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## The collaborative assessment and management of suicidality (CAMS) versus enhanced care as usual (E-CAU) with suicidal soldiers: Moderator analyses from a randomized controlled trial

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### ABSTRACT

Given historically high rates of suicide among military personnel over the past decade the present study analyzed whether key demographic, military, and research-based variables moderated clinical treatment outcomes of 148 suicidal active duty US Army soldiers. This is a secondary analysis of data from a randomized controlled trial comparing the collaborative assessment and management of suicidality (CAMS) to enhanced care as usual (E-CAU; Jobes et al., 2017). Nine potential moderator variables were derived from the suicidology literature, military-specific considerations, and previous CAMS research; these were sex, age, marital status, race, lifetime suicide attempts, combat deployments, time in service, initial distress, and borderline personality disorder diagnosis. The clinical outcomes included six suicide- and mental health-related variables. Six of the eight significant moderator findings in this study showed CAMS outperforming E-CAU in certain subgroups with medium to large effect sizes ranging from 0.48 to 1.50. Collectively, the results suggest that CAMS was associated with the greatest improvement among lower complexity soldier patients, particularly those with lower initial distress and fewer deployments. Those who were married or older generally responded better to CAMS, although the results were not entirely consistent with respect to age. CAMS's effectiveness for married soldiers and those with lower initial distress was a particularly robust finding that persisted when adjusting more stringently for multiple testing. This study sheds light on several factors associated with the success of CAMS among suicidal soldiers that can assist in matching the treatment to those that may benefit the most.

### ARTICLE HISTORY

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### KEYWORDS

RCT; moderators; CAMS;  
suicidal soldiers

**What is the public significance of this article?**—This study suggests that the Collaborative Assessment and Management of Suicidality (CAMS), an evidence-based treatment for reducing suicide risk, is superior to usual care for certain subgroups of suicidal soldiers. Lower complexity Soldier patients appear to benefit the most from CAMS, particularly those with less initial distress and with fewer combat deployments. Married or older patients also appear to generally improve more with CAMS.

Suicide is the 10<sup>th</sup> leading cause of death in the United States with 44,193 deaths in 2015 (Xu, Murphy, Kochanek, & Arias, 2016). Each year, an estimated 1.4 million adult Americans attempt suicide and 9.8 million report having suicidal thoughts (Centers for Disease Control and Prevention, 2015). Although historically lower than the general population, since 2008 the United States Armed Forces (particularly the US Army) have experienced

dramatic increases in suicide rates (Schoenbaum et al., 2014; Ursano et al., 2014). Considering the overall public health impact of suicide and its related suffering, it is noteworthy how few clinical treatments for suicide risk have shown consistent effectiveness in randomized controlled trials (RCTs), which is the gold standard of evidence for effective care (Jobes, Au, & Siegelman, 2015). Indeed, only three major approaches for treating suicide risk have demonstrated replicated effectiveness in multiple trials. These include dialectical behavior therapy (Linehan, 1993, 2014), two forms of suicide-specific cognitive-behavioral therapy (CBT)—cognitive therapy for suicide prevention (CT-SP; Brown et al., 2005; Wenzel, Brown, & Beck, 2009) and brief cognitive behavior therapy (BCBT; Rudd et al., 2015)—and the collaborative assessment and management of suicidality (CAMS; Jobes, 2016), which is the focus of this article.

CAMS is an evidence-based suicide-specific therapeutic framework that targets and treats patient-defined “suicidal drivers” and has previously shown promise with suicidal military personnel (Jobes, Wong, Conrad, Drozd, & Neal-Walden, 2005). In contrast to other treatments, CAMS is an innovative atheoretical flexible therapeutic framework shown to work across a range of clinical settings and different suicidal populations around the world (Jobes, Gregorian, & Colborn, 2018). As reported by Jobes et al. (2005), CAMS was significantly associated with rapid reduction of suicidal ideation and decreased emergency department and primary care visits for 55 suicidal airmen in comparison to nonrandomized treatment as usual (TAU). CAMS has been subsequently shown in several RCTs to be effective across a range of outcomes. In a study of 32 suicidal community mental health outpatients, Comtois et al. (2011) found CAMS to be significantly more effective than TAU in reducing suicidal ideation and overall symptom distress, while significantly increasing hope and patient satisfaction. Within a superiority RCT, CAMS showed promise for effectively treating self-harm and suicide attempts, performing as well as DBT among a sample of 108 suicide attempters with borderline personality traits (Andreasson et al., 2016). There are also seven additional nonrandomized published clinical trials that have shown replicated effects wherein CAMS was associated with rapid reduction of suicidal ideation, decreases in symptom distress, depression, and changes in suicidal cognitions (Ellis, Green, Allen, Jobes, & Nadorff, 2012; Ellis, Rufino, & Allen, 2017; Ellis, Rufino, Allen, Fowler, & Jobes, 2015; see also a review by Jobes, 2012).

Operation Worth Living (OWL) was a RCT that compared CAMS versus enhanced care as usual (E-CAU) with 148 suicidal active duty US Army soldiers. As reported by Jobes et al. (2017), the primary experimental outcomes of this well-powered RCT showed robust effect sizes across four follow-up assessments at 1, 3, 6, and 12 months for both CAMS and E-CAU treatments (with 78% retention of participants at 12 months). Although the between-group experimental effects were mostly nonsignificant, CAMS participants were more likely to have no suicidal ideation at the 3-month assessment following 6–8 sessions (on average) of CAMS in comparison to E-CAU. Given that participants in both groups improved and did not have a return to suicidality over 12 months, CAMS effectively resolved suicidality sooner than E-CAU.

From a purely experimental standpoint, non-significant between-group RCT results can be difficult to interpret. Nevertheless, null findings from RCTs can be important to advancing treatment science. When

overall between-group intervention effects are non-significant, further investigations of potential moderating variables are important. Indeed, one potential explanation for a nonsignificant intervention main effect is that an intervention may be effective for one or more subgroups of individuals, but ineffective in other subgroups, which can cause the overall effect to be non-significant (MacKinnon, 2011). Furthermore, evaluating moderators of treatment may help clarify for whom a treatment is effective, thus optimizing treatment-matching and informing specific treatment recommendations.

The current moderator-focused investigation uses data from the larger OWL RCT to examine the potential impact of nine baseline variables on overall treatment outcomes. Five variables have been studied over many years: (a) sex, (b) age, (c) marital status, (d) race, (e) history of suicide attempts (refer to Maris, Berman, & Silverman, 2000). Two variables were based on military-specific experiences: (f) combat deployments and (g) years in military service (Department of Defense Task Force on the Prevention of Suicide by Members of the Armed Forces [DoD Task Force], 2010). The remaining variables were derived from existing CAMS research and deemed to be particularly relevant to the intervention: (h) baseline distress and (i) presence of borderline personality disorder (Pistorello et al., 2017).

## Method

### Setting

The data were drawn from the OWL RCT (Jobes et al., 2017), which was conducted within the Division of Behavioral Health on a US Army installation in the Southeastern United States. Behavioral health clinicians, clinic chiefs, and other medical staff identified potential soldier participants who reported suicidal ideation or were thought to be at risk for suicide. All study procedures were reviewed and approved by the Department of Defense institutional review board (IRB) and Human Research Protection Office as well as University of Washington and The Catholic University of America IRBs and reported in detail by Jobes et al. (2017).

### Participants

#### Patients

Data from 148 soldiers with significant levels of suicidal ideation (baseline Scale for Suicide Ideation—current scores were 13 or higher) assessed at baseline, 1, 3, 6 and 12 months from the OWL RCT were included

(Jobes et al., 2017). Exclusion criteria were (a) inability to understand, consent, or benefit from study procedures due to significant psychosis, paranoia, cognitive impairment, or where psychosocial therapeutic care was otherwise contraindicated; (b) a judicial order to treatment; or (c) separation, change of duty station, or deployment expected in the next 12 weeks. At the request of our military collaborators the following individuals were also excluded: (a) soldiers in the Warriors in Transition Unit; and (b) pregnant soldiers.

### **Clinicians**

Study therapists were all clinical social workers except for one masters-level mental health counselor.

### **Treatment conditions**

Soldier participants were randomized to one of two treatment conditions: CAMS or E-CAU (Jobes et al., 2017).

### **CAMS intervention**

CAMS is a model of care developed by the principal investigator (PI) of the larger RCT, which is designed to modify how clinicians engage, assess, and plan treatment with suicidal patients (Jobes, 2016). CAMS facilitates collaboration between clinician and patient that targets both direct and indirect “drivers” of current and future suicide thinking and behaviors (i.e., CAMS is specifically designed to target and treat those issues that make a patient suicidal). CAMS-guided care proceeds until resolution of suicidal risk is achieved as per Jobes’ (2016) established criteria of three consecutive sessions of reduced “overall risk of suicide” (<3 out of 5 rating) as assessed by the Suicide Status Form (SSF) and patient report of having managed suicidal thoughts, feelings, and behaviors. Successfully resolved CAMS patients typically have developed new (nonsuicidal) coping skillsets as well as increased psychological resilience, reasons for living, and a greater sense of purpose and meaning (Jobes, 2016). CAMS clinicians received a 1.5-day content training and role-playing with the PI and were engaged in weekly consultation calls with the PI’s team. The PI and his team reviewed video recordings of CAMS sessions using the CAMS Rating Scale (CRS) to establish initial adherence and 10% of cases were randomly checked thereafter to prevent any potential “drift” in CAMS adherence; no such drift was observed across the randomly selected sessions (Corona, 2016).

### **E-CAU intervention**

The comparison condition for this study was E-CAU. A central goal of the larger RCT was to determine whether the provision of CAMS is an improvement over standard existing Army procedures. However, to assure comparability to CAMS in this trial, care as usual was enhanced by requiring a minimum of four sessions and offering clinical consultation meetings to E-CAU clinicians. All E-CAU control sessions were digitally recorded with a proportion scored for nonadherence to CAMS to ensure between-group experimental fidelity. Fidelity reviews of recordings of E-CAU providers confirmed that key elements of the CAMS framework were not implemented in the control arm (Corona, 2016). E-CAU clinicians relied on their own professional training; no specific trainings were offered.

### **Measures**

#### **Suicide Attempt Self-Injury Count**

The Suicide Attempt Self-Injury Count (SASI-Count) is a brief interview covering past self-inflicted injuries categorizing them into suicide attempts and non-suicidal acts (Linehan & Comtois, 1996; Linehan, Comtois, Brown, Heard, & Wagner, 2006). The tool also creates counts of self-inflicted injuries by method, medical risk severity, and lethality. The present study focused on the assessment of lifetime attempts conducted at baseline. Interviewer ratings on the SASI-Count are the same as in the Suicide Attempt Self-Injury Interview, which has shown strong reliability and validity (Linehan et al., 2006).

#### **Structured Clinical Interview for DSM-IV Axis II**

The Structured Clinical Interview for DSM-IV Axis II is a diagnostic instrument based on DSM-IV diagnostic criteria for Axis II disorders (First, Gibbon, Spitzer, & Benjamin, 1997) and was used to identify patients with Borderline Personality Disorder at baseline given the suicide risk associated with this disorder.

#### **Scale for Suicide Ideation-Current**

The Scale for Suicide Ideation-Current is a 19-item interviewer-administered scale measuring suicidal ideation at its worst point in the past 2 weeks (Beck, Brown, & Steer, 1997). The responses were summed to create an index of SI ranging from 0 to 38, with higher scores reflecting greater ideation. This measure has been found to be valid and reliable when used with psychiatric patients (Cronbach’s alpha = .89; Beck et al., 1997; Beck, Kovacs, & Weissman, 1979).

### **Treatment History Interview–Military**

The Treatment History Interview–Military (THI-M; Linehan, 1996) is an interviewer-administered self-report measure used to capture the participant's use of health and behavioral health services. The THI-M is a briefer version of the full Treatment History Interview (THI) adapted for a military health care system. The THI has high convergent validity with hospital records and psychotherapist reports. The present study focused on the number of ED visits for (a) suicide attempts or suicidal ideation and (b) behavioral health-related reasons.

### **Outcome Questionnaire-45**

The Outcome Questionnaire-45 (OQ-45) is a 45-item questionnaire designed to measure key areas of mental health functioning, including symptom distress, interpersonal problems, and social role functioning (Lambert et al., 1996). Among adult psychiatric patients, the OQ-45 possesses good psychometric properties with internal consistencies for the subscales ranging from .71 to .91 (Lambert et al., 1996; Umphress, Lambert, Smart, Barlow, & Clouse, 1997). The present study focused on baseline symptom distress (range: 0 to 100) and global severity score (range: 0 to 180), with higher scores reflecting greater distress or severity.

### **The Medical Outcomes Study Short Form-36 Version 2**

The Medical Outcomes Study Short Form-36 Version 2 (SF-36) is a 36-item self-report tool yielding a physical and a mental health summary score, as well as eight subscales (Ware, Snow, Kosinski, & Gandek, 1993). In various populations, internal consistency for the scales has been shown to be at least .70 and the SF-36 has been widely used in Veteran populations (Voelker et al., 2002). The present study focused on the mental health subscale scores, which range from 0 to 100 with higher scores reflecting better overall mental health.

### **Connor-Davidson Resilience Scale**

The Connor-Davidson Resilience Scale (CD-RISC) is a 25-item questionnaire regarding attitudes toward coping with adversity; it has high internal consistency (Cronbach's  $\alpha = .89$ ) and test-retest reliability (ICC = .87) as well as convergent and divergent validity (Connor & Davidson, 2003). The responses were summed to create an index of resilience ranging from 0 to 100.

### **Data analyses**

To evaluate intervention moderator effects, longitudinal regression analyses were conducted using generalized linear mixed modeling (GLMM) to evaluate whether (a) sex (male vs. female), (b) age in years, (c) marital status (not married vs. married), (d) race (White, Black, Other), (e) lifetime suicide attempts (0, 1, 2 or more), (f) combat deployments (0, 1, 2, 3 or more), (g) first 4 years of service (4 years or less vs. greater than 4 years), (h) baseline symptom distress, and (i) borderline personality disorder diagnosis were associated with prospective differences in the effect of the CAMS versus E-CAU intervention on the primary study outcomes (i.e., moderation of the treatment by time interaction). The study outcomes evaluated were (a) suicidal ideation (SI); (b) suicide-related emergency department (ED) visits; (c) behavioral health-related ED visits; (d) overall mental health (SF-36); (e) resilience (CD-RISC); and (f) global severity (OQ-45). The ED visit variables were dichotomized into no visits versus one or more visits because of low postbaseline rates above one and combined from baseline through 12 months due to very low frequencies at each assessment point.

Each outcome variable was regressed on treatment (CAMS vs. E-CAU), moderator, Treatment  $\times$  Moderator, time, Moderator  $\times$  Time, Treatment  $\times$  Time, and Treatment  $\times$  Time  $\times$  Moderator in separate GLMM models. The statistical test of moderation was the magnitude and statistical significance of the treatment by time by moderator interaction. For the outcomes that were evaluated at all assessment points (0, 1, 3, 6, and 12 months), there was greater average improvement during the active treatment phase (Months 1–3, approximately) compared with follow-up period (Months 3–12, approximately), where outcome trajectories flattened. To accommodate these nonlinear trajectories over time, the time variable was defined as the natural log of the number of months since study baseline. Logistic and Gaussian GLMMs were used for binary and relatively normally distributed variables, respectively.

The primary SI outcome (SSI-C) had a positively skewed distribution and many zeroes. For this outcome we used a two-part regression model known as a hurdle model (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013), which assumes that a threshold must be crossed from zero into positive values. The hurdle model approach effectively divides the SI outcome into two outcomes, each modeled in its own regression equation. One outcome is a dichotomous variable representing zero SI versus any SI and includes the entire sample.

The second outcome represents the degree of SI when there is any SI. Thus, a hurdle model contains two sub-models: (a) a logistic regression for zeroes versus not zeroes; and (b) a zero-truncated over-dispersed Poisson regression for the distribution of nonzero values. The hurdle model of the SI outcome provided two sets of results corresponding to the impact of treatment on (a) likelihood of any SI (i.e., logit model) and (b) average SI given any SI (i.e., zero-truncated count model).

We also conducted post-hoc sensitivity analyses that accounted for multiple tests more stringently using the Benjamini and Hochberg (1995) procedure, assuming a maximum false discovery rate of 0.25.

## Results

### Descriptive analyses

The sample consisted of 148 participants ranging in age from 18 to 48 years ( $M = 26.8$ ,  $SD = 5.9$ ). Descriptive statistics on the moderators for the overall sample and by study condition are summarized in Table 1.

### Intervention moderation analyses

Table 2 summarizes the estimated intervention moderation effects (Cohen's  $d$ ) from baseline to 12 months by proposed moderator for each of the eight study

outcomes. The effect sizes for age, combat deployments, and baseline symptom distress represent the effect of a 1  $SD$  increase in the moderator. Significant moderation results are shown in Figures 1–4.

Figure 1 illustrates the predicted intervention effect of CAMS versus E-CAU by age for participants who were 21 years old (1  $SD$  below the mean), 27 years old (mean), and 33 years old (1  $SD$  above the mean). With respect to the probability of any behavioral health ED admit, CAMS was increasingly effective with age such that the probability of any behavioral health-related ED admit decreased more among older participants ( $d = 0.89$ , 95% CI = [0.02, 1.80],  $p = .042$ ). With respect to overall mental health, CAMS was associated with lower mental health scores at younger ages. Average mental health was higher at baseline among older participants who received CAMS, however, those scores decreased over time compared with participants in E-CAU ( $d = -0.25$ , 95% CI = [-0.49, -0.01],  $p = .047$ ), who had a comparable increase across all ages in mental health scores.

Figure 2 illustrates the predicted intervention effect of CAMS versus E-CAU by marital status for participants who were married versus not married. With respect to resilience, CAMS was associated with a 7.7-point greater improvement in resilience from baseline to 12 months among married participants ( $d = 0.48$ , 95% CI = [0.14, 0.82],  $p = .007$ ). With respect to global severity, CAMS was associated with a 14.1-point greater reduction in global severity score from baseline to

**Table 1.** Descriptive statistics of moderator variables overall and by treatment condition.

Moderators	Range	Overall			CAMS			E-CAU		
		<i>N</i>	%	<i>M</i> ( <i>SD</i> )	<i>n</i>	%	<i>M</i> ( <i>SD</i> )	<i>n</i>	%	<i>M</i> ( <i>SD</i> )
Sex										
Male	—	119	80.4		56	76.7		63	84.0	
Female	[0, 1]	29	19.6		17	23.3		12	16.0	
Ethnicity										
White/Caucasian	—	75	53.2		37	51.4		38	55.1	
Black/African American	[0, 1]	34	24.1		17	23.6		17	24.6	
Other	[0, 1]	32	22.7		18	25.0		14	20.3	
Marital status										
Not married	—	72	49.3		36	50.7		36	48.0	
Married		74	50.7		35	49.3		39	52.0	
Lifetime suicide attempts	[0, 2]									
None		74	50.0		37	50.7		37	49.3	
One		34	23.0		16	21.9		18	24.0	
Multiple		40	27.0		20	27.4		20	26.7	
Combat deployments	[0, 3]									
0		61	41.5		31	42.5		30	40.5	
1		38	25.9		18	24.7		20	27.0	
2		28	19.0		17	23.3		11	14.9	
3 or more		20	13.6		7	9.6		13	17.6	
First four years of service	[0, 1]									
>4 years		75	51.0		35	47.9		40	54.1	
≤4 years		72	49.0		38	52.1		34	45.9	
Borderline PD diagnosis	[0, 1]									
No		100	72.5		49	70.0		51	75.0	
Yes		38	27.5		21	30.0		17	25.0	
Age in years	[18, 48]	148		26.8 (5.9)	73		26.5 (6.0)	75		27.1 (5.8)
Baseline symptom distress	[9, 92]	145		56.5 (15.9)	73		54.8 (16.5)	72		58.2 (15.2)

Note. CAMS = Collaborative Assessment and Management of Suicidality; E-CAU = Enhanced Care as Usual; PD = personality disorder.

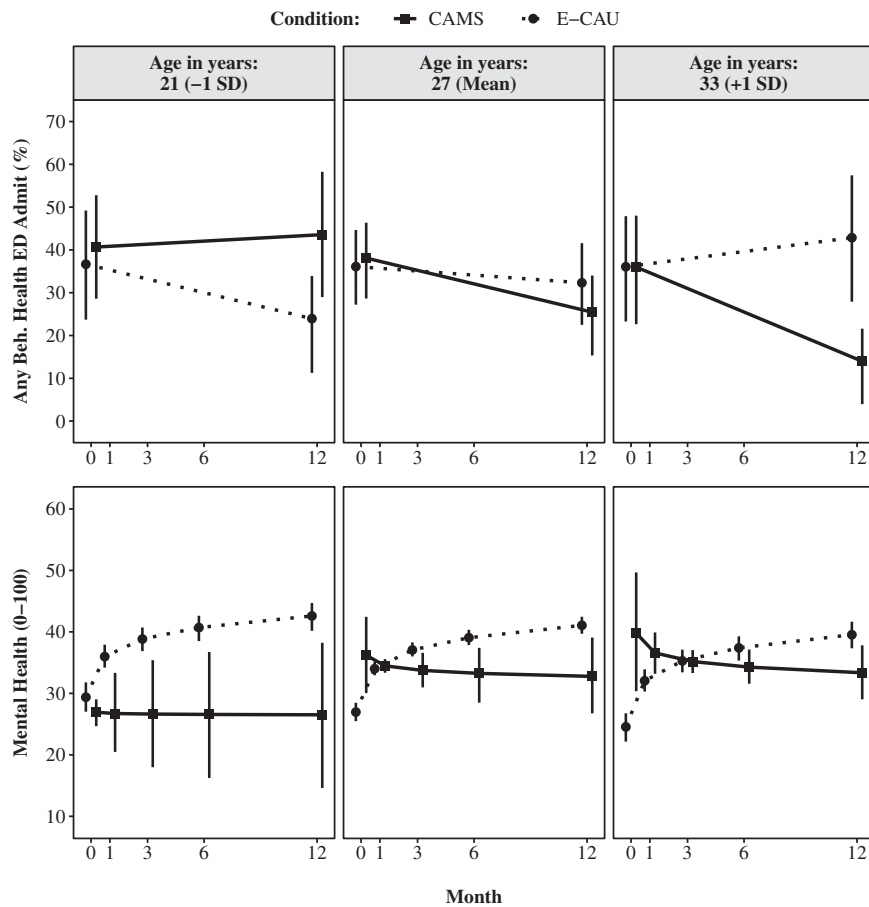
**Table 2.** Summary of moderation effects from baseline to 12 months across primary outcome variables.

Moderator variable	Outcome variable											
	SI		Any suicide-related ED admits		Any behavioral health-related ED admits		Overall mental health		Global severity		Resilience	
	Any SI <i>d</i> [95% CI]	SI intensity <i>d</i> [95% CI]	Any suicide-related ED admits <i>d</i> [95% CI]	Any behavioral health-related ED admits <i>d</i> [95% CI]	Overall mental health <i>d</i> [95% CI]	Global severity <i>d</i> [95% CI]	Resilience <i>d</i> [95% CI]					
Female	-0.30 [-2.30, 1.71]	0.51 [-1.34, 2.51]	0.69 [-1.28, 2.87]	0.03 [-1.98, 2.02]	0.31 [-0.34, 0.97]	0.12 [-0.31, 0.59]	0.19 [-0.24, 0.63]					
Age in years <sup>a</sup>	0.20 [-0.48, 0.92]	1.50 [-0.86, 6.51]	0.68 [-0.14, 1.63]	<b>0.89 [0.02, 1.80]</b>	<b>-0.25 [-0.49, -0.01]</b>	-0.09 [-0.27, 0.08]	0.04 [-0.13, 0.22]					
Married	1.11 [-0.46, 2.72]	-0.07 [-1.81, 1.75]	-0.45 [-2.10, 1.18]	-0.17 [-1.75, 1.41]	0.19 [-0.31, 0.68]	<b>0.55<sup>b</sup> [0.20, 0.90]</b>	<b>0.48<sup>b</sup> [0.14, 0.82]</b>					
Race												
- Black vs. White	-0.29 [-2.34, 1.64]	-0.80 [-2.57, 1.15]	-0.01 [-2.08, 2.11]	0.92 [-1.14, 2.93]	0.21 [-0.40, 0.82]	0.20 [-0.29, 0.62]	0.41 [-0.03, 0.84]					
- Other vs. White	-0.90 [-2.67, 0.88]	-0.02 [-1.82, 2.00]	-0.31 [-2.41, 1.98]	1.32 [-0.73, 3.60]	-0.33 [-0.96, 0.30]	-0.23 [-0.70, 0.20]	-0.10 [-0.55, 0.33]					
Lifetime suicide attempts	0.11 [-0.85, 0.94]	0.42 [-0.84, 1.77]	-0.06 [-0.96, 0.91]	-0.06 [-0.96, 0.85]	-0.07 [-0.37, 0.22]	0.07 [-0.13, 0.28]	-0.08 [-0.29, 0.12]					
Combat deployments <sup>a</sup>	0.12 [-0.59, 0.88]	0.80 [-0.59, 2.38]	0.41 [-0.39, 1.30]	0.36 [-0.43, 1.17]	<b>-0.27 [-0.53, -0.04]</b>	-0.11 [-0.28, 0.06]	0.09 [-0.07, 0.26]					
First 4 years of service	-0.51 [-2.06, 0.98]	1.22 [-0.91, 3.35]	-0.83 [-2.48, 0.73]	-0.52 [-2.06, 1.03]	<b>0.54 [0.05, 1.04]</b>	0.27 [-0.09, 0.62]	-0.24 [-0.60, 0.10]					
Baseline symptom distress <sup>a</sup>	0.10 [-0.63, 0.84]	-0.04 [-0.97, 2.21]	<b>-1.10 [-2.15, -0.16]</b>	<b>-1.50<sup>b</sup> [-2.74, -0.42]</b>	-0.20 [-0.45, 0.05]	0.03 [-0.14, 0.22]	0.13 [-0.05, 0.31]					
Borderline PD diagnosis	-0.63 [-2.84, 1.42]	0.04 [-1.69, 1.93]	-0.35 [-2.47, 1.50]	-0.82 [-2.62, 1.10]	0.05 [-0.51, 0.61]	0.25 [-0.15, 0.66]	0.25 [-0.15, 0.63]					

Note. Statistically significant results ( $p < .05$ ) are highlighted in bold. A positive versus negative moderation effect corresponds with better outcomes among Collaborative Assessment and Management of Suicidality (CAMS) participants at higher versus lower levels of the moderator variable, respectively.  $d$  = Cohen's  $d$ ; CI = confidence interval; SI = suicidal ideation; ED = emergency department; PD = personality disorder.

<sup>a</sup>Effect sizes are scaled to a +1 SD change in the moderator.

<sup>b</sup>Effect is statistically significant when controlling for multiple tests using the Benjamini and Hochberg (1995) procedure.



**Figure 1.** Moderation of intervention effect by age in years ( $-1$  SD, Mean, and  $+1$  SD). Non-overlapping confidence intervals correspond with a statistically significant difference at  $p < .05$ . CAMS = Collaborative Assessment and Management of Suicidality; E-CAU = Enhanced Care as Usual.

12 months among married participants ( $d = 0.55$ , 95% CI = [0.20, 0.90],  $p = .001$ ).

Figure 3a illustrates the predicted intervention effect of CAMS versus E-CAU on overall mental health by combat deployments for participants with an average of 0 ( $-1$  SD), 1.0 ( $M$ ), and 2.1 ( $+1$  SD) deployments. CAMS was associated with a 2.2-point smaller increase in mental health score from baseline to 12 months for each additional deployment ( $d = -0.27$ , 95% CI = [-0.53, -0.04],  $p = .025$ ). Figure 3b illustrates the predicted intervention effect of CAMS versus E-CAU on overall mental health by time in service for participants with 4 years or less of service versus greater than 4 years of service. CAMS was associated with a 4.3-point greater increase in mental health score from baseline to 12 months for participants with 4 years or less of military service ( $d = 0.54$ , 95% CI = [0.05, 1.04],  $p = .035$ ).

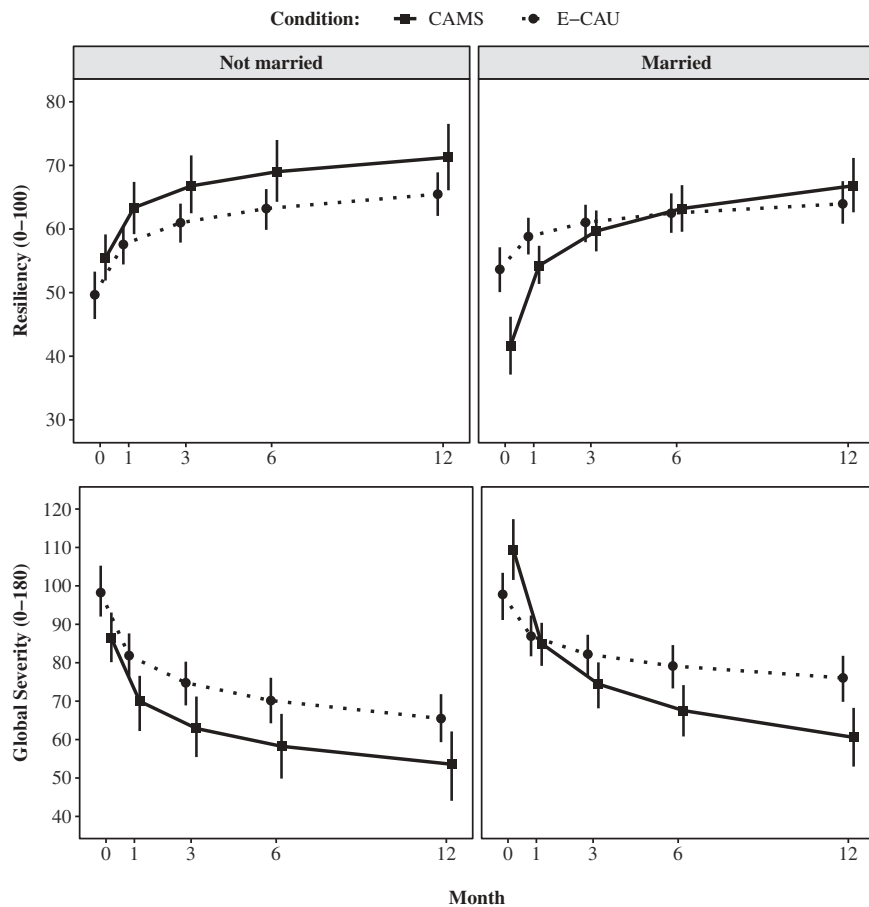
Figure 4 illustrates the predicted intervention effect of CAMS versus E-CAU by baseline distress for participants with a distress score of 41 ( $-1$  SD), 57 ( $M$ ), and 72 ( $+1$  SD). With respect to any suicide-related ED admission, CAMS

was associated with greater reduction in the probability of an ED admit for suicide attempt or suicidal ideation from baseline to 12 months among participants reporting lower baseline distress ( $d = -1.10$ , 95% CI = [-2.15, -0.16],  $p = .022$ ). Similarly, with respect to any behavioral health-related ED admission, CAMS was associated with greater reduction in the probability of an ED admission for any behavioral health reason from baseline to 12 months among individuals reporting lower baseline distress ( $d = -1.50$ , 95% CI = [-2.74, -0.42],  $p = .004$ ).

#### Post-hoc sensitivity analyses adjusting for multiple tests

Three of the moderation effects reported in Table 2 remained statistically significant after accounting for multiple tests. Specifically, CAMS was associated with a greater reduction in the probability of an ED admission for any behavioral health reason from baseline to 12 months among individuals reporting lower baseline distress. In addition, CAMS was associated with (a)





**Figure 2.** Moderation of intervention effect by marital status (Not married vs. Married). Non-overlapping confidence intervals correspond with a statistically significant difference at  $p < .05$ . CAMS = Collaborative Assessment and Management of Suicidality; E-CAU = Enhanced Care as Usual.

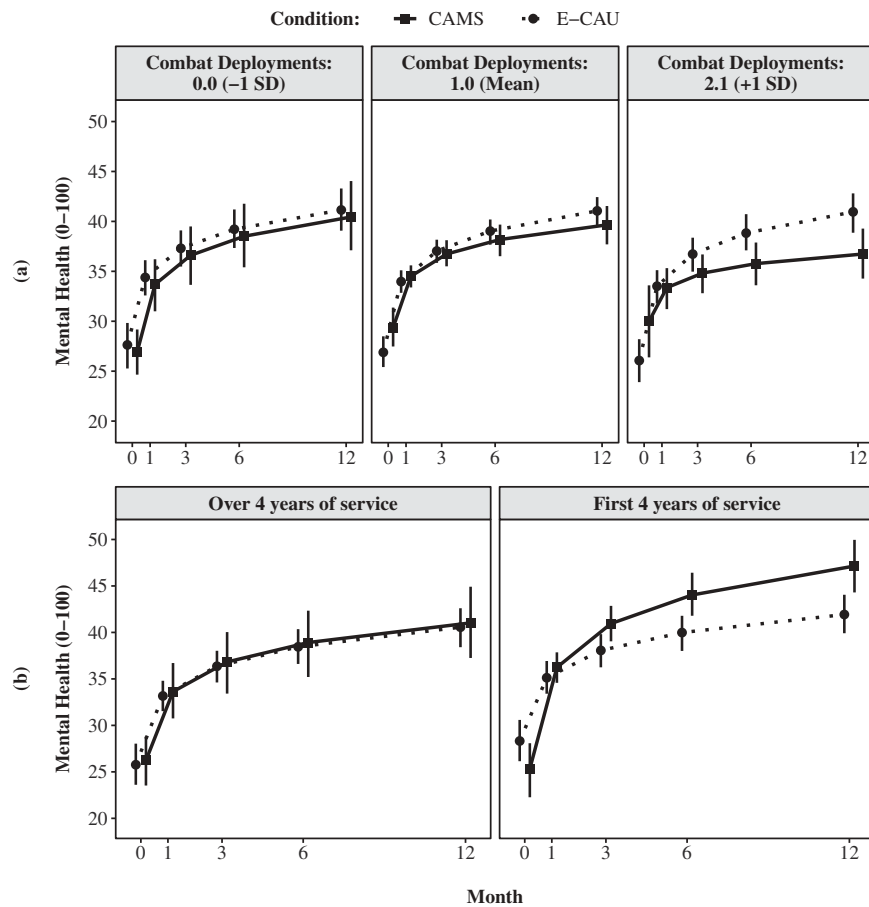
greater improvement in resilience and (b) greater reduction in global severity score from baseline to 12 months among married participants.

## Discussion

The present study was a secondary analysis of a RCT that compared CAMS to E-CAU to investigate whether nine baseline characteristics were prospectively associated with differences in primary intervention outcomes. We found that age, marital status, number of combat deployments, time in service, and initial levels of distress moderated the effectiveness of the CAMS intervention when compared with E-CAU. Specifically, the CAMS intervention was significantly associated with a greater reduction in any suicide- or behavioral health-related ED admission among participants who were older or reported lower initial distress at the start of study treatment. The CAMS intervention was associated with greater improvements in overall mental health among those in their first four years of military

service. However, CAMS was associated with less improvement in overall mental health among those soldiers with two or more combat deployments compared with soldiers with fewer combat deployments. Finally, CAMS was significantly associated with greater improvements in resilience and greater reductions in global severity among married Soldier participants.

Collectively, six of the eight statistically significant moderator findings in this study showed CAMS outperforming E-CAU in certain subgroups with effect sizes ranging from medium to large (per Cohen, 1988). The findings suggest that CAMS was associated with the greatest improvement among lower complexity patients, specifically those with lower symptom distress and fewer combat deployments at baseline. Those who were married or older generally responded better to CAMS, although the results were not entirely consistent with respect to age. Specifically, older CAMS recipients evidenced greater average mental health at baseline, but that age-related advantage eroded over time, whereas mental health trajectories did not appear



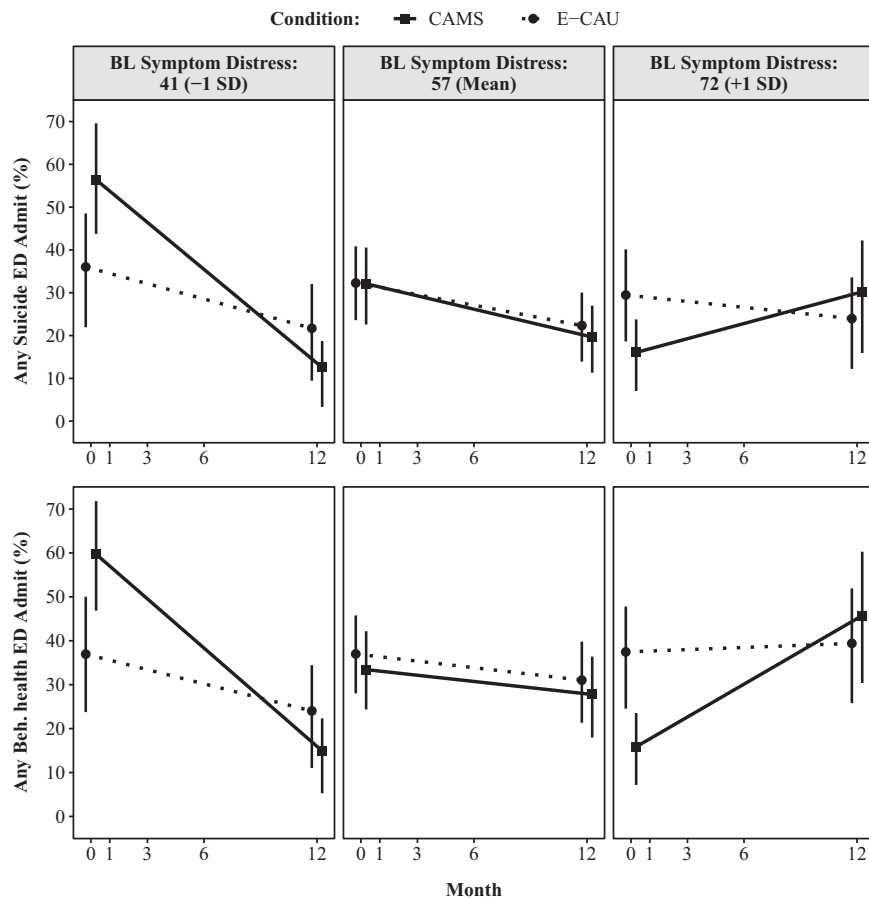
**Figure 3.** Moderation of intervention effect on mental health by (a) Combat deployments ( $-1$  SD, Mean,  $+1$  SD) and (b) First four years of service (Over four years vs. First four years). Non-overlapping confidence intervals correspond with a statistically significant difference at  $p < .05$ . CAMS = Collaborative Assessment and Management of Suicidality; E-CAU = Enhanced Care as Usual.

to vary by age among those receiving E-CAU. However, this moderator effect of age was small. Borderline personality and history of suicide attempts were hypothesized as moderators based on unpublished data from a different CAMS RCT (Pistorello et al., 2017) but were not significant moderators of treatment outcomes in the present study; future CAMS intervention research is needed to reconcile these nonsignificant moderator findings.

Another key finding was the observed reduction in ED admissions for any behavioral health issue as well as suicide-related ED admissions for certain soldiers who were treated with CAMS. These data are valuable in light of correlational findings from an early CAMS study of 55 suicidal US airmen (Jobes et al., 2005). In that nonrandomized clinical trial, conducted in two US Air Force military treatment facilities, suicidal troops receiving CAMS had significantly fewer ED (as well as primary care) visits than suicidal troops who received treatment-as-usual control care in the 6 months following the end of treatment. As noted in

that earlier article, a mental health treatment that can help decrease nonmental health care utilization has distinct cost-savings implications. From a military-centric perspective, significant moderator data showing CAMS increasing resilience among married soldiers is intriguing as resilience is highly valued within military culture (DoD Task Force, 2010). It is well known that marriage is a protective buffer for suicide (Maris et al., 2000) but not necessarily among military service members (refer to Gilman et al., 2014). Nevertheless, data from the present study underscore the merits of marital enrichment programming on military installations as a possible means of decreasing suicidal risk among service members; such programming could be a valuable enhancement to suicide-specific care.

There was one small outlier moderator effect whereby soldiers with two or more deployments exhibited a greater improvement in overall mental health when treated with E-CAU compared with CAMS. This finding is more difficult to understand and interpret. It is possible that multiple deployments



**Figure 4.** Moderation of intervention effect by baseline symptom distress ( $-1$  SD, Mean,  $+1$  SD). Non-overlapping confidence intervals correspond with a statistically significant difference at  $p < .05$ . CAMS = Collaborative Assessment and Management of Suicidality; E-CAU = Enhanced Care as Usual; ED = Emergency department; Beh. = Behavioral.

might have a habituating effect, creating a “thicker psychological skin.” If that were the case, however, it would not explain why patients receiving E-CAU would exhibit more improvement in mental health compared to those receiving CAMS.

There are important limitations to the present study. We are mindful that the reporting of multiple tests poses the risk of increased Type I error. Nevertheless, we decided the exploratory approach to our moderator analyses was warranted for three reasons: (a) the pressing nature of military suicide, (b) the remarkably limited treatment-based data on the topic, and (c) the prospect of replicating previous correlational data along with testing some well-known moderators from the extant literature. However, three key moderator findings persisted even under more stringent controls for multiple testing; these showed CAMS to be particularly effective for soldiers that were married and those with lower initial distress. Specifically, married soldiers receiving CAMS had greater improvements in resilience and global severity and those with lower

initial distress had greater reductions in suicide-related ED admissions.

Relatedly, another limitation of this study is that we do not know why CAMS differentially benefited married soldiers and those less distressed at baseline. We can note that in the CAMS arm of the trial, the PI’s consultation team routinely encouraged providers to involve the patient’s spouse in support of their care (when possible). Moreover, it makes intuitive sense that less distressed soldiers at baseline might have more psychological resources and potentially more motivation to effectively engage as a “co-author” and collaborator of the driver-oriented treatment within CAMS-guided care (Jobes, 2016). But these are observations and speculations that clearly argue for further study as well as replication of the results to ensure that CAMS does indeed have a differential and effective impact on certain sub-groups of suicidal individuals. To this end, such research is now being actively pursued to rigorously determine exactly who is best suited to benefit from CAMS and the “dose” and sequencing of CAMS-based

care associated with the most meaningful clinical impact on suicidality, particularly in comparison to other evidence-based suicide-specific treatment within a Sequential Multiple Assignment Randomized Trial (SMART) design (refer to Pistorello et al., 2017).

In any case, the need to understand, assess, and optimally treat suicidal service members is plain. More clinical treatment research is needed to understand the complex interplay of psychological, social, and biological factors that invariably all contribute to the tragedy of a military suicide. We hope that this current effort at least sheds some light on possible treatment and related policy considerations that may one day ultimately lead to decreasing military suicides. In closing, let it not be said of us that for those who take a solemn oath to serve their nation through military service died by suicide because our systems of behavioral care, clinical treatments, or clinical science failed to sufficiently tackle this formidable challenge.

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