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Review article

Use of the acquired capability for suicide scale (ACSS) among United States military and Veteran samples: A systematic review

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ABSTRACT

Background: Military personnel and Veterans are at increased risk for suicide. Theoretical and conceptual arguments have suggested that elevated levels of acquired capability (AC) could be an explanatory factor accounting for this increased risk. However, empirical research utilizing the Acquired Capability for Suicide Scale (ACSS) in military populations has yielded mixed findings.

Methods: To better ascertain what factors are associated with AC, and whether methodological limitations may be contributing to mixed findings, a systematic review was conducted.

Results: A total of 31 articles utilized the ACSS to examine factors associated with AC, including combat history, in United States (U.S.) military personnel and Veterans. Nearly all studies (96.8%) were rated high risk of bias. Use of the ACSS varied, with seven different iterations utilized. Nearly all studies examined correlations between the ACSS and sample characteristics, mental health and clinical factors, Interpersonal Theory of Suicide constructs, and/or suicide-specific variables. Results of higher-level analyses, dominated by cross-sectional designs, often contradicted correlational findings, with inconsistent findings across studies.

Limitations: Included studies were non-representative of all U.S. military and Veteran populations and may only generalize to these populations.

Conclusions: Due to the high risk of bias, inconsistent use of the ACSS, lack of sample heterogeneity, and variability in factors examined, interpretation of current ACSS empirical data is cautioned. Suggestions for future research, contextualized by these limitations, are discussed.

1. Introduction

Suicide is a major public health concern in the United States (U.S.), as rates of suicide remain high, despite increased resources allocated towards research and prevention efforts in recent years. In 2017, the U.S. suicide rate of a rate of 14.5 per 100,000 was the highest suicide rate observed among the general U.S. population in over a decade, making suicide the tenth leading cause of death (Drapeau and McIntosh, 2018). The suicide rate amongst U.S. Military personnel and Veterans is even more alarming, with suicide rates ranging between 21.9 and 29.1 per 100,000 in 2017 (Office of Mental Health and Suicide Prevention, 2019; Pruitt et al., 2019). Non-declining and elevated suicide rates highlight the need for continued research aimed at understanding the complexities of suicide to improve risk-prediction and treatment interventions.

The Interpersonal Theory of Suicide (IPTS) is a theoretical model that differentiates between those who will develop suicidal ideation from those who will go on to attempt suicide, based on a set of empirically-based risk factors (Joiner, 2005; Van Orden et al., 2010). Given its parsimonious and novel addition to the field of suicidology, the IPTS quickly gained interest and empirical inquiry, especially due to its potential to improve the accuracy of prevention and intervention

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efforts for those at highest risk for suicide. Hundreds of empirical, conceptual, and case studies have been published since study inception.

The IPTS postulates that the intersection of two distinct psychological states, *perceived burdensomeness* and *thwarted belongingness*, and a sense of hopelessness about these states, contributes to suicidal desire. Perceived burdensomeness refers to the view that one's existence is a burden on friends, family members and/or society. Thwarted belongingness refers to the experience of feeling alienated from valued social relationships, including friends and family. Although the presence of either perceived burdensomeness or thwarted belongingness will incite passive suicidal ideation, it is hypothesized that a synergistic effect results from the simultaneous presence of both states, in conjunction with hopelessness, to cause active suicidal desire. Based upon the IPTS theory, the Interpersonal Needs Questionnaire (INQ; Van Orden et al., 2008, 2012), a self-report scale designed to assess perceived burdensomeness and thwarted belongingness, was developed. The INQ has been widely adopted by researchers, and its use is ubiquitous in the growing body of research supporting the theorized relationship between perceived burdensomeness, thwarted belongingness and suicidal ideation (Christensen et al., 2013; Chu et al., 2017; Ma et al., 2016).

The third and final construct, *acquired capability for suicide (AC)*, is the proposed factor required for transition from ideation to behavior (Smith and Cukrowicz, 2010). Acquired capability is comprised of two components, lowered fear of death and a heightened pain tolerance, which develop over time from repeated exposure to physically painful and/or fear-inducing experiences (i.e., painful and provocative events). The theory posits that mechanisms underlying fearlessness about death and dying are critical to developing suicidal intent, with heightened pain tolerance essential to engaging in a lethal, or near lethal suicide attempt (Smith and Cukrowicz, 2010; Smith et al., 2016).

In the context of the U.S. military, researchers have suggested that elevated AC could be a critical explanatory factor accounting for increased risk for suicide among military personnel and Veterans. Elevated AC is broadly attributed to the frequency with which the demands of military service require exposure to painful and provocative experiences, which may cause habituation to fear of painful experiences, including suicide (Selby et al., 2010). Researchers often cite a familiarity with lethal means (i.e., firearms; Houtsma et al., 2018), exposure to death, and engagement in combat or deployment as military-specific events that may contribute to increased AC within this population.

The complex, individualized nature of AC presents methodological and instrumental challenges, which has contributed to the notable dearth of research examining the concept. Assessments of capability must consider an individual's lifetime exposure to painful and provocative events, and the resulting psychological effects, specifically regarding fear of death and pain tolerance. To meet this need, the Acquired Capability for Suicide Scale (ACSS), a 20-item self-report scale designed to assess levels of fearlessness about death, pain tolerance, and painful and provocative events, was developed (Bender et al., 2011). To date, two iterations of the original ACSS, a 5-item scale (Van Orden et al., 2008) and a 7-item sub-scale, which measures fearlessness about death only (ACSS-FAD; Ribeiro et al., 2014), have been psychometrically validated. No single version has been widely adopted by researchers, however, and use of the ACSS has been notably inconsistent, with studies reporting using 1, 4, 5, and 8-item versions of the scale in addition to the 5-item and 7-item ACSS-FAD.

Existing research regarding AC in military personnel and Veterans has shown mixed findings, with researchers emphasizing the need for a more thorough review of the existing literature to extrapolate which factors are associated with AC to identify directions for future research. A comprehensive review of the literature is necessary to ascertain what factors are associated with AC in military and Veteran populations and to identify whether methodological limitations may be contributing to mixed findings in these populations. An improved understanding of factors associated with AC in military and Veteran populations is an essential step in determining whether there are unique military-related experiences or characteristics that may contribute to increased AC in these populations. This could clarify whether AC may manifest differently in service members and Veterans, which could inform theoretical and assessment considerations. Further, identification of consistent methodological limitations across studies of AC in military and Veteran populations is essential to improving assessment of this construct. This review aims to summarize the current state of the literature, to identify which factors, including military and combat-related experiences, show empirically-based associations with the ACSS. Furthermore, results from this systematic review will assist in highlighting limitations to current empirical data to inform recommendations for ways to advance our understanding of the role of AC in military and Veteran suicide risk.

2. Method

Prior to performing the article search, authors registered this review with the National Institute for Health Research's international prospective register of systematic reviews, PROSPERO (CRD42019121769). The following key questions were recorded as the primary aims of the review:

KQ1: What factors are associated with AC (as measured by the ACSS) among U.S. military personnel and Veterans?
KQ2: (Exploratory Question): Is combat history associated with AC among U.S. military personnel and Veterans?

Methods and presentation of results map onto the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009).

2.1. Search strategy

A health sciences librarian (BH) conducted literature searches on February 5, 2019. All databases were restricted to English language citations. No other limits were applied. The following databases were queried: **Ovid MEDLINE(R)** and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to February 04, 2019; **psychINFO** via Ovid; **Embase**.com; **PsycARTICLES** via ProQuest; **Psychology and Behavioral Sciences Collection** via EBSCO; **PTSDpubs** via ProQuest; **Google Scholar** (first 150 citations harvested). The search strategy was designed to capture the concepts of “military” and "veteran" as they relate to the concept of "acquired capability for suicide."

Study Selection. Inclusion criteria for the systematic review were selected in accordance with the Population, Intervention, Comparators, Outcomes, Timing/Setting (PICOTS) framework (Matchar, 2012; Moher et al., 2009).

Participants/population. U.S. military personnel and Veterans of all genders and ages.

Intervention(s)/exposure(s). Assessment of AC using the ACSS.

Comparator(s)/control. No specific comparators were required.

*Outcomes***.** All factors examined in relation to ACSS.

Timing/setting. Restriction was not based on timing, setting, or study design.

Additional criteria for inclusion were: (1) The presentation of original study data in a peer-reviewed journal article, and (2) the full-text article was in English.

2.2. PRISMA stage: identification

Using the search strategy and PICOTS study selection framework, a total of 535 records were identified prior to deduplication.

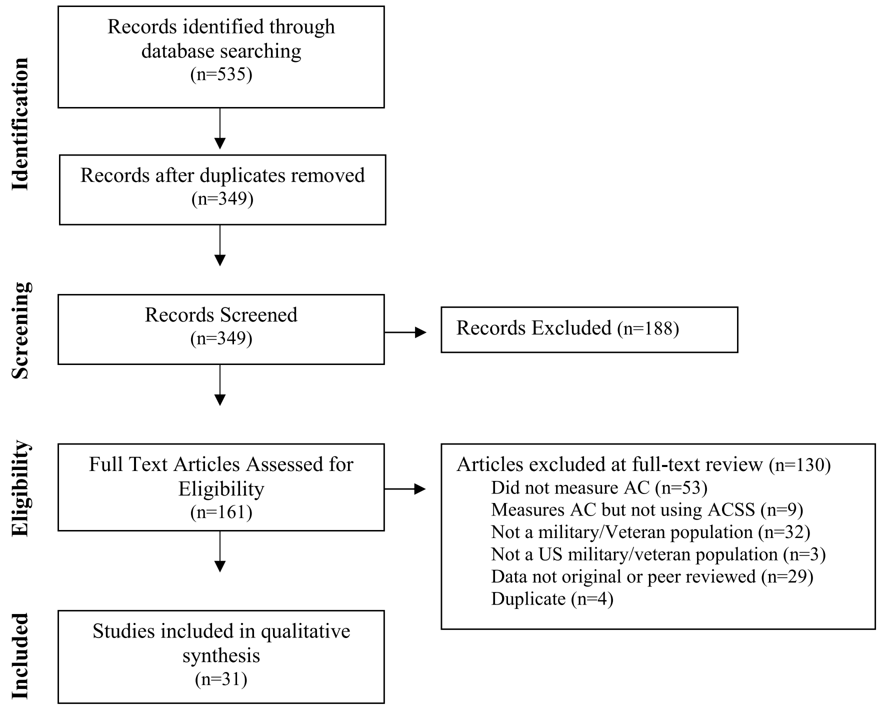

Fig. 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) study selection process.

2.3. PRISMA stage: screening

All retrieved records were de-duplicated and organized using the Endnote version X9 citation management application. 350 total unique citations were then uploaded to Covidence, a systematic review software that manages citation screening and reviewing. Covidence identified one additional duplicate, leaving 349 citations for initial title/abstract review.

Prior to initial review, the two primary reviewers (EBK, LAG) established and refined the review process by conducting mock reviews of a sample of articles selected by another author. Fig. 1 depicts the study selection process. These reviewers then conducted independent reviews of the title and abstract of each of the 349 articles. Reviewers were not privy to inclusion/exclusion decisions of other reviewers. Inclusion/exclusion conflicts were resolved by a third reviewer (CLJ). At the title and abstract review stage, 188 records were excluded for irrelevant content and publication type (e.g., book chapters, meta-analyses, etc.), leaving 161 citations for full-text review. Inter-rater reliability regarding study inclusion was good among the two primary reviewers (89% agreement).

2.4. PRISMA stage: eligibility

The two primary reviewers independently examined the full-text of the remaining 161 manuscripts to determine whether each met criteria for inclusion into the review. Each reviewer coded the excluded articles according to an established hierarchy of exclusion criteria, and disagreements among the primary reviewers regarding article inclusion/exclusion and the coding of exclusion criteria were resolved by the third reviewer. Inter-rater reliability between primary reviewers regarding the inclusion/exclusion of articles (99% agreement) and the coding of excluded articles (90% agreement) was excellent. Reviewers excluded 130 articles for reasons detailed in (see Fig. 1). Ultimately, 31 articles met criteria for inclusion.

2.5. PRISMA stage: included

Data extraction. The preliminary data extraction template was tested before being finalized, and the following information was extracted: sample characteristics, ACSS versions used, significant factors associated with ACSS, and measures of combat. Two authors (EBK, LAG) divided the 31 included articles and independently extracted data for assigned articles. The authors then checked the evidence table of the other author to verify that data was extracted accurately. Conflicts were resolved by a third author (SN). Lead and senior authors of included articles were contacted when questions arose regarding ACSS items and sample/datasets used.

Reviewers (EBK, LAG) independently classified the research design of each included article using the Taxonomy of Study Design Tool (Hartling et al., 2011); conflicts were resolved by a third reviewer (CLJ). Inter-rater reliability among the primary reviewers was excellent (90% agreement).

Risk of bias. Procedures and tools to assess risk of bias for each study were developed in accordance to the Effective Public Health Practice Project's (EPHPP) Quality Assessment Tool for Quantitative Studies (Armijo-Olivo et al., 2012). Two authors (EBK, LAG) independently rated each study on a comprehensive set of factors (i.e., selection bias, study design, confounders, blinding, data collection methods, withdrawals and drop-outs, intervention integrity, analyses) intended to detect possible sources of bias. Discrepancies were discussed among authors until all authors reached consensus. Table 1 depicts risk of bias sub-factor and overall scores, in addition to the study design for each article.

3. Results

3.1. Risk of bias and study design

Of the 31 studies included, 30 studies (96.8%), were rated high risk of bias (Table 1). The greatest sources of bias across all studies were study design and blinding. The vast majority of studies ($N = 27$; 87.1%) were cross-sectional, resulting in a study design subscale rating of high risk of bias. The remaining four studies included three (9.7%) before-after studies and one (3.2%) randomized control trial (RCT).

Table 1
Risk of bias.

Article	Study design	Source of Bias						Overall Bias
		Study design	Selection bias	Confounders	Blinding	Data collection	Withdrawals & dropouts	
Anestis et al., 2015	Cross-Sectional	●	•	○	●	○	⊖	●
Assavedo et al., 2018	Cross-Sectional	●	•	○	●	○	⊖	●
Baer et al., 2018a	Cross-Sectional	●	•	○	●	○	⊖	●
Baer, et al., 2018b	Cross-Sectional	●	•	○	●	○	⊖	●
Bryan et al., 2010a	Cross-Sectional	●	•	•	●	○	⊖	●
Bryan et al., 2010b	Before-After	•	•	•	●	•	⊖	●
Bryan and Anestis, 2011	Cross-Sectional	●	•	•	●	○	⊖	●
Bryan and Cukrowicz, 2011	Cross-Sectional	●	•	•	●	○	⊖	●
Bryan et al., 2012	Cross-Sectional	●	•	○	●	○	⊖	●
Bryan et al., 2013	Cross-Sectional	●	•	●	●	○	⊖	●
Bryan et al., 2015	Before-After	•	•	●	●	○	●	●
Bryan et al., 2018	RCT	○	•	○	•	○	●	•
Butterworth et al., 2017	Cross-Sectional	●	●	○	●	○	⊖	●
Chiurliza et al., 2016	Cross-Sectional	●	•	●	●	•	⊖	●
Chu et al., 2016a	Cross-Sectional	●	•	○	●	•	⊖	●
Chu, et al., 2016b	Before-After	•	•	○	●	•	⊖	●
Chu et al., 2018	Cross-Sectional	●	•	○	●	○	⊖	●
Gutierrez et al., 2016	Cross-Sectional	●	●	○	●	○	⊖	●
Harrop et al., 2017	Cross-Sectional	●	•	●	●	○	⊖	●
Kerbrat et al., 2015	Cross-Sectional	●	•	●	●	•	⊖	●
Khazem et al., 2016	Cross-Sectional	●	•	○	●	•	⊖	●
Martin et al., 2018	Cross-Sectional	●	•	○	●	○	⊖	●
Monteith et al., 2013	Cross-Sectional	●	•	○	●	○	⊖	●
Monteith et al., 2017	Cross-Sectional	●	•	○	●	○	⊖	●
Nademin et al., 2008	Cross-Sectional	●	●	○	●	●	⊖	●
Pennings et al., 2017	Cross-Sectional	●	•	○	●	○	⊖	●
Podlogar et al., 2017	Cross-Sectional	●	•	○	●	•	⊖	●
Poindexter et al., 2017	Cross-Sectional	●	•	○	●	○	⊖	●
Ribeiro et al., 2015	Cross-Sectional	●	•	●	●	•	⊖	●
Rogers et al., 2017	Cross-Sectional	●	•	•	●	•	⊖	●
Silva et al., 2017	Cross-Sectional	●	•	•	●	•	⊖	●

Note. Risk of bias: ○ = low; • = moderate; ● = high; ⊖ = not applicable. RCT = Randomized Controlled Trial. a,b Different articles, same authorship.

3.2. ACSS versions

Across the 31 studies, seven iterations of the ACSS were used to measure AC in 34 unique US military and Veteran samples (Table 2): 4 items with a 5-point scale (7 studies, 8 samples; Chiurliza et al., 2016; Chu et al., 2016a, 2016b; Podlogar et al., 2017; Ribeiro et al., 2015; Rogers et al., 2017; Silva et al., 2017); 4 items with a 7-point scale (1 sample; Bryan et al., 2015); 5 items with a 5-point scale (1 sample; Gutierrez et al., 2016); 5 items with a 7-point scale (6 studies, 8 samples; Bryan et al., 2010a, 2010b, 2012, 2013; Bryan and Anestis, 2011; Bryan and Cukrowicz, 2011); 7 items with a 5-point scale (7 studies, 7 samples; Anestis et al., 2015; Assavedo et al., 2018; Bryan et al., 2018; Khazem et al., 2016; Monteith et al., 2017; Pennings et al., 2017; Poindexter et al., 2017); 20 items with a 4-point scale (1 sample; Harrop et al., 2017); 20 items with a 5-point scale (8 studies, 8 samples; Baer et al., 2018a; Baer et al., 2018b; Butterworth et al., 2017; Chu et al., 2018; Kerbrat et al., 2015; Martin et al., 2018; Monteith et al., 2013; Nademin et al., 2008). All versions intended to measure both components of ACSS, with exception the 7-item version (ACSS-FAD), which only assesses fearlessness about death. One study, which administered the 20-item version, separately reported responses to the ACSS-FAD in addition to full ACSS scores (Kerbrat et al., 2015). Studies that administered the 5-item ACSS utilized two different versions (with 3 of 5 items overlapping) with two different response scales. Despite the fact that no 4-item ACSS scale has been validated, nearly half of all studies utilized a 4-item ACSS, and these studies utilized two different versions (with 3 of 4 items overlapping) with two different response scales.

3.3. KQ1 – correlational findings

Basic correlations between ACSS and other study variables were reported for 32 samples across 29 articles (Table 2).

Sample Characteristics. Nearly all studies examined correlations between a sample characteristic and ACSS.

Gender. ACSS was significantly elevated for male participants in all ten studies for which data were reported (Bryan and Cukrowicz, 2011; Bryan et al., 2010b; Chu et al., 2018; Harrop et al., 2017; Martin et al., 2018; Monteith et al., 2013; Pennings et al., 2017; Podlogar et al., 2017; Rogers et al., 2017). An additional 9 studies which did not report these data included gender as a covariate in analyses (Anestis et al., 2015; Assavedo et al., 2018; Baer et al., 2018a; Baer et al., 2018b; Bryan and Anestis, 2011; Butterworth et al., 2017; Chu et al., 2016a, 2016b; Poindexter et al., 2017).

Age. Of the 13 studies that considered age in relation to ACSS, two found significant negative correlations (Martin et al., 2018; Monteith et al., 2013), three reported a nonsignificant relationship (Monteith et al., 2017; Pennings et al., 2017; Podlogar et al., 2017), and eight did not provide correlation data but controlled for age in analyses (Anestis et al., 2015; Assavedo et al., 2018; Baer et al., 2018a, 2018b; Bryan et al., 2010a; Chu et al., 2016a, 2016b; Poindexter et al., 2017).

Race. Race was significantly correlated with ACSS in four studies; white participants reported higher ACSS than African-Americans in three of the studies (Martin et al., 2018; Pennings et al., 2017; Podlogar et al., 2017), and the fourth (Chiurliza et al., 2016) indicated that Alaska Native/American Indian participants reported higher ACSS than other racial groups, however, the significance of this finding was unclear.

Mental Health and Clinical Factors. Several mental health and clinical factors were examined in correlational analyses, with contradictory findings across factors and studies.

Depression. ACSS was not significantly associated with depression in any of the 10 samples for which data were reported; across the 10 samples (Anestis et al., 2015; Bryan et al., 2012; Bryan et al., 2010a,

Table 2
Significant findings related to acquired capability for suicide scale (ACSS).

Article	Participants	ACSS details	Factors associated with ACSS		
			Correlations	Covariates	Significant findings
			20 Item		
Baer et al., 2018a	N = 121 Military Inpatient Army 42.1% Male 69.4% White 66.9% SA 100% Deployed 54.2%	$n_{No\ NSSI}$ = 59; n_{NSSI} = 62 5-point scale (NR) α = NR $M_{No\ NSSI}$ = 47.44 (SD = 13.78) $M_{Hx\ NSSI}$ = 54.24 (SD = 12.34)	$ACSS_{NSSI} > ACSS_{No\ NSSI}$**	–	–
Baer et al., 2018b	N = 134 Military Inpatient Army 41.0% Male 71.6% White 68.7% SA 91.0% Deployed 54.9% (of which 79.5% Combat)	5-point scale (0–4) α = 0.82 M = 50.73 (SD = 13.23)	DERS Awareness**	Model 1-DERS Depression (BDI) Hopelessness (BHS) Age*** Male Combat Deployment Model 2-BIS Depression (BDI) Hopelessness (BHS) Age*** Male Combat Deployment*	Regression Model 1 (ACSS): DERS Awareness** Regression Model 2 (ACSS): -
Butterworth et al., 2017	N = 400 Military Army National Guard 89.3% Male 82.3% White 68.8% SA: M = 0.07 (SD = 0.26) Deployed (Combat) 100%	5-point scale (0–4) α = 0.83 M = 56.93 (SD = 12.45)	DRRI Combat: 1/4 Injury & Death-Related* 1/4 Injury & Death-Related** 3/11 Non-Injury & Death-Related*	Male (p = NR) Race (p = NR) Time Since Deployment (p = NR)	ANCOVA: DRRI Combat: 1/11 Non-Injury & Death-Related: Going on Combat Patrols or Missions (p = NR)
Chu et al., 2018	N = 973 Military (78.3%) & Veterans (21.7%) Army Reserves 48.4% Male 78.8% White 63.8% SA 23.7% (1.3% missing) Deployed 5.4% (74.2% missing) Combat 17.8% (59.1% missing)	n = 892 5-point scale (0–4) α = 0.8 M = 51.37(SD = 12.44)	NSSI History (SITBI)* TB*** PB*** SI (DSI-SS)*** SA (SITBI)*** ISI* Male***	Age (p = NR) Male (p = NR) ISI (p = NR) BHS (p = NR)	MM (SA): NSSI Med: PBxTB Mod: $ACSS_{high}$ (p = NR)
Harrop et al., 2017	N = 666 Military Army National Guard 90.4% Male 82% White 64% SA 3% Deployment NR	4-point scale (1–4) α = 0.84 M = NR	PPES** Male** LSRP: Egocentricity** Antisocial** PNI: Grandiosity**	PPES** Male**	Regression (ACSS): Dark Triad*** LSRP-Antisocial** PNI-Grandiosity*
Kerbrat et al., 2015	N = 733 Active Duty Army 53.6% Male 69.7% White 56.3% SA 53.5% Deployed (Combat) 43.2%	5-point scale (0–4) $\alpha_{ACSS\text{-}20}$ = 0.78 $M_{ACSS\text{-}20}$ = 51.27 (SD = 12.75) $\alpha_{ACSS\text{-}FAD}$ = 0.74 $M_{ACSS\text{-}FAD}$ = 17.67 (SD = 6.21)	–	Branch (Army reference): Navy*	Regression (ACSS-20): Male*** SA (0 SA reference): Single* Multiple** Combat Deployment** Regression (ACSS-FAD): Male** SA (0 SA reference): Multiple* Combat Deployment*
Martin et al., 2018	N = 512 Military JFTC Army National Guard 91.8% Male 82.3% White 62.1% SA NR Deployed 65.7%	n = *501* 5-point scale (0–4) α = 0.84 M = 56.48 (SD = 12.58)	PTSD (PCL-M)** SI (BSS)** Age** Male** Race** Education**	SI (BSS) (p=NR) Age (p=NR) Male (p=NR) Race (p=NR) Education (p=NR) PB (p=NR) TB (p=NR)	Mediation (ACSS): PTSD*** Mediator: DT***

(*continued on next page*)

Table 2 (*continued*)

Article	Participants	ACSS details	Factors associated with ACSS Correlations	Covariates	Significant findings
Monteith et al., 2013	*N* = 185 Veterans Inpatient Army 63.2% Male 48.1% White 57.3% SA 49.7%; *M* = 0.78 (*SD* = 0.86) Deployed 65.9% Combat (Men 100%; Women NR)	5-point scale (0–4) α = 0.84 *M* = 2.56 (*SD* = 0.72)	Male** Age** SI (BSS)* TB** PB** PTSD (PCL): Avoidance-numbing* Hyperarousal**	Model 1 - 1 SA (vs. 0) Age Male BSS* BDI PCL factors Model 2 - 2± SA (vs. 0) Age Male* BSS*** PCL Factors *Re*-experiencing*	Regression Model 1(SA) - Regression Model 2(SA) PB x ACSS* TB x ACSS*
Nademin et al., 2008	*N* = 122 Active Duty Air Force 100% Male 66.4% White 46.3% SA NR Deployment NR	5-point scale (NR) α = 0.85 *M* = 65.43 (*SD* = 9.5)	–	–	–
7 Item (ACSS-FAD)					
Anestis et al., 2015	*N* = 934 Military JFTC Army National Guard 84.0% Male 77.7% White 57.5% SA 6.9% Deployed 60.1%	5-point scale (0–4) α = 0.8 *M* = 20.28 (*SD* = 6.21)	SI (BSS)**	–	Step 1 Male** PB** ACSS x PB** Step 2 ACSS x TBxPB *** PB x TB*** Low ACSS(-)** High ACSS**
Assavedo et al., 2018	*N* = 937 Military JFTC (n_{SI}=72) Army National Guard 84.3% Male 75.3% White 57.4% SA 6.6% Deployment NR	5-point scale (0–4) α_{full} = 0.8 *M* = 17.29 (*SD* = 6.20) M_{SI} = 19.17 (*SD* = 6.19)	ACSS Military > ACSS Civilian$_{2+SA}$*** ACSS Military$_{SI}$ > ACSS Civilian$_{2+SA}$***	–	–
Bryan et al., 2018	*N* = 152 Active Duty (n_{TAU}= 76, n_{BCBT}=76) Army 100% Male 87.5% White 72.4% SA_{t0} 77.0% Deployments: *M* = 1.6 (*SD* = 1.4)	5-point scale (0–4) α_{t0} = 0.71 $M_{t0,BCBT}$ = 18.4 (*SD* = 5.6) $M_{t0,TAU}$ = 19.4 (*SD* = 5.7) α_{t1} = 0.77 $M_{t1,BCBT}$ = 18.7 (*SD* = 5.4) $M_{t1,\ TAU=}$ 19.3 (*SD* = 6.4) α_{t2} = 0.76 $M_{t2,\ BCBT}$ = 19.4 (*SD* = 5.9) $M_{t2,\ TAU}$ - 19.7 (*SD* = 5.7)	SA 2-year follow-up TB_{t0} x FAD_{t0} (-)*	–	–
Khazem et al., 2016	*N* = 432 Military National Guard 94.5% Male 91.3% White 74.2% SA 4.0% Deployed 71.0%	5-point scale (0–4) α = 0.8 $M_{loaded\ \&\ unsecured}$ = 22.15 (*SD* = NR) $M_{unloaded\ \&/or\ secured}$ = 20.59 (*SD* = NR)	Firearm Storage ACSS$_{loaded\ \&\ unsecured}$ > ACSS$_{unloaded\ \&/or\ secured}$*	–	–
Monteith et al., 2017	*N* = 92 Female Veterans (History of MST) Army 62% White 48.9% SA: *M* = 0.63 (*SD* = 0.49) Deployed (Combat) 33.7%	5-point scale (0–4) α = 0.78 *M* = 17.56 (*SD* = 6.18)	SI (BSS)***	Model 1-FAD-only: Depression (BDI)** PTSD (PCL) SA (BSS-20)* Model 2-FAD, PB, TB: Depression (BDI) PTSD (PCL) SA (BSS-20)	Regression Model 1 (SI): FAD** Regression Model 2 (SI): FAD**
Pennings et al., 2017	*N* = 935 Military JFTC Majority National Guard Male 82.3% White 57.4% SA NR Deployment NR	5-point scale (NR) α = 0.8 *M* = 20.28 (*SD* = 6.21)	PCL-M Factors Hyperarousal* Anxious-arousal** SI (BSS)** Male** Race*	Model 1: SES Marital Status Male** Model 2: SES Marital Status Male**	Regression Model 1 (FAD): PCL-M (4-factors) Hyperarousal** Regression Model 2 (FAD): PCL-M (5-factors) Anxious-arousal**

(*continued on next page*)

Table 2 (*continued*)

Article	Participants	ACSS details	Factors associated with ACSS: Correlations	Covariates	Significant findings
Poindexter et al., 2017	N = 119 Veterans Male 84% White 66% SA NR Deployed (Combat) 49%	5-point scale (0–4) α = 0.69 M = NR	–	Combat* Age Male	–
		5 Item			
Bryan et al., 2010a	N = 522 Deployed (n_{MH} = 44, n_{TBI} = 151, $n_{Non\text{-}Clinical}$ = 327) Air Force 74% Male 90.4% White 67.6% SA 0.7% Deployed 100% (prior NR)	7-point scale (NR) α = 0.71 M = 4.45 (SD = 1.28)	Male** PTSD (PCL-M)** Combat (CES)**	Male** SBQ-R* PTSD (PCL-M) Depression (BHM) Clinical Group**	Regression (ACSS): CES***
Bryan et al., 2010b	N = 88 Active Duty Air Force 100% Male 62.5% White 61.4% SA NR Deployment NR	7-point scale (NR) α = 0.71 M = 4.38 (SD = 1.35)	Male** Military > Clinical Civilians*** Military > Clinical Civilians_{2+SA}***	Age Male Positive Affect Negative Affect*** Negative Affect Change	Regression (SBQ-R): ACSS* PB x ACSS** $PB_{mean\ ACSS}$** $PB_{high\ ACSS}$**
Bryan and Anestis, 2011	N = 161 Deployed, TBI Clinic Army 78.9% Male 93.2% White 70.8% SA 1.2% Deployed 100% (47.8% prior)	7-point scale (NR) α = 0.66 M = 4.52 (SD = 1.33)	PTSD (PCL-M) Re-experiencing**	Model 1: Male Model 2: Male TBI Injury Mechanism Blast/Non-blast TBI LOC Duration	MM Model 1 (ACSS): *Re*-experiencing** MM Model 2 (ACSS): Re-experiencing**
Bryan and Cukrowicz, 2011	N = 348 Deployed Air Force 100% Male 89.7% White 63.5% SA NR Deployed 100% (52.3% prior)	7-point scale (NR) α = 0.66 M = 4.45 (SD = 1.23)	Male** SBQ-R** PTSD (PCL-M)* Combat (CES): Injury and Death** Mission Duties** Aggression**	Male** SBQ-R* PTSD (PCL-M)* Deployment History	Linear Regression (ACSS): Model 1: Injury & Death*** Model 2: Mission Duties** Model 3: Aggression*** Model 4: All CES subfactors Aggression*
Bryan, Clemans, & Hernandez, 2012[†]	N = 137 Deployed, TBI Clinic Army 80.3% Male 92.7% White 69.3% SA NR Deployments: M = 0.82 (SD = 1.07) — N = 55 Deployed, MH Air Force 82.8% Male 87.9% White 75.9% SA NR Deployments: M = 1.16 (SD = 1.64)	7-point scale (NR) α = 0.72 M = NR — 7-point scale (NR) α = NR M = NR	Suicidality (SBQ-R)** PB** — PB**	Male (p = NR) Age (p = NR) Depression (BHM) (p = NR) PTSD (PCL-M) (p = NR) LOC duration (p = NR) — Male (p = NR) Age (p = NR) PTSD (PCL-M) (p = NR)	Regression (SBQ-R): ACSS*** PB x ACSS* $ACSS_{lowPB}$*** $ACSS_{mean\ PB}$*** $ACSS_{high\ PB}$*** — Regression (SBQ-R): PB x ACSS(-)*
Bryan et al., 2013[†]	N = 348 Deployed, Non-clinical Air Force 100% Male 89.7% White 63.5% SA NR Deployed 100% (prior 52.3%) Combat Experiences: M = 2.97 (SD = 4.55) — N = 219 Deployed, Clinical Army 61.6% Male 91.8% White 72.1% SA NR	7-point scale (NR) α = 0.66 M = 4.45 (SD = 1.24) — 7-point scale (NR) α = 0.69 M = 4.31 (SD = 1.36)	SBQ-R(-)* CES* — CES*** PCL-M**	- — -	Structural Equation Modeling Combat→ACSS ($p < .05$)[a] — Structural Equation Modeling Combat→ACSS ($p < .05$)[a]

(*continued on next page*)

Table 2 (*continued*)

Article	Participants	ACSS details	Factors associated with ACSS Correlations	Covariates	Significant findings
	Deployed 100% (prior 49.3%) Combat Experiences: $M = 7.66$ ($SD = 6.80$)				
Gutierrez et al., 2016	$N = 477$ Veterans Male 88.1% White 56.2% SA 31.0% Combat Experience 44.2%	5-point scale (0–4) $\omega = 0.74$ $M_{Full} = 11.38$ ($SD = 4.22$) $M_{SA} = 11.89$ ($SD = 4.54$) $M_{NoSA} = 11.18$ ($SD = 4.03$)	RFL-48(-)*** MSRI-28 Negative Affect*** TBI(-)*** SI (BSS)***	–	–
			4 Item		
Chiurliza et al., 2016	$N = 3387$ R&RC Army 100% Male 91.4% White 65.4% SA NR Deployment NR	5-point scale (0–4) $\alpha = 0.77$ $M_{AI/AN} = 10.51$ ($SD = 3.28$) $M_{NHW} = 9.76$ ($SD = 3.19$)	Race[b] AI/AN > NHW	-	-
Chu et al., 2016a	$N = 3377$ R&RC Army 100% Male 91.9% White 64.7% SA: $M = 0.01$ ($SD = 0.09$) Deployment NR	$n = 3390$ 5-point scale (0–4) $\alpha = 0.76$ $M = 9.53$ ($SD = 3.25$)	SA** ISI***	Age Male Agitation (BAM) SI (DSI-SS) ISI SCS	<u>Linear Regression (SA):</u> ACSS** MDE x ACSS** $MDE_{High\ ACSS}$***
Chu et al., 2016b	$N = 1566$ R&RC Army 100% Male 92.4% White 66.1% SA: $M = 0.01$ ($SD = 0.09$) Deployments: $M = 2.09$ ($SD = 1.35$)	5-point scale (0–4) α = NR $M = 9.53$ ($SD = 3.25$)	Deployment* SA* ISI** TB(-)*	Age (p = NR) Male (p = NR) Military Rank (p = NR) Education (p = NR) Race (p = NR)	<u>Regression (ACSS):</u> Deployment*
Podlogar et al., 2017†	$n = 790$ JFTC National Guard 100% Male 83.9% White 65.5% SA NR Deployed 64.2% —— $n = 3175$ R&RC Active Duty Army 100% Male 93.3%, White 67.8% SA NR Deployed 95%	$N = 2016$ $\alpha = 0.75$ 5-point scale (0–4) $n = 623$ $M = 9.13$ ($SD = 3.54$) —— $n = 1323$ $M = 9.56$ ($SD = 3.23$)	Active Duty > National Guard**	Age Female(-)*** AA/Black(-)** (S/D/W)* Some College(-)** Ever Deployed Reference: White, Male, Active Duty, Never Married, Education: GED or Equivalent, Never Deployed	<u>MANCOVA:</u> $National\ Guard_{never\ deployed}$** $National\ Guard_{ever\ deployed}$(-)*
Ribeiro et al., 2015	$N = 1208$ R&RC Army 100% Male 91.7% White 66.0% SA NR Deployment NR	5-point scale (0–4) $\alpha = 0.77$ $M = 9.53$ ($SD = 3.28$)	TB(-)[a]	TB** PB SCS***	<u>Regression (DSI-SS)</u> Step 2: ACSS* Step 3: ACSS x BAM*** $BAM_{High\ ACSS}$* $BAM_{Low\ ACSS}$(-)**
Rogers et al., 2017	$N = 3374$ R&RC Army 100% Male 91.9% White 65.7% SA 0.47% Deployed 94.2% (53.6% missing)	5-point scale (0–4) $\alpha = 0.76$ $M_{Male} = 9.71$ ($SD = 3.18$) $M_{Female} = 7.50$ ($SD = 3.37$)	Male ***	-	-
Silva et al., 2017	$N = 3428$ R&RC Army 100% Male 90.5% White 64.7% SA 0.47% Deployments: $M = 2.09$ ($SD = 1.35$)	5-point scale (0–4) $n = 3382$ $\alpha = 0.76$ $M = 9.54$ ($SD = 3.24$)	ISI** TB(-)*	TB*** PB*** Agitation (BAM)*** ISI MDE*	<u>Regression (DSI-SS):</u> Step 2: PB x ACSS*** Step 3: TB x PB x ACSS***

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Table 2 (*continued*)

Article	Participants	ACSS details	Factors associated with ACSS: Correlations	Covariates	Significant findings
Bryan et al., 2015	N = 168 Active Duty Airforce 100% Male 87.1% White 64.7% SA NR Deployed 60.6%	7-point scale (1–7) α = 0.65–0.72 M_{t0} = 4.57 (SD = 1.16) M_{t1} = 4.77 (SD = 1.17) M_{t2} = 4.58 (SD = 1.23) M_{t3} = 4.61 (SD = 1.08) M_{t4} = 4.66 (SD = 1.14) M_{t5} = 4.53 (SD = 1.09)	Aim 2: CES_{t0}* CES_{t1}* CES_{t2}** CES_{t4}*	Aim 2: CES at Baseline	Aim 1 (ΔACSS): $ACSS_{t1} > ACSS_{t0}$* $ACSS_{t2} < ACSS_{t1}$* Aim 2 (Correlation $ACSS_{t0\text{-}t5}$): $CES_{t0\text{-}t5}$ NS Aim 3 (ACSS stability): ACSS = attractor ***

Note. Timepoints are denoted by $_t$ and timepoint number. Outcome variable(s) are in parentheses following analysis type. Negative associations are denoted by (-). Interactions are denoted by x. ACSS = Acquired Capability for Suicide Scale; SA = Suicide Attempt; NSSI = Non-Suicidal Self-Injury; NR = Not Reported; α = alpha correlation coefficient; M = Mean; SD = Standard Deviation; DERS = Difficulty in Emotion Regulation Scale; BDI = Beck Depression Inventory; BHS = Beck Hopelessness Scale; BIS = Barratt Impulsivity Scale; DRRI = Deployment Risk and Resiliency Inventory (Combat Experiences Subscale); ANCOVA = Analysis of Covariance; SITBI = Self Injurious Thoughts and Behaviors Interview; TB = Thwarted Belongingness; PB = Perceived Burdensomeness; SI = Suicidal Ideation; DSI-SS = Depressive Symptom Index Suicide Subscale; ISI = Insomnia Severity Index; MM = Moderated Mediation; Med = Mediator; Mod = Moderator; PPES = Painful and Provocative Events Scale; LSRP = Levenson Self Report Psychopathy Scales; PNI = Pathological Narcissism Inventory; FAD = Fearlessness About Death; JFTC = Joint Forces Training Center; PTSD = Posttraumatic Stress Disorder; PCL = PTSD Checklist; BSS = Beck Scale for Suicidal Ideation; TAU = Treatment as Usual; BCBT = Brief Cognitive Behavioral Therapy; MST = Military Sexual Trauma; BSS-20 = Beck Scale for Suicidal Ideation Item 20; SES = Socioeconomic Status; SBQ-R = Suicide Behaviors Questionnaire-Revised; BHM = Behavioral Health Measure – Depression subscale; LOC = Loss of Consciousness; TBI = Traumatic Brain Injury; MH = Mental Health; CES = Combat Experiences Scale; ω = correlation coefficient; RFL-48 = Reasons for Living Inventory; MSRI-28 = Multidimensional Suicide-Related Response Inventory; R&RC = Recruitment & Retention Center; AI/AN = American Indian/Alaska Native; NHW = Non-Hispanic White; BAM = Brief Agitation Measure; SCS = Suicide Cognitions Scale; MDE = Major Depressive Episode; AA = African American; S/D/W = Separated/Divorced/Widowed; MANCOVA = Multivariate Analysis of Covariance.

[a] Association significant, p value not interpretable.

[b] Unable to interpret significance due to discrepancies in table versus text.

[†] Same study, different samples.

* $p < .05$.

** $p < .01$.

*** $p < .001$

2013; Chu et al., 2016a, 2016b; Monteith et al., 2013, 2017; Silva et al., 2017), four measures of depression (i.e., number of major depressive episodes (MDEs), Behavioral Health Measure (BHM) Depression subscale, Beck Depression Inventory (BDI), Patient Health Questionnaire (PHQ-9) were utilized.

Insomnia severity. Insomnia severity, exclusively measured by the Insomnia Severity Index (ISI), was significantly, positively, associated with ACSS in each of the four samples for which correlations were reported (Chu et al., 2018; Chu et al., 2016a,b; Silva et al., 2017).

Traumatic brain injury (TBI). Gutierrez et al. (2016) reported ACSS was lower among those who endorsed a history of TBI; however, loss of consciousness (LOC) duration was not significantly associated with ACSS in a sample with mild TBI (Bryan et al., 2012).

Post-traumatic stress disorder (PTSD). Correlations between ACSS and PTSD symptoms were reported for nine samples. PTSD symptomology was assessed by the military version of the Posttraumatic stress disorder checklist (PCL-M) in seven samples, the civilian version (PCL-C) in one and a non-specified version (PCL) in one (Monteith et al., 2013). Of five samples for which total PCL-M scores were reported in relation to ACSS, four demonstrated significant, positive correlations (Bryan and Cukrowicz, 2011; Bryan et al., 2010a, 2013[1]; Martin et al., 2018). The fifth indicated a nonsignificant correlation between overall PTSD symptomology and ACSS (Bryan et al., 2013[1]), as did the sample administered the PCL-C (Monteith et al., 2017). In the remaining three samples, PCL items were categorized into PTSD symptom clusters. Symptom clusters differed by study, but two studies reported significant correlations between ACSS and PTSD Hyperarousal (Monteith et al., 2013; Pennings et al., 2017). ACSS was correlated with PTSD Avoidance-Numbing (Monteith et al., 2013), PTSD Re-experiencing (Bryan and Anestis, 2011), and PTSD Anxious-Arousal (Pennings et al., 2017) across three studies.

Non-suicidal self-injury (NSSI). NSSI was assessed in three studies; among these, correlations between NSSI history and ACSS were reportedly positive and significant in two (Baer et al., 2018b; Chu et al., 2018) and nonsignificant in the third (Chu et al., 2016b).

IPTS constructs. Correlations between ACSS and measures of other IPTS constructs (i.e., PB and/or TB) were reported for 19 samples (Anestis et al., 2015; Baer et al., 2018a; Bryan and Anestis, 2011; Bryan et al., 2012; Bryan et al., 2010a, 2013, 2010b; Chu et al., 2018; Chu et al., 2016b; Gutierrez et al., 2016; Harrop et al., 2017; Martin et al., 2018; Monteith et al., 2017, 2013; Pennings et al., 2017; Ribeiro et al., 2015; Silva et al., 2017). Among the 19 samples, TB was positively correlated with ACSS in two (Chu et al., 2018; Monteith et al., 2013) and negatively correlated with ACSS in three (Chu et al., 2016b; Ribeiro et al., 2015; Silva et al., 2017); nonsignificant associations were found in the remaining 14 samples. PB was positively correlated with ACSS in four samples (Bryan et al., 2012; Chu et al., 2018; Monteith et al., 2013); correlations between PB and ACSS in the other fifteen samples were reportedly nonsignificant. No consistency in IPTS and ACSS correlations across studies (direction and strength) were observed, even when examining studies that used the same version of the ACSS.

Nademin et al. (2008) developed a measure intended to comprehensively assess each of the IPTS constructs (AC, PB, TB) by self-report or posthumous chart review. ACSS scores were not correlated with the AC subscale of the measure or with the measure overall.

Suicide-specific variables. Among 18 samples for which correlation data were reported, seven different measures were used to assess suicide risk across three domains: suicidal ideation (Beck Scale for Suicidal Ideation (BSS), Depressive Symptom Index Suicide Subscale (DSI-SS), Multidimensional Suicide-Related Response Inventory (MSRI-28) Suicidal Ideation subscale), prior suicide attempts (BSS item #20, Self-Injurious Thoughts and Behaviors Interview (SITBI), chart review), suicide risk (Suicide Behaviors Questionnaire-Revised; SBQ-R).

Suicidal ideation. Correlations between suicidal ideation and ACSS

[1] [1,2]Denotes subsample.

were reported for 11 samples. Of the six samples (Anestis et al., 2015; Gutierrez et al., 2016; Martin et al., 2018; Monteith et al., 2017, 2013; Pennings et al., 2017) that administered the BSS, suicidal ideation was correlated with ACSS in five (Anestis et al., 2015; Gutierrez et al., 2016; Monteith et al., 2017, 2013; Pennings et al., 2017); conversely, suicidal ideation was only significantly correlated with ACSS in one (Chu et al., 2018) of the six samples (Anestis et al., 2015; Chu et al., 2018, 2016a,b; Ribeiro et al., 2015; Silva et al., 2017) that administered the DSI-SS. Notably, in a study that included both the BSS and DSI-SS, ACSS was only significantly correlated with the BSS. Additionally, (Gutierrez et al., 2016) found nonsignificant correlations between ACSS and the MSRI-28 suicidal ideation subscale, despite a significant correlation between BSS and ACSS.

Suicide attempt. Lifetime history of prior suicide attempts was assessed by a single item in each of the seven samples for which correlations with ACSS were reported (Anestis et al., 2015; Chu et al., 2018, 2016a, b; Gutierrez et al., 2016; Monteith et al., 2017, 2013). Prior SA was significantly correlated with ACSS in both of the studies determining SA by chart review (Chu et al., 2016a,b) and among the sample that administered a single item from the SITBI (Chu et al., 2018). BSS item #20 was not significantly correlated with ACSS in any of the four samples in which it was administered (Anestis et al., 2015; Gutierrez et al., 2016; Monteith et al., 2017, 2013).

Suicide risk. Correlations between ACSS and the SBQ-R were reported for 7 samples. Correlations were positive in two samples (Bryan et al., 2012[1]; Bryan and Cukrowicz, 2011), negative in one (Bryan et al., 2013[1]), and nonsignificant in the remaining four (Bryan et al., 2010a; Bryan et al., 2010b[1]; Bryan et al., 2012[2]; Bryan et al., 2013[2]).

3.4. KQ1 – non-correlational findings

Twenty-nine of the included articles utilized higher-level analyses to further examine associations between ACSS and other factors (Table 2). Although the cross-sectional design of the majority of the studies limits the extent to which directionality may be inferred, non-correlational approaches provide improved insight into the interactions between ACSS and the many associated factors discussed in the previous section. Results of higher-level analyses contradict simple correlations in many cases.

Sample Characteristics. Only three studies examined differences in ACSS as a function of sample characteristics, including comparison of ACSS between military and civilian status and military firearm ownership.

Military vs *civilian*. Two studies compared ACSS in military service members to civilian samples. Assavedo et al. (2018) reported significantly elevated ACSS among a large military sample in comparison to a sample of civilians with a history of multiple prior suicide attempts; additional analyses indicated higher ACSS among the subset of the military sample with current suicidal ideation when compared with the civilian multiple attempt group. These findings were consistent with results in Bryan et al. (2010), in which a military sample was found to endorse higher levels on the ACSS compared to a clinical sample, which included some participants with a history of prior suicide attempts. The military samples each reported higher levels of ACSS than each of their respective non-military samples, including separate analyses comparing only the subgroup of the clinical sample with a history of prior suicide attempts.

Firearm ownership. In Khazem et al. (2016), FAD was significantly elevated among military personnel who reported storing their firearms loaded and in a non-secure location, compared with those who reported storing firearms either unloaded, in a secure location, or both. In a mediated moderation model, although firearm storage moderated the association between suicidal ideation and the self-reported likelihood of engaging in a future suicide attempt, this association was not explained by ACSS-FAD.

Mental Health and Clinical Factors. Six studies examined the relationship between mental health and clinical factors and ACSS using regression analyses. Four measured both components of ACSS (i.e., pain tolerance and fearlessness of death), and two reported administering the ACSS-FAD only.

Emotion regulation and impulsivity. One study investigated the association between emotion dysregulation (Difficulty in Emotion Regulation Scale: DERS) and impulsivity (Barratt Impulsivity Scale: BIS) on ACSS in independent models. ACSS was significantly associated with only the DERS lack of emotional awareness subscale, and none of the BIS subscales (Baer et al., 2018a). These findings remained after inclusion of depressive symptoms, hopelessness and demographic covariates, however, history of combat deployment was significantly associated with ACSS in the BIS model only and not the DERS model.

Painful and provocative events. One study conducted an exploratory factor analysis (EFA) of the Painful and Provocative Events Scale (PPES) and examined the influence of each EFA-derived PPES factor on ACSS-FAD scores, controlling for combat history, age and gender. None of the PPES factors were significantly associated with ACSS-FAD; however, combat history was significantly associated with ACSS-FAD (Poindexter et al., 2017). In another study, PPES total score was significantly associated with ACSS when included as a covariate in a regression model designed to explore factors of narcissism and psychopathy in relation to ACSS (Harrop et al., 2017). In the final model, the impulsive-antisocial component of psychopathy (i.e., Levenson Self Report Psychopathy Scales-Antisocial) and the grandiosity subfactor of pathological narcissism (i.e., Pathological Narcissism Inventory-Grandiosity) were found to be associated with ACSS, however, these components explained an incremental amount of variance beyond included covariates.

PTSD. Three tests of the association between PTSD and ACSS were reported, one utilized hierarchical multiple regressions, and the other two designed moderated mediation analyses. Pennings et al. (2017) examined a 4-factor model and 5-factor model of PTSD symptom clusters as predictors of ACSS-FAD in independent regression models, controlling for sex, marital status and socioeconomic status (SES). In the 4-factor model, PTSD hyperarousal cluster was the only significant predictor of ACSS-FAD, and in the 5-factor model, PTSD anxious-arousal was the only symptom cluster significantly associated with ACSS-FAD. Martin et al. (2018) identified distress tolerance as a mediator, indirectly strengthening the relationship between overall symptoms of PTSD (PCL-M) and ACSS. In the other, PTSD re-experiencing symptoms demonstrated a significant direct association with ACSS, even after controlling for the effects of gender and general mental health (Bryan and Anestis, 2011).

NSSI. NSSI was significantly associated with ACSS in two studies. The first found significantly elevated ACSS among participants with a lifetime history of at least one NSSI event compared to those with no history of NSSI in a sample of military personnel with at least one prior suicide attempt (Baer et al., 2018b). The second utilized moderated mediation analyses to investigate the indirect effects of ACSS, PB and TB in the relation between NSSI and suicide attempt history (Chu et al., 2018). ACSS significantly moderated the mediating effects of TB and PB on NSSI and attempt history at high levels of ACSS (1 standard deviation above mean).

Suicide-specific variables. Two articles included analyses of interactions between ACSS and mental health factors in relation to suicide risk (e.g., lifetime history of suicide attempts, suicidal ideation). Ribeiro et al. (2015) examined the role of agitation on suicide risk by regressing ACSS and agitation (BAM) on suicidal ideation (DSI-SS) in a model with TB, PB and suicide cognitions included as covariates. The main effect of ACSS significantly, albeit modestly, was associated with suicidal ideation, and the two-way interaction of ACSS and agitation further demonstrated a significant, but modest effect. In another study, in which regression analyses were used to examine the interaction of MDEs and ACSS as predictors of past suicide attempts, BAM was included as a covariate, along with the ISI, suicidal ideation (DSI-SS), suicidal cognitions, age and gender. None of the covariates demonstrated significant effects in the model; however, the main effect of ACSS and the interactive effects of MDEs and ACSS significantly predicted past suicide attempts (Chu et al., 2016a).

IPTS constructs. Nine tests of the fundamental IPTS model (i.e., interactions between ACSS, PB and TB predicting suicide-related outcomes) were conducted with military samples. Monteith et al. (2017) regressed ACSS-FAD on suicidal ideation (BSS) in one model, and simultaneously with PB and TB in a second, while controlling for symptoms of depression and PTSD, and past suicide attempts. ACSS-FAD predicted SI in both models. Silva et al. (2017) further tested the interactions between IPTS constructs with suicidal ideation (DSI-SS) as the outcome, in a large military sample (n = 3428). After accounting for the covariates of agitation, insomnia, and depression, the main effect of ACSS, two-way interaction of PB and ACSS and three-way interaction between PB, TB and ACSS all significantly predicted SI.

Interactions between the IPTS constructs and suicide risk, as measured by SBQ-R, were examined in three samples. In two samples, the main effect of ACSS significantly predicted SBQ-R. All three studies found significant two-way interactions between PB and ACSS; however, the interaction positively predicted SBQ-R in Bryan et al. (2010b) and Bryan et al. (2012)[1], and negatively predicted SBQ-R in the second sample of Bryan et al. (2012)[2]. No tests of interactions between TB and ACSS, or the three-way interactions between PB, TB and ACSS, significantly predicted SBQ-R.

Three studies (Anestis et al., 2015; Gutierrez et al., 2016; Monteith et al., 2013) utilized similar regression models, substituting past suicide attempts (BSS item #20) as the outcome. The main effect of ACSS did not significantly predict suicide attempt history in any of the three samples. The interaction between ACSS and PB significantly predicted attempt history in one study (Anestis et al., 2015); in an additional study, the interactions of ACSS and PB, and ACSS and TB, were significant only among those with multiple prior attempts, compared with those with no prior attempts (Monteith et al., 2013). The three-way interaction between PB, TB and ACSS predicted suicide attempt history in one of the three samples (Anestis et al., 2015).

Secondary data from a randomized controlled trial of brief cognitive behavioral therapy (BCBT) vs. treatment as usual (TAU) were analyzed in Bryan et al. (2018) to explore ways in which IPTS constructs (FAD, PB, TB) influenced the relationship between treatment group allocation and suicide attempts reported at 2-year follow-up. Measures of ACSS-FAD, PB and TB were conducted at baseline, 3 months and 6 months. The only statistically significant finding involving ACSS-FAD was a negative correlation between follow-up suicide attempts and the interaction of baseline measures of TB and ACSS-FAD. Further moderated-mediation analyses demonstrated no significant indirect effects of ACSS-FAD, TB, and PB on the association between treatment group and follow-up suicide attempts.

3.5. KQ2

Measures of deployment or combat history were provided for 26 samples included in this review, 14 of which did not examine deployment or combat history in relation to ACSS (Table 2). Among the remaining 12 samples (Baer et al., 2018a; Bryan and Cukrowicz, 2011; Bryan et al., 2010a ; Bryan et al., 2013, 2015; Butterworth et al., 2017; Chu et al., 2016b ; Kerbrat et al., 2015; Podlogar et al., 2017; Poindexter et al., 2017), deployment or combat experience was assessed in four ways. The Combat Experiences Scale (CES) was administered to 5 samples across 4 studies (Bryan and Cukrowicz, 2011; Bryan et al., 2010a; Bryan et al., 2013, 2015), and the Combat Experiences subscale of the Deployment Risk and Resiliency Inventory (DRRI) was administered in one sample (Butterworth et al., 2017). Among the remaining samples, single-item, dichotomous (yes/no) or numerical values were utilized to capture deployment history (3 samples, 2 studies; Chu et al., 2016b; Podlogar et al., 2017) and combat history (3 samples, 3 studies; Baer et al., 2018a; Kerbrat et al., 2015; Poindexter et al., 2017).

Correlations between combat or deployment experience and ACSS were reported for seven samples, of which three were deployed at some point during the study (Bryan and Anestis, 2011; Bryan and Cukrowicz, 2011; Bryan et al., 2010b). Three approaches were used to capture these data. First, deployment history, assessed by a single-item measure of prior number of deployments, was correlated with ACSS in one (Bryan and Cukrowicz, 2011) of two samples for which data were reported (Bryan and Cukrowicz, 2011; Chu et al., 2016b). Second, overall measures of combat history were reported in correlation with ACSS for four samples, all of which were assessed by the Combat Experiences Scale (CES). Total CES scores were positively correlated with ACSS in each of the three samples utilizing cross-sectional data (Bryan et al., 2010a, 2013). The fourth, which utilized a before-after design, reported correlations between CES and AC at six timepoints: (1) before pre-deployment training, (2) after pre-deployment training, (3) 1-month post-deployment, (4) 3-months post-deployment, (5) 6-months post-deployment, and (6) 12-months post-deployment. CES was positively correlated with ACSS at timepoints 1, 2, 3, and 5; however, when controlling for CES at baseline, correlations between measures of CES and ACSS were no longer statistically significant at any timepoint (Bryan et al., 2015). Finally, factors of combat experience were measured in two studies, one utilizing EFA-derived CES factors (Bryan and Cukrowicz, 2011) and the other utilizing the Combat Experiences subscale of the DRRI (Butterworth et al., 2017). Bryan and Cukrowicz (2011) found that all three EFA-derived CES factors (Injury and Death, Mission Duties, Aggression) were significantly correlated with ACSS. The main effects of each EFA-derived CES factor significantly predicted ACSS in a regression model; however, only the association with the Aggression sub-factor remained significant when all three sub-factors were added to the model simultaneously. Butterworth et al. (2017) identified significant correlations between ACSS and two of four items directly related to injury and death, and three of eleven items not directly related to injury and death. When controlling for gender, race and time since last deployment in subsequent ANCOVA analyses, only "going on combat patrols or missions," (an experience not related to direct exposure injury and death), was associated with ACSS.

Podlogar et al. (2017) examined the influence of deployment history in a comparison of ACSS among Army Active Duty (AD) and Army National Guard (NG). Results of MANCOVA analyses indicated that, when controlling for other demographic variables, ACSS was significantly higher among NG with no history of deployment (i.e., "never deployed") than AD never deployed. The AD never deployed were then compared with NG who endorsed a history of deployment (i.e., "ever deployed"); NG ever deployed endorsed lower ACSS than AD never deployed.

Two studies examined the association between combat and ACSS in regression models. Number of prior combat deployments was significantly associated with ACSS in a regression model controlling for mental health covariates, including suicidal behaviors (SBQ-R), and symptoms of depression and PTSD, in a sample of deployed servicemembers (Bryan et al., 2010a). In a regression model utilizing the CES, Kerbrat et al. (2015) examined on the association between ACSS total scores and ACSS-FAD subscale scores in independent models; CES positively predicted ACSS total and ACSS-FAD subscale scores.

Indirect effects of the association between combat and ACSS were found for an additional four samples. Tests of a structural equation model intended to examine pathways by which combat may predict suicide risk were conducted in two samples (Bryan et al., 2013). Although combat experience, as assessed by CES, did not significantly predict suicide risk (SBQ-R), it was associated with ACSS in both samples. In two studies previously described, combat exposure was included as a covariate in regression models. In

Poindexter et al. (2017), when PPES factors were regressed on ACSS-FAD scores, only combat was a significant predictor of ACSS-FAD. Finally, in the emotional characteristics models, combat experience was only a significant covariate in the impulsivity (BIS) model, and not the regulation (DERS) model (Baer et al., 2018a).

4. Discussion

Although there have been reviews of IPTS constructs in civilian samples, this is the first systematic review to examine factors associated with AC, as measured by the ACSS, in military and Veteran samples. Utilizing a standardized and recommended tool to assess risk of bias, all but one of the included studies in our systematic review were rated as high risk of bias. Notably, this bias is driven by a lack of diverse methodological approaches to examine ACSS in military and Veteran samples, with researchers relying heavily on cross-sectional designs. Due to the high risk of bias across included studies, it is essential that individual study results, and the composite findings from this review, be interpreted with caution. Findings should be used to guide and support future research directions, rather than suggesting an unequivocal consensus of the factors associated with AC, as assessed by the ACSS, in military and Veteran samples.

Another notable finding from this systematic review, is the inconsistency in the use of ACSS versions across studies (i.e., differing items, number of items, response scales). Several of the ACSS-versions utilized lack psychometric validation, which further complicates interpretation of study findings as results obtained may be due to measurement confounds, rather than lack of an actual empirical association. ACSS-specific data collection information (i.e., whether the ACSS version utilized was valid and reliable) was not considered when evaluating risk of bias using the EPHPP quality assessment tool to minimize potential confounds between risk of bias and systematic review aims. Thus, there is likely an even greater influence of bias in data collection methods for this area of the literature. Given the vast number of different iterations of the ACSS utilized, and the lack of psychometric validation for many of the versions, drawing conclusions across studies is challenging. In general, results from this systematic review suggested that no one version of the ACSS was associated with consistent findings across studies.

Across included studies, there was a moderate range of factors examined in relation to ACSS. Factors were heavily dominated by demographics, common comorbid clinical symptoms (i.e., depression, insomnia, TBI, PTSD), IPTS constructs, and suicide-specific variables. This review yielded mixed findings, with no set of factors consistently associated with ACSS. The one exception might be insomnia severity; however, only a few studies examined this association. When examining statistically significant correlations, nearly all correlations were small to moderate in effect size ($r < \pm .30$), with some correlations differing in direction between studies (Cohen, 1988). Furthermore, many factors significantly associated with ACSS in correlational analyses were no longer significant, or variance was reduced, when included in models designed to better approximate total variance. The small effects found across studies could suggest lack of an association between these factors and ACSS/suicide risk, may be due to insufficient models lacking critical interactive variables, and/or be a function of methodological and statistical limitations. Although helpful building blocks for future research, the current lack of depth and breadth of factors that have been examined in relation to the ACSS is problematic given the dynamic and multidetermined nature of suicide risk.

A little over one-third of included studies examined the association between deployment or combat history and ACSS. In addition to the complexities of ACSS assessment, the discrepant nature in the ways in which deployment and combat history were assessed compounds the difficulty in drawing conclusions about this association. The majority of studies utilized single-item, non-validated measures of deployment or combat history, limiting the potential to better understand whether certain aspects of deployment or combat experience may be associated with increased levels of ACSS. Keeping these assessment limitations in mind, the majority of studies reviewed did find evidence in support of a positive association between deployment or combat history and ACSS. Although several studies did find evidence of this association in cross-sectional designs, the small effect sizes of these findings suggest that the variability in ACSS that can be solely attributed to combat experiences may not be robust.

4.1. Limitations

Due to the defined inclusion criteria utilized for this systematic review, it is important to note that findings may only generalize to U.S. military and Veteran populations. Levels of AC may vary based upon experiences both outside of military service (e.g., pre-military life experiences, demographics) and during military service (e.g., type and frequency of deployment to combat zones). Furthermore, because selection into military service differs cross-culturally as a function of enlistment versus mandatory service, current findings may not generalize to non-U.S. military and Veteran populations.

In addition to generalizability cross-culturally, another limitation is that a sizeable portion of the current ACSS U.S. military and Veteran literature is based upon samples that were drawn from very similar populations. For example, nearly half of all included samples were drawn from Army National Guard and Army Recruiter and Retention populations. Furthermore, seven of the eight samples that utilized the 4-item ACSS (with a 5-point response scale) were drawn from the same sample and all the 5-item ACSS (with a 7-point response scale) were derived from the same dataset. Thus, a significant and alarming majority of studies that have examined the ACSS in military populations have been conducted on the same sample/dataset, limiting not only generalizability, but also empirical findings. Given the inherent challenges to active duty military research, the lack of large-scale representative samples is not unique to the ACSS literature, but a limitation nonetheless. Several of the active duty military studies included an informed consent process that outlined actions that would result from an endorsement of suicide risk (e.g., further clinical assessment) and/or were carried out during a time of demobilization, both of which may have been associated with underreporting of key factors that may be associated with ACSS. Finally, there have only been a few studies examining the ACSS in Veteran populations; additional research in this population is instrumental to informing the role of AC in suicide prevention post-transition from the military.

The focus of this systematic review was to determine the empirical support behind factors associated with AC, as measured by the ACSS. Although AC is most commonly associated with the IPTS, other current theories of suicide (Klonsky and May 2015; O'Connor, 2011; O'Connor and Nock, 2014) also propose that AC plays a distinct role in the transition from ideation to behavior. Both O'Connor's (2011) Integrated Motivational-Volitional Model of suicidal behavior and Klonsky and May's (2015) Three-Step Theory propose that AC is associated with initiation to behavior via additional AC-related constructs (e.g., impulsivity, access to means, genetics) that either underlie or enhance the development of AC. Moreover, recent IPTS revisions (Chu et al., 2017) have suggested that “acquired” should be dropped from term, with refinement of the construct now labeled as “capability for suicide.” Given the role of AC across theories, the lack of an assessment specific to AC in non-IPTS theories, and the fact that there are no updated IPTS assessments, all of which suggest that researchers will continue to utilize the ACSS for some time, we elected to focus this systematic review on the ACSS to characterize the current status of the ACSS and to inform assessment refinement moving forward. A critical next step will be to determine the best way to assess AC using convergence across theories to ultimately improve our understanding of factors associated with AC cross-theories.

Due to the high risk of bias in the reviewed literature, we elected to not conduct a meta-analysis or aim to quantify non-correlational effect sizes, which is a limitation. This was due to methodological and scientific considerations, as a quantification approach would likely produce unwarranted and unequivocal conclusions that would further exacerbate the current empirical understanding of the ACSS. Probing quantitative findings will be critical moving forward as researchers work to improve the reliability and validity of the ACSS, incorporate the ACSS into study designs that minimize bias, and use the ACSS across diverse samples/datasets.

4.2. Conclusions and future directions

A primary goal of this systematic review was to determine the current state of the literature to inform recommendations for future research. To build upon the foundational literature, a major recommendation is that additional research, designed *specifically* to investigate AC research aims, be conducted utilizing non-cross-sectional designs. A majority of the existing literature examining ACSS in military and Veteran samples involves secondary data analyses or non-ACSS primary aims, which narrows both researchers' and clinicians' ability to more comprehensively examine AC. Furthermore, these methodological approaches need to be adopted while also maintaining growth in sample composition. Low risk of bias studies are needed to examine factors associated with AC in samples that represent all branches of the U.S. military and Veteran status (e.g., enrolled in Veterans Affairs Health Administration care vs non-enrolled). To further improve the understanding of AC, these samples also need to consider demographic heterogeneity (e.g., gender, length of military service) and consider multiple cohort designs, which include civilians, to improve ACSS assessment and AC construct precision.

Due to the dynamic and multidetermined outcome of suicide, it is essential that AC research focus on *construct refinement*. Refinement of outstanding questions related to state versus trait AC and subjective versus objective AC are essential to improving assessment efforts. At this time, the psychometric validation of the ACSS-FAD suggests that this is the best theory-consistent IPTS-specific assessment of AC, however, this neglects the assessment of the other indicator of AC, pain tolerance. To achieve AC construct refinement, the field would benefit from continued examination of the ACSS in conjunction with AC proxy measures (e.g., suicide-specific pain tolerance, behavioral assessments of AC) to build empirical guidance on the best way to assess AC (May and Victor, 2017; Nazem et al., 2017; Smith and Cukrowicz, 2010). These approaches, which would permit improved cross-theory assessment, would also help consolidate theory and conceptual refinement of AC.

Based on the theoretical underpinnings of major theories of suicide, AC holds incredible promise as a key underlying mechanism that can explain increased risk for suicide in military and Veteran populations. Because an improved understanding of factors associated with AC is critical to the precision of identification efforts (i.e., who is at greatest risk for death by suicide), continued research that builds upon the findings in this systematic review can directly inform aspects of military and Veteran-based approaches to suicide prevention.

Contributions

All authors assisted in the conceptualization of the study and development of methodology. BH completed the literature search. EBK, LAG, and SN primarily contributed to the drafting and revisions of the manuscript. All authors reviewed and approved the final manuscript.

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Limitations

Included studies were non-representative of all U.S. military and Veteran populations and may only generalize to these populations.

CRediT authorship contribution statement

Emily B. Kramer: Conceptualization, Methodology, Writing - review & editing. **Laurel A. Gaeddert:** Conceptualization, Methodology, Writing - review & editing. **Christine L. Jackson:** Conceptualization, Methodology, Writing - review & editing. **Ben Harnke:** Conceptualization, Methodology, Investigation, Writing - review & editing. **Sarra Nazem:** Conceptualization, Methodology, Writing - review & editing.

Declaration of Competing Interest

All authors declare that there are no conflicts of interest to report.

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