefore, it is not possible to establish whether male and female soldiers who died by suicide were affected the same or differently. Third, the unit of analysis for the unit cohesion constructs was on the individual level, as reported by an informant. More recent research is needed examining unit cohesion from the perspective of the informant and comparing the individual- and unit-level cohesion factors related to STBs (Campbells-Sills et al., 2020; Rugo et al., 2020).

Finally, the response rates were low compared with surveys conducted in the general population, but they were high for multi-informant interviews conducted in a military population (Cavanagh et al., 2003; Conner et al., 2012). To increase our understanding of the etiology and treatment of suicidality, future research should focus on study design efforts to increase outreach and recruitment efforts for difficult-to-reach family members who knew the decedent well. The low supervisor response rate was mainly attributable to the inability to locate or reach the supervisor and may be improved in future studies with multimodal recruitment efforts including email and/or text message reminders rather than by letter invitation. Multimodal efforts may help educate control SUPs who may have been less invested in the research, as to the importance of their response to the overall research.

## Implications

The fact that neither NOK nor SUP identified factors that distinguished soldiers who died by suicide from controls who reported suicidal ideation suggests that more research is needed to understand the critical transition from suicide ideation to suicide. The present study thus suggests that supervisors may be of assistance in identifying those at risk of suicidal thinking (and hence at risk of suicide) at the screening level based on their assessments of social support or unit cohesion. This lack of difference may also be explained by the self-report single-item assessment used for suicidal ideation. Single-item measurement of suicidal behaviors is widely used, but may contribute to lack of clarity of the full range of suicidal thoughts. Millner et al. (2015) reported in a clinical sample, 8.8% of those who endorsed a single-item measure of suicidal ideation endorsed thoughts that would not meet the standard definition of suicide (Millner et al., 2015). Although we used a modified version of the Columbia

Suicide Severity Scale (Posner et al., 2011), which is a binary assessment of suicidal ideation in the past year, we were unable to account for the heterogeneity of suicide ideation over time. Further, we did not assess for current suicidal ideation in the past month, which would have been a better immediate indicator of risk. Future research is needed to determine the reliability of single-item measures of suicidal behaviors with increased number of response options and more follow-up questions for further clarification.


Other methods of assessment are important to consider for suicide risk screening and prevention. For example, existing suicide risk screening and assessment measures typically focus on quantitative data regarding psychiatric symptoms and diagnoses, and psychological and behavioral variables associated with suicidal ideation and attempts. However, these instruments may not fully represent the critical, and in some cases subtler signs of suicidality. In contrast, open-ended qualitative interviews may allow participants an opportunity to describe their internal and subjective observations in their own words. Further research may also help identify protective factors that can be addressed through suicide prevention programs. Training can also be designed to enhance protective factors, such as resilience training programs, individual motivation strategies, and team-building strategies. Importantly, the findings of this study will increase knowledge on prevention efforts aimed at protecting military personnel from suicidal behavior.

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## ORCID

Catherine L. Dempsey  <https://orcid.org/0000-0002-5712-6590>

Robert J. Ursano  <https://orcid.org/0000-0002-1861-9173>

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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