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Suicide and Life-Threatening BEHAVIOR

ORIGINAL ARTICLE

The effectiveness of the Collaborative Assessment and Management of Suicidality (CAMS) compared to alternative treatment conditions: A meta-analysis

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Abstract

Introduction: This meta-analysis aimed to test the efficacy of the Collaborative Assessment and Management of Suicidality (CAMS) intervention against other commonly used interventions for the treatment of suicide ideation and other suicide-related variables.

Method: Database, expert, and root and branch searches identified nine empirical studies that directly compared CAMS to other active interventions. A random effects model was used to calculate the effect size differences between the interventions; additionally, moderators of the effect sizes were tested for suicidal ideation.

Results: In comparison to alternative interventions, CAMS resulted in significantly lower suicidal ideation ($d = 0.25$) and general distress ($d = 0.29$), significantly higher treatment acceptability ($d = 0.42$), and significantly higher hope/lower hopelessness ($d = 0.88$). No significant differences for suicide attempts, self-harm, other suicide-related correlates, or cost effectiveness were observed. The effect size differences for suicidal ideation were consistent across study types and quality, timing of outcome measurement, and the age and ethnicity of participants; however, the effect sizes favoring CAMS were significantly smaller with active duty military/veteran samples and with male participants.

Conclusions: The existing research supports CAMS as a *Well Supported* intervention for suicidal ideation per Center of Disease Control and Prevention criteria. Limitations and future directions are discussed.

INTRODUCTION

Globally, approximately 800,000 individuals die by suicide each year (World Health Organization [WHO], 2019). The frequency of suicide-related deaths is also a major concern in the United States (U.S.), where annually 47,511 die by suicide, over 1.4 million adults attempt suicide, and 12 million have serious suicidal thoughts (Substance Abuse & Mental Health Service Administration [SAMHSA], 2020; WHO, 2019). Given the pervasive nature of this leading cause of death, studies have tested interventions addressing suicide-related deaths, attempts, self-harm, and ideation. A recent meta-analysis of this research (Fox et al., 2020) that included data from 591 articles found that interventions for addressing suicidal thoughts and behaviors are effective overall; however, the effects tend to be small and have not improved over time. Although the results from Fox and colleague's (2020) meta-analysis provide an overall picture of the research, the

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results were primarily based on four specific interventions (medication, cognitive therapy, cognitive-behavioral therapy, and dialectical behavior therapy [DBT]) and may not fully represent other emerging approaches. In addition, although suicidal ideation is often measured in studies of these common interventions, most studies focus on suicidal *behaviors*; suicidal ideation is often not a direct treatment target (Jobes & Joiner, 2019). This omission is concerning given the significant proportion of the population who experience suicidal thoughts and the burden of distress that it, in and of itself, entails (Borges et al., 2010; White, 2016). Moreover, it is important to target suicidal ideation as research indicates that roughly 30% of those who experience suicidal ideation will make a suicide attempt and that ideation is a significant precursor for suicide attempts and deaths (Hubers et al., 2018; Jobes & Joiner, 2019; Nock et al., 2008; O'Connor, 2011). Also, a summary of the research on newer and less studied specific interventions is needed since the effects of the studied interventions are relatively small (Fox et al., 2020).

Practitioner Points

- The results of this meta-analysis support the efficacy of CAMS over alternative interventions for the treatment of suicidal ideation.
- Moderator analyses indicated that the effect sizes favoring CAMS were significantly larger for non-military and female patients

The collaborative assessment and management of suicidality

The Collaborative Assessment and Management of Suicidality (CAMS) is a suicide risk intervention with growing empirical support (Jobes, 2012). CAMS was developed to manage suicidal thoughts and behaviors in university counseling centers (Jobes, 1995; Jobes & Berman, 1993; Jobes et al., 1997). Although it originally focused on outpatients with suicidal ideation in a time-limited setting, it has since been tested in of other settings (Dimeff et al., 2018; Ellis et al., 2017). In addition, CAMS was designed to be flexible enough for integration into a wide range of approaches without the intensive training required for some other evidence-based interventions for suicidal thoughts and behaviors (e.g., DBT; DeCou et al., 2019). In particular, the goals of CAMS are to increase risk assessment quality, focus treatment on reducing suicidal risk across diagnoses, improve documentation, and work effectively on an outpatient basis (Jobes, 2009).

CAMS consists of a distinct therapeutic style and a set of procedures to enhance suicide-focused assessment and intervention. Similar to other models of collaborative or therapeutic assessment (Finn, 2007; Poston & Hanson, 2010), CAMS emphasizes collaboration and transparency with suicidal patients throughout the consent, assessment, intervention, and termination stages (Jobes, 2016). CAMS also takes an empathetic, non-judgmental stance in exploring the functional and maladaptive aspects of a patient's suicidal behavior and ideation in a way similar to motivational interviewing approaches (Hettema et al., 2005). In terms of procedural components, CAMS centers around the use of the Suicide Status Form (SSF; Jobes, 2016). The first-session version of the SSF contains three sections focused on assessment and treatment planning. The first section is completed by the patient and consists of quantitative ratings of empirically and theoretically derived independent risk factors for suicide as well as qualitative written responses. These are based on foundational suicide research and theory on risk factors, such as psychological pain (Shneidman, 1993), hopelessness (Beck, 1986), and self-regard/self-hate (Baumeister, 1990; Neuringer, 1974). The second section, completed by the clinician with the patient's input during the session, assesses for several other proximal risk factors, such as suicidal plans and history. Finally, the third section of the SSF contains a guide for developing the treatment plan, which includes a focus on addressing self-harm, creating a CAMS Stabilization Plan, and mitigating factors that are driving the patient's suicidal thoughts and behaviors. Notably, these CAMS interventions are flexibly tailored to the patient's problems (e.g., chain analysis, problem-solving, referral to other needed resources; Jobes et al., 2015; Stanley et al., 2009). In subsequent sessions, a tracking version of the SSF is used to assess suicidal thoughts and update the treatment plan until the patient has three consecutive sessions with low suicide risk (i.e., no or manageable ideation and no suicidal or self-harm behaviors). At that point, a final version of the SSF is used to document overall outcomes and case disposition.

Previous research on CAMS

The first clinical trial of CAMS examined the SSF's psychometric properties and pre-post- changes in outcomes during treatment in a college counseling center (Jobes et al., 1997). In a two-part design, non-clinical undergraduates ($n = 161$) and student-patients ($n = 106$) completed the SSF and other measures related to suicide risk factors on the SSF (e.g., psychological pain, hopelessness). In addition, each of the six items of the SSF "Core Assessment" demonstrated good convergent validity with the expected measures and differentiated between the clinical and non-clinical samples. In terms of treatment outcomes, pre-treatment SSF scores predicted which patients demonstrated more quickly resolved (within an average

of 6.50 sessions) versus more long-lasting suicidal ideation (no resolution during the study despite an average of 16.53 sessions) with good (71%) accuracy. For those with more quickly resolved suicidal ideation, SSF scores improved significantly during treatment, ranging from medium ($d = 0.54$) to large effects ($d = 1.51$). Taken together, these early results support the psychometric properties of the SSF and demonstrate clinically significant effects of the CAMS approach on suicidal thoughts and behaviors and psychological distress (Brausch et al., 2020; Conrad et al., 2009).

To date, there have been a number of studies adding to the evidence base for CAMS, including randomized controlled trials (RCTs) with active controls (Andreasson et al., 2016; Comtois et al., 2011; Jobes et al., 2017; Johnson et al., 2019; O'Connor et al., 2012; Pistorello et al., 2020; Ryberg et al., 2019), naturalistic controlled trials (Ellis et al., 2015, 2017; Jobes et al., 2005), uncontrolled descriptive studies (Ellis et al., 2012; Nielsen et al., 2011), and recent investigations of app-based deliveries of CAMS (Dimeff et al., 2018; Dimeff et al., 2021; O'Toole et al., 2019). These have included investigations conducted in a number of contexts, such as inpatient psychiatric hospitals (Ellis et al., 2012, 2015; 2017), military settings (Jobes et al., 2005, 2017), community mental health centers (Comtois et al., 2011; Nielsen et al., 2011), and emergency departments (Dimeff et al., 2018; Dimeff et al., 2021). Together, these studies also capture patients with presenting problems such as Borderline Personality Disorder (Andreasson et al., 2016), depression, anxiety, and trauma-related concerns (Ellis et al., 2017; Jobes et al., 2017).

As previously noted, Fox and colleagues' (2020) recent, large meta-analysis found that existing suicide interventions reduced suicide ideation as well as other suicide-related variables. However, the interventions were not found to differ from each other in their effectiveness. Among their 591 included articles were three CAMS studies; however, much of the existing research on CAMS was not included because it was published after the inclusion cutoff date, did not meet other exclusion criteria, or was missed in their literature search. Given that only three CAMS studies were included and that the CAMS intervention was grouped in their "other" intervention category, Fox and colleagues' overall findings may not reflect findings that are specific to CAMS. Further, their overall results do not provide nuanced details on the efficacy and moderators of CAMS that a review specific to this intervention can provide.

Only one systematic review of CAMS studies has been conducted to date. Hanratty et al. (2019) narratively synthesized comparisons of CAMS to alternative interventions in non-retrospective designs ($k = 4$). The authors concluded that CAMS showed some promise in improving suicidal ideation and some other outcomes, such as hopelessness. However, the small number of included studies and the substantial heterogeneity in study designs precluded drawing firm conclusions about the efficacy of CAMS, especially in regard to reducing suicide attempts and self-harm behaviors.

While this review (Hanratty et al., 2019) provided an initial examination of CAMS research, it has a number of limitations. First, it did not include RCTs of CAMS that have been published since 2017 (e.g., Jobes et al., 2017; Pistorello et al., 2020; Ryberg et al., 2019). Additionally, its exclusion of controlled retrospective designs resulted in some naturalistic trials being omitted (e.g., Jobes et al., 2005); inclusion of such studies is important for documenting the effects of psychological interventions in real-world clinical settings (Hunsley & Lee, 2007). Further, a quantitative synthesis of CAMS trials was not conducted, which precludes calculating overall effect sizes and testing potential moderators. As such, an updated and expanded synthesis of research related to CAMS is warranted.

Aims of the current meta-analysis

To address these gaps in the literature, the goal of the current meta-analysis was to quantitatively synthesize evidence on the effectiveness of CAMS in addressing suicide-related variables. In particular, we sought to update the review by Hanratty et al. (2019) by including studies published through June 2020 and by broadening our scope to include studies that used archival data. Similar to the previous review (Hanratty et al., 2019), we only included studies that compared CAMS to another active intervention. Although there have been several observational studies that report outcomes among suicidal patients who receive CAMS (Jobes et al., 1997; Nielsen et al., 2011; O'Toole et al., 2019) or examine the psychometric properties of the SSF (Brausch et al., 2020; Corona et al., 2019), these were excluded because of their inability to demonstrate causality. Additionally, this meta-analysis focused on suicidal ideation rather than suicidal behavior or self-harm as primary outcomes. While these behavioral outcomes are clearly important, their low base rates limit the extent to which reliable estimates of their frequency in CAMS compared to alternative treatments can be determined. Further, addressing suicidal ideation in and of itself represents a notable reduction in suffering for many patients (Jobes & Joiner, 2019) and may reduce the risk of later death by suicide (Franklin et al., 2016).

MATERIALS & METHODS

Literature search procedures

Figure 1 presents a flow chart for study inclusion. To be included in this meta-analysis, studies needed to report

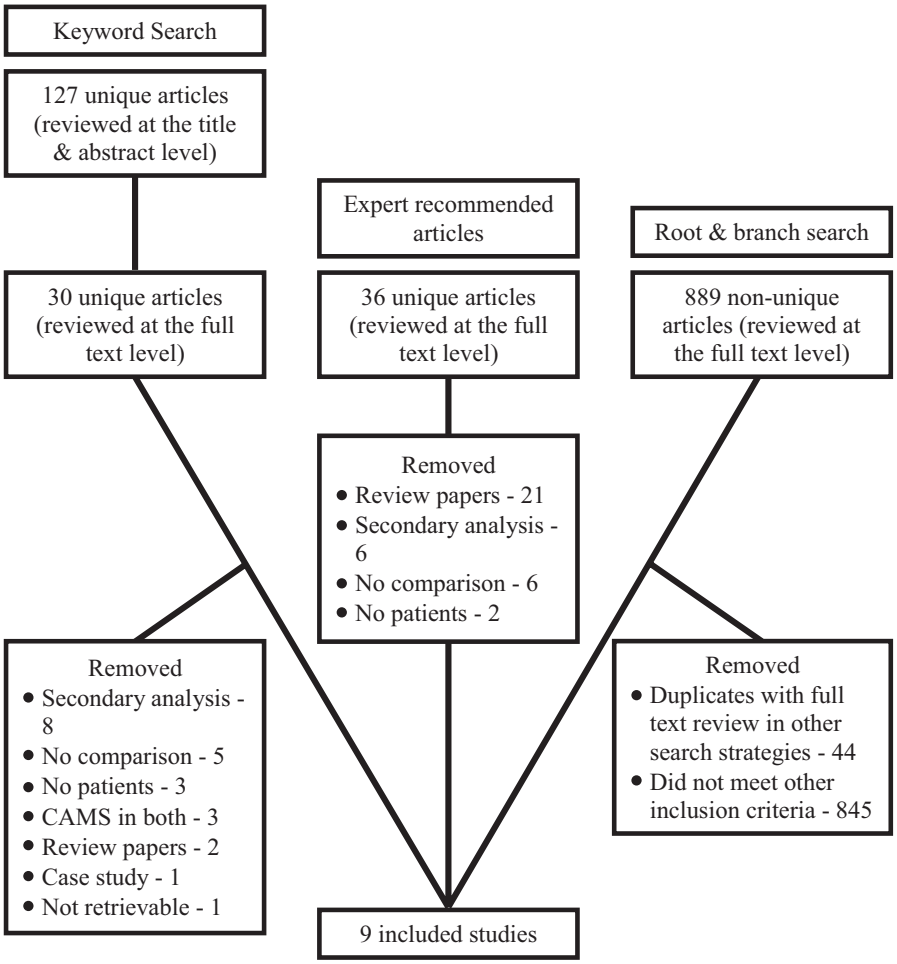

FIGURE 1 Flow chart for search and inclusion coding

post-treatment patient outcomes for both a CAMS intervention and an active treatment comparison condition (e.g., treatment as usual, DBT). Studies could be published or unpublished and could be published in any language as long as the corresponding author was able to provide data to the researchers in English.

Three search strategies were used to identify potential studies for inclusion. First, a keyword database search was conducted in Academic Search Complete, APA PsycArticles, APA PsycInfo, and MEDLINE using the keywords "Collaborative Assessment and Management of Suicide" OR "Suicide Status Form." This search resulted in 127 unique articles that were initially reviewed at the title and abstract level. The title and abstract review was completed by two independent coders (the second and third authors). Coders then identified articles that could potentially meet study inclusion criteria, and those articles were forwarded for a full-text review. At this stage, 97 articles were removed because they were identified as being irrelevant to the purpose of this review. The remaining 30 articles were reviewed at the full-text level. The same coders reviewed each article independently and made a decision regarding inclusion. They had a 96.67% agreement rate. The one article that they disagreed on was discussed with a third reviewer (the first author) until a consensus among all three reviewers was achieved. Eight of the articles were removed because they were secondary analyses of data from a study that was already included in the meta-analysis, five were removed because the study did not include an active comparison group (i.e., pre-/post-test of CAMS only), three did not include patient outcomes (i.e., focused on therapist/trainee level outcomes or role-play scenarios), three included components of the CAMS intervention in the comparison condition, two were review papers, and one was a case study. In sum, the keyword search strategy resulted in eight studies that met all inclusion criteria.

Second, corresponding authors of all articles ($k = 30$) that were identified as potentials for inclusion from the keyword search were contacted to see if they knew of any additional unpublished data or published data that may have been missed through a keyword search. Thirty-six previously un-identified articles were suggested by these experts. These articles were all reviewed at the full-text level by the two independent coders who had a 100% agreement rate. Only one article met inclusion criteria. The majority of the others were review/theory papers ($k = 21$), six were secondary analyses of already included studies, six did not include a comparison group, and two did not include patient outcomes.

TABLE 1 Characteristics of the included studies

Study	Design	Quality score	Comparison treatment	Setting	Military/veteran sample	Average age	% female	% non-Hispanic White
Andreasson et al. (2016)	Efficacy	5	DBT	Outpatient	No	31.7	74.1	–
Comtois et al. (2011)	Efficacy	5	TAU	Outpatient	No	36.8	62.0	66.0
Dimeff et al. (2021)	Efficacy	5	TAU	Inpatient/ED	No	34.4	65.0	87.0
Ellis et al. (2017)	Effectiveness	5	TAU	Inpatient/ED	No	31.2	63.5	93.3
Jobes et al. (2005)	Effectiveness	4	TAU	Outpatient	Yes	29.1	34.8	83.6
Jobes et al. (2017)	Efficacy	7	TAU	Outpatient	Yes	26.8	19.6	53.2
Johnson et al. (2019)	Efficacy	6	TAU	Outpatient	Yes	48.0	11.9	70.9
Pistorello et al. (2020)	Efficacy	7	TAU	Outpatient	No	20.0	68.0	48.4
Ryberg et al. (2019)	Efficacy	6	TAU	Various	No	35.9	53.0	–

Abbreviations: DBT, dialectical behavior therapy; ED, emergency department; TAU, treatment as usual.

Third, a root and branch search was conducted for all included studies. The included studies contained 415 non-unique references (roots). Through Google Scholar, 474 non-unique articles were also identified that cited one of the included studies (branches). These articles were all reviewed at the full-text level by the two independent coders. All of them either did not meet inclusion criteria ($k = 845$) or had already been identified and reviewed at the full-text level through the first two search strategies ($k = 44$).

Coding procedures

Each of the nine studies that met all inclusion criteria were coded by two independent coders. The coding included a review of treatment, participant, and study variables, as well as intervention outcomes (see below for descriptions of each). Across all variables, the coders displayed a 93.95% agreement rate. The discrepancies were discussed with a third coder until a consensus between all three coders was achieved.

A summary of the coding results can be found in Tables 1 and 2. Treatment characteristic variables included the type of CAMS intervention (full intervention or Suicide Status Form only), the comparison treatment, treatment mode (individual, group, or virtual), treatment setting (outpatient, inpatient/emergency department, or various), and average number of sessions for the CAMS intervention. Participant characteristics were coded as active duty military/veteran sample (yes or no), average sample age, % female, and % non-Hispanic White.

Five variables relating to the characteristics of the studies were coded. These included study year, study design (efficacy or effectiveness), whether the CAMS originator was a co-author (yes or no), whether the study had any financial support (yes or no), and study quality. A study quality score was identified based on a review of seven different variables (randomization, patients similar at baseline, therapists similar, treatment adherence, equal treatment outside of the intervention, an accounting of all patients, and blinding), each being coded as yes (1), unclear (0), or no (0). A total study quality score was then calculated by summing the scores across the seven items. This measure of study quality was based on the Centre for Evidence-Based Medicine's Critical Appraisal Tool for Therapy Studies (https://www.cebm.ox.ac.uk/resources/ebm-tools/critical-appraisal-tools).

Several different categories of outcomes were coded for each study. The primary outcome was chosen *a priori* as level of suicidal ideation. Secondary outcomes included suicide attempts, self-harm, distress/symptom impairment, hope/hopelessness, other suicide-related correlates (self-esteem, reasons for living, well-being, and resilience), treatment acceptability (dropout and satisfaction), and cost effectiveness (number of sessions until symptom resolution, hospitalizations/emergency department visits, total cost of intervention, total other healthcare costs). In this meta-analysis, we used the term self-harm, which is sometimes referred to as non-suicidal self-injury (NSSI). This choice was based on the fact that the term self-harm can be more encompassing and is more frequently used in an international context. For all outcomes, data (i.e., frequencies, means, and standard deviations), rather than the results from statistical tests, were coded. Study authors were contacted in situations where the desired data were not presented in the manuscript. Where applicable, data from all post-intervention follow-up time points were also recorded.

Data analyses

A weighted standard difference in means (d) was calculated for each of the seven outcome categories, representing the

TABLE 2 Coded outcomes of the included studies

Study	Suicidal ideation	Suicide attempts/ self-harm	Distress	Hope/ Hopelessness	Other suicide-related correlates	Treatment acceptability	Costs
Andreasson et al. (2016)	BSSI	Attempts, NSSI	HDRS−17	BHS	RSES	Dropout	–
Comtois et al. (2011)	SSI	Attempts & NSSI	OQ45	OHS	RFL	Dropout, CSQ	BH ED admissions
Dimeff et al. (2021	–	–	SIDQ-Distress & Agitation	–	–	Satisfaction survey	
Ellis et al. (2017)	BSSI, CSSRS, PHQ9#9	Attempts	PHQ9, WHO-DAS	BHS	WHO−5	Dropout	Hosp.
Jobes et al. (2005)	OQ45#8	Attempts	OQ45	–	–	–	ED visits, Hosp., sessions to resolution
Jobes et al. (2017)	SSI	SASI-C	SF36, OQ45	–	CDRS	Dropout	Suicide ED visits, Tx costs, health care costs
Johnson et al. (2019)	BSSI	–	OQ45	–	–	CSQ	–
Pistorello et al. (2020)	SSI, CCAPS−34#25	SASI-C	CCAPS−34, CGIS	BHS	–	Dropout, CSQ	–
Ryberg et al. (2019)	BSSI	Attempts, NSSI	OQ45	–	–	–	Inpatient admissions

Abbreviations: BH, behavioral health; BHS, Beck Hopelessness Scale; BSSI, Beck Scale for Suicide Ideation; CCAPS-34, Counseling Center Assessment of Psychological Symptoms - 34; CDRS, Connor-Davidson Resilience Scale; CSQ, Patient Satisfaction Questionnaire; CSSRS, Columbia Suicide Severity Rating Scale; ED, emergency department; HDRS-17, Hamilton Depression Rating Scale - 17; NSSI, non-suicidal self-injury; OHS, The Optimism and Hope Scale; OQ45, Outcome Questionnaire 45.2; PHQ9, Patient Health Questionnaire - 9; RFL, Reasons for Living Scale; RSES, Rosenberg Self-Esteem Scale; SASI-C, Suicide Attempt Self-Injury Count; SF36, Short Form 36 Health Survey; SSI, Scale for Suicidal Ideation; WHO-5, World Health Organization – 5 Well-being Index; WHO-DAS, World Health Organization Disability Assessment Schedule.

difference in outcomes between the CAMS and comparison interventions. Across all outcome categories, a positive *d* value represents an effect that favors the CAMS condition, while a negative value represents an effect that favors the comparison treatment. Several studies reported more than one measurement of the various outcomes (i.e., multiple instruments and multiple post-intervention time points). In these cases, an effect size *d* was calculated for each outcome reported; however, a pooled *d* for the study outcome category was used for the calculation of the weighted total effect. In these calculations, a fixed effect model was used for pooling the findings within a study, while a random effects model was used to calculate the weighted average effect sizes. A random effects model was chosen given that the studies were predicted to vary in their designs and findings. Heterogeneity for the weighted average effect sizes was examined through the use of the I^2 statistic, which represents the percent of variance in effect sizes between studies. The one-study-removed method was used to examine the influence of individual studies on the total findings and a fail-safe *N* was calculated as a test of the robustness of the results against missing data. Last, moderators of the primary outcome (suicidal ideation) were tested using a mixed effects model, which allows studies to vary within groups. Categorical moderators (study design, type of comparison treatment, treatment mode, treatment setting, active duty military/veteran sample, and CAMS originator as co-author) were tested with a *Q* statistic, which represents the variability in effect sizes between the categorical groups compared to the variability in effect sizes within the groups. Continuous moderators (study quality, follow-up time point, number of CAMS sessions, participant age, % female, and % non-Hispanic White) were also tested with a *Q* statistic; however, for continuous moderators the *Q* statistic represents the variability in effect sizes explained by the continuous variable. All calculations were completed using Comprehensive Meta-Analysis (Borenstein et al., 2005).

RESULTS

The nine included studies comprised data from 749 patients. These studies were primarily randomized controlled trials ($k = 7$), with a relatively high study quality rating ($M = 5.56$, $SD = 1.01$, *range* = 4 to 7). The majority of the CAMS interventions were offered in an individual, in-person format ($k = 7$) in an outpatient setting ($k = 6$). In all but one study with DBT, the comparison group was treatment as usual, which were a mix of other active interventions that were used by providers at the clinical research sites. No inactive/waitlist controls were included. Averaging across studies, the mean age of participating patients was 32.76, $SD = 7.71$, years old; just over half were female ($M = 50.16\%$, $SD = 22.51\%$; male, 49.62%, $SD = 22.68\%$; non-binary, 0.33%, $SD = 0.70\%$); and 71.77% ($SD = 17.13\%$) were non-Hispanic White (non-Hispanic Black, 11.63%, $SD = 9.67\%$; Hispanic, 4.26%, $SD = 2.15\%$; Asian, 5.80%, $SD = 6.23\%$; American Indian, 0.37%, $SD = 0.75\%$; multi-racial, 8.58%, $SD = 10.75\%$). One-third of the included studies ($k = 3$) were conducted with active duty military/veteran samples.

Suicidal ideation

All but one study (Dimeff et al., 2021) included outcome data on suicidal ideation. See Figure 2 for a forest plot diagram of the results. While one study (Johnson et al., 2019) found a small non-significant effect size in favor of the alternative intervention, the remaining studies all found positive effect sizes (four non-significant, three significant) in favor of the CAMS intervention. The overall weighted effect size of the CAMS intervention on suicidal ideation compared to the alternative intervention conditions was significant, $d = 0.25$, 95% CI [0.07, 0.42], $p < 0.01$, favoring the CAMS intervention. One-study-removed analyses resulted in *d*s ranging from 0.20 to 0.32, indicating that the results were not highly influenced by any single study. Calculation of the fail-safe *N* indicated that 32 missing studies with non-significant results would be necessary to reduce the observed effect size to a non-significant level. Relatedly, a review of the funnel plot suggested little to no publication bias. Moderate heterogeneity in the effects were observed between studies, $Q(7) = 17.42$, $p = 0.02$, $I^2 = 59.82$.

Suicide attempts

Five studies included outcome data on suicide attempts. See Figure 2 for a forest plot diagram of the results. While three studies found non-significant effects in favor of the alternative interventions, two studies found non-significant effects in favor of the CAMS intervention. The overall weighted effect size was not significant, $d = 0.04$, 95% CI [−0.31, 0.38], $p = 0.83$. One-study-removed analyses resulted in *d*s ranging from −0.09 to 0.13. Low heterogeneity was observed, $Q(4) = 4.92$, $p = 0.30$, $I^2 = 18.69$.

Self-harm

Four studies provided post-intervention data on incidents of self-harm. See Figure 2 for a forest plot diagram of the results. While three of the studies specifically reported

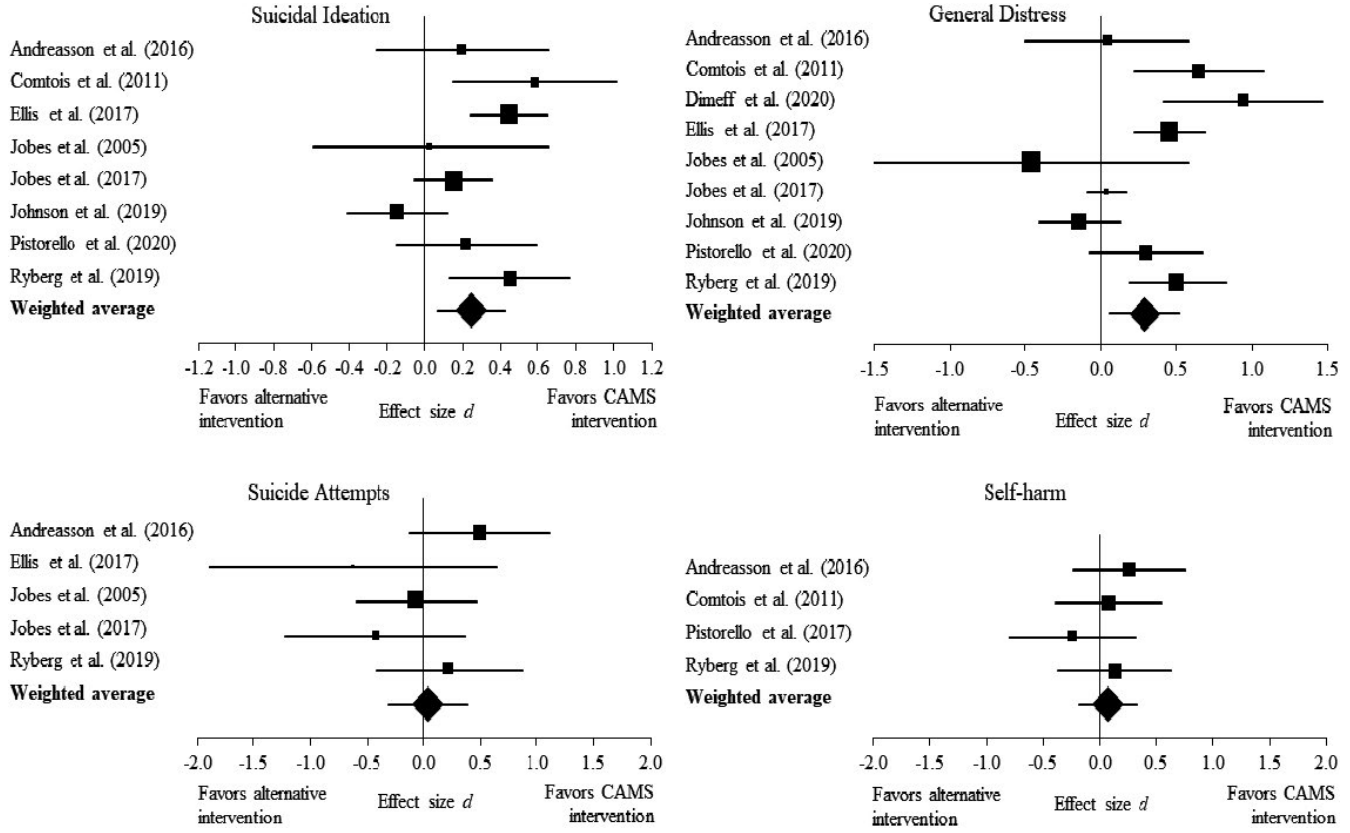

FIGURE 2 Forest plot of effect sizes for suicidal ideation, general distress, suicide attempts, and self-harm

self-harm data, Comtois et al. (2011) combined their self-harm data with suicide attempts data. To take a conservative approach, the results from Comtois et al. (2011) are included here rather than in the suicidal attempts analyses. One study found non-significant effects in favor of the alternative intervention and three studies found non-significant effects in favor of the CAMS intervention. The overall weighted effect size for self-harm was not significant, $d = 0.07$, 95% CI [−0.18, 0.32], $p = 0.57$. One-study-removed analyses resulted in *d*s ranging from 0.01 to 0.16. Very low heterogeneity was observed, $Q(3) = 1.84$, $p = 0.61$, $I^2 = 0.00$.

Distress

All of the included studies reported post-intervention data on at least one measure of general distress. See Figure 2 for a forest plot diagram of the results. Two studies found non-significant effects in favor of the alternative interventions and seven found effects (three non-significant, four significant) in favor of the CAMS intervention. The overall weighted effect size for general levels of distress was significant, $d = 0.29$, 95% CI [0.06, 0.52], $p = 0.01$, in favor of the CAMS intervention. One-study-removed analyses resulted in *d*s ranging from 0.22 to 0.36. Forty missing studies with non-significant results would be needed to reduce the observed effect size to a non-significant level. The funnel plot suggested little to no publication bias. Substantial heterogeneity was observed, $Q(8) = 34.42$, $p < 0.001$, $I^2 = 76.76$.

Hope/hopelessness

Four of the studies reported post-intervention data on a measure of hope or hopelessness. See Figure 3 for a forest plot diagram of the results. All four found effects (one non-significant, three significant) in favor of the CAMS intervention. The overall weighted effect size was significant, $d = 0.88$, 95% CI [0.26, 1.49], $p < 0.01$, in favor of the CAMS intervention. One-study-removed analyses resulted in *d*s ranging from 0.62 to 1.11. Fifty-two missing studies with non-significant results would be needed to reduce the observed effect size to a non-significant level. The funnel plot suggested little to no publication bias. Substantial heterogeneity was observed, $Q(3) = 18.88$, $p < 0.001$, $I^2 = 84.11$.

Other suicide-related correlates

Four studies also reported post-intervention data on a measure of another suicide-related correlate (e.g., self-esteem, resilience). See Figure 3 for a forest plot diagram of the

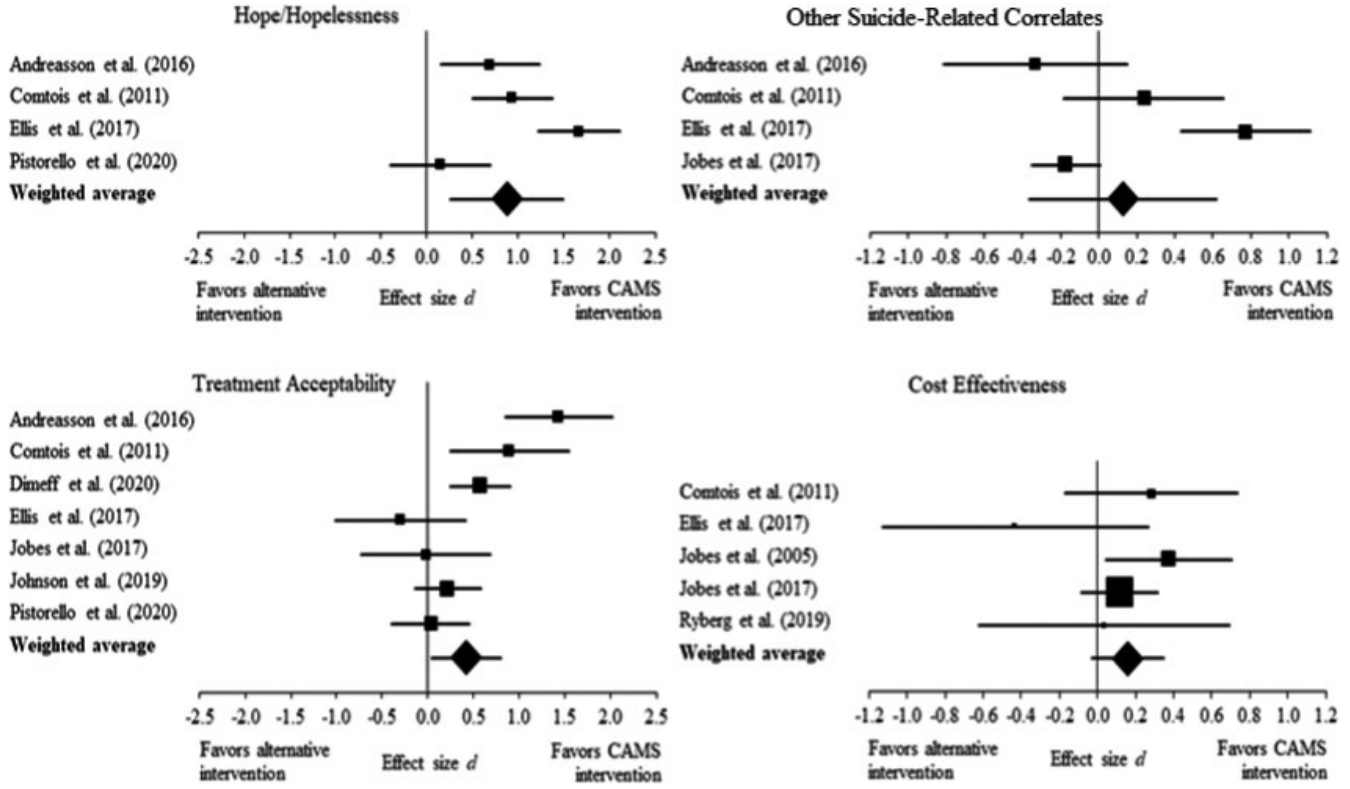

FIGURE 3 Forest plot of effect sizes for hope/hopelessness, other suicide-related correlates, treatment acceptability, and cost effectiveness

results. While two found non-significant effects in favor of the alternative intervention, two found effects (one non-significant, one significant) in favor of the CAMS intervention. The overall weighted effect size was not significant, $d = 0.13$, 95% CI [−0.36, 0.62], $p = 0.60$. One-study-removed analyses resulted in *d*s ranging from −0.10 to 0.27. Substantial heterogeneity was observed, $Q(3) = 26.09$, $p < 0.001$, $I^2 = 88.50$.

Treatment acceptability

Seven studies reported data on treatment acceptability (dropout and/or satisfaction). See Figure 3 for a forest plot diagram of the results. While two found non-significant effects in favor of the alternative intervention, five found effects (two non-significant, three significant) in favor of the CAMS intervention. The overall weighted effect size for treatment acceptability was significant, $d = 0.42$, 95% CI [0.04, 0.80], $p = 0.03$, in favor of the CAMS intervention. One-study-removed analyses resulted in *d*s ranging from 0.27 to 0.51. Twenty-eight missing studies with non-significant results would be needed to reduce the observed effect size to a non-significant level. The funnel plot suggested little to no publication bias. Substantial heterogeneity was observed, $Q(6) = 24.20$, $p < 0.001$, $I^2 = 75.21$.

Cost effectiveness

Five studies reported data on the cost effectiveness of the interventions. See Figure 3 for a forest plot diagram of the results. Only one found non-significant effects in favor of the alternative intervention, while four found effects (three non-significant, one significant) in favor of the CAMS intervention. The overall weighted effect size for cost effectiveness was not significant, $d = 0.16$, 95% CI [−0.03, 0.35], $p = 0.60$. One-study-removed analyses resulted in *d*s ranging from 0.10 to 0.19. Low heterogeneity was observed between the study effect sizes, $Q(4) = 4.96$, $p = 0.29$, $I^2 = 19.36$.

Moderators of the effect on suicidal ideation

Given that the Dimeff et al. (2021) article did not include suicidal ideation data, it was not included in any of the moderator analyses. Four study variables (efficacy vs. effectiveness, study quality, CAMS originator as co-investigator, and outcome time point) were tested as moderators of the outcome effect on suicidal ideation (the primary outcome of this meta-analysis) between CAMS and the alternative interventions. While the majority of studies were deemed efficacy trials, two were coded as effectiveness studies. No significant difference in the effect sizes was observed between these two types of designs, $Q(1) = 0.43$, $p = 0.51$. The magnitude of

the effect sizes also did not differ significantly based on the rating of study quality, *slope* = −0.10, $Q(1) = 3.11$, $p = 0.08$. Although studies ($k = 5$) that included the CAMS originator as a co-investigator showed a smaller effect size ($d = 0.15$, 95% CI [−0.08, 0.37], $p = 0.20$) than studies ($k = 3$) that did not include the CAMS originator as a co-investigator ($d = 0.42$, 95% CI [0.26, 0.58], $p < 0.001$), this difference only trended toward significance, $Q(1) = 3.71$, $p = 0.054$. The eight included studies reported suicidal ideation outcomes at several different time points. These time points were collapsed for the calculation of the overall weighted effect; however, we were also interested in testing if the differences between CAMS and the alternative interventions remained stable over time. Across the studies, 21 different effects were observed, ranging from immediately post-intervention to 12 months follow-up. The timing of the outcome measurement was not a significant moderator of the magnitude of the observed effect, *slope* = 0.00, $Q(1) = 0.02$, $p = 0.88$.

Four treatment variables (comparison group, treatment mode, setting, and number of sessions) were also tested as potential moderators. The effect size in the study that used DBT as the comparison group did not differ significantly from the effect sizes observed in the other studies that used TAU comparison groups, $Q(1) = 0.05$, $p = 0.83$. A significant difference was observed based on treatment mode, $Q(1) = 9.34$, $p < 0.01$. While the single study that tested CAMS in a group format found that it did not perform as well as the alternative intervention ($d = -0.15$, 95% CI [−0.41, 0.12], $p = 0.28$), the studies ($k = 7$) that tested CAMS in an individual format showed that it significantly outperformed the alternative interventions ($d = 0.32$, 95% CI [0.18, 0.45], $p < 0.001$). No significant differences in the effect sizes were observed between the studies conducted in outpatient ($k = 6$), inpatient ($k = 1$), and multiple ($k = 1$) settings, $Q(2) = 5.26$, $p = 0.07$. The number of CAMS sessions administered was a significant moderator of the observed effect sizes, *slope* = 0.04, $Q(1) = 8.07$, $p < 0.01$. Specifically, as the number of CAMS sessions increased, the effect size difference between CAMS and the alternative intervention on suicidal ideation also increased.

Last, four participant moderators (sample type, average participant age, percent non-Hispanic White, and percent female) were tested. A significant difference was observed based on whether or not the study was conducted with an active duty military/veteran sample, $Q(1) = 8.64$, $p < 0.01$. The studies ($k = 3$) conducted with active duty military/veteran samples showed significantly smaller effect sizes ($d = 0.03$, 95% CI [−0.19, 0.24], $p = 0.82$) than the studies ($k = 5$) conducted with non-active duty military/veteran samples ($d = 0.41$, 95% CI [0.27, 0.55], $p < 0.001$). Participant age, *slope* = −0.01, $Q(1) = 2.19$, $p = 0.14$, and ethnicity, *slope* = 0.01, $Q(1) = 3.01$, $p = 0.08$ were not found to significantly moderate the overall effect; however, the percent of the sample that identified as female was found to be a significant moderator, *slope* = 0.01, $Q(1) = 10.87$, $p < 0.001$. Specifically, as the percent of the sample that was female increased, so did the outcome difference between CAMS and the alternative interventions.

DISCUSSION

The results of this meta-analysis support the use of CAMS as an intervention for suicidal ideation and several other related variables. The CAMS intervention significantly outperformed comparison interventions in reducing suicidal ideation (small effect) and general levels of distress (small effect). The CAMS intervention also resulted in significantly greater levels of hope/lower levels of hopelessness (large effect) compared to the alternative treatments. Further, fewer patients dropped out of CAMS and a higher level of treatment satisfaction was reported by the participants who received the CAMS intervention (small effect). The significant findings seem to be robust to potential missing articles and do not seem to be unduly influenced by results from a single study. These findings contrast with those of a previous review (Hanratty et al., 2019) in which the authors concluded that evidence regarding CAMS efficacy was insufficient. However, the current meta-analysis, when compared to Hanratty et al., and's (2019), included several more recently published trials and provided a quantitative synthesis of the data, rather than a narrative one. The results favoring CAMS over alternative interventions for these outcome variables are also impressive given that Fox and colleagues (2020) in their meta-analysis did not find outcome differences between the main intervention categories that they investigated.

It has been argued elsewhere (Jobes & Chalker, 2019; Jobes & Joiner, 2019) that there is virtue in targeting suicidal ideation as a *goal* of clinical care with suicidal patients. As noted by Jobes and Joiner (2019) the population of individuals with suicidal ideation is 225 times greater than the suicide completion population. They argue that effectively targeting and treating suicidal ideation "upstream" may well avert suicide attempts and deaths "downstream." Further, Jobes and Chalker (2019) argue against a "one-size fits all" approach to treating suicidal risk, instead advocating for matching different evidence-based treatments for different suicidal states (e.g., CAMS for those with suicidal ideation and DBT for patients with multiple attempts and chronic suicidal risk). Thus, the results of this meta-analysis indicate that CAMS is one of a number of effective treatments that clinicians may employ based on patients' needs. In particular, CAMS may be more effective in treating suicidal ideation than other interventions because it specifically targets the drivers of patients' suicidal ideation. Other interventions often focus on behaviors designed to decrease distress while contemplating

suicide or alternative actions that can be taken. In contrast, CAMS focuses on specific goals and the cognitive aspects of suicidal ideation itself.

In contrast to the significant findings, no significant differences between the CAMS intervention and the alternative interventions were observed for suicide attempts, self-harm, other suicide-related correlates (e.g., well-being, resilience), or for cost effectiveness. Although no significant differences between the interventions were found in these three areas, the CAMS intervention was still effective in reducing suicide attempts, self-harm, and other suicide-related correlates. The non-significant results simply indicate that both types of interventions (CAMS and the alternatives) were similarly effective in treating these outcomes. Jobes et al. (2017) suggested that possible between-group effects may be lost due to the "enhanced" TAU being used as the control conditions, which may not represent care as usual in naturalistic settings. This results in a high comparison standard for the CAMS intervention in the included studies.

The findings from the moderator analyses suggested that CAMS resulted in greater reductions of suicidal ideation compared to the alternative interventions at a similar magnitude regardless of the type of study, the quality of the study, whether the CAMS originator was a co-author, the timing of outcome measurement, the type of comparison condition, the type of setting, and the age and ethnicity of the participants. Several of these non-significant findings are notable. Frequently, treatments that perform well in well-controlled research settings do not demonstrate the same effects in naturalistic settings (Hansen et al., 2002; Lambert, 2013); however, the similar effects that were observed between efficacy and effectiveness designs offer preliminary evidence that CAMS may be well-suited to applied settings. Although the CAMS originator was a co-investigator on the majority of the studies that were included in this meta-analysis, the studies that did not include him as a co-investigator actually showed the largest effects favoring the CAMS intervention. This finding suggests relatively little to no allegiance bias in the overall findings in support of CAMS as a treatment for suicidal ideation. Further, the fact that time of outcome assessment was not a significant moderator offers preliminary evidence that the benefits of CAMS over the alternative interventions remained stable over time.

Based on the moderator analyses, there is initial evidence that CAMS may better treat suicidal ideation compared to alternative interventions in some situations. First, CAMS appears to be more even more effective in an individual format compared to a group format. However, this should be interpreted with caution since only one study in this meta-analysis tested CAMS in group format (Johnson et al., 2019). Second, the outcome differences tend to be larger with a greater number of CAMS sessions. This finding should be considered in the context of the time-limited nature of the included studies (i.e., maximum mean treatment length of approximately 16 sessions). The benefits of continuing CAMS beyond this remain unknown. Third, the difference between CAMS and the alternative interventions was also larger with non-active duty military/veteran samples. Since the studies with active duty military samples all included the CAMS originator (Jobes et al., 2005, 2017) or were a group application of CAMS (Johnson et al., 2019), though, it is unclear whether this is an artifact of the previously noted moderating effects of these variables (CAMS originator and group vs. individual format). Last, the results of the moderator analyses suggest that CAMS might be slightly more effective with female patients than patients of other genders. However, the gender analyses were based on the overall make-up of the sample (% that were female) and no direct comparisons among genders were made. In sum, CAMS may be most effective when conducted in individual format and a moderate length of treatment is allowed; further research is needed to clarify moderating effects of military status and gender.

Limitations

Although the findings from this meta-analysis do support the CAMS intervention, there are a number of limitations that should be considered. First, although there was adequate power to calculate the overall weighted effect sizes, insufficient power due to the relatively small number of included studies may have contributed to non-significant findings in the moderator analyses. Related, variability in the outcomes that studies have employed further limited the available sample size for calculating effect sizes for less common outcomes and moderator analyses. For example, the weighted effect size for self-harm, hope, and other suicide-related correlates are based on data from only four studies and the suicide attempts and cost effectiveness results are based on data from only five studies. Thus, the generalizability of the findings may be limited in these cases. Future research investigating CAMS as an intervention should measure effects in these areas. Also, it is important to recognize that several of the tested moderators likely overlap, which may influence some of the results. For example, whether the sample was composed of active duty military service members/veterans and the percent of the sample that was female were both significant moderators in the present study. It may be that one of these findings could explain the significance of the other (e.g., studies using active duty military/veteran samples tend to use fewer female participants), rather than both of them being true, independent moderators. Related, the findings from the moderator analyses should be considered preliminary evidence only. When considering the characteristics of the studies, there was relatively little heterogeneity in some areas. For example, only one study that used DBT as a comparison

group was compared to the remaining ones that used TAU. Similarly, only two studies were identified as effectiveness studies, while the remaining ones were efficacy trials. As additional research is conducted, future reviews can examine whether the findings from the moderator analyses remain consistent. Although little heterogeneity was seen in some of the moderators, a larger amount of heterogeneity was seen in the measurement of the various outcomes (e.g., timing of outcome measurement, variance in the operationalization, or measures used for some of the outcomes). Heterogeneity here weakens assumptions related to combining effect sizes across studies, and we suggest future studies use consistent methods for assessing these outcomes. Further, the active comparison groups evaluated in the present meta-analysis primarily consisted of TAU. While those groups included active treatment components, there were between-study differences in the components of TAU. These differences make it difficult to determine which treatment components (e.g., safety measures, cognitive restructuring, emotion regulation) were leveraged in the TAU groups and how the effectiveness of those components compare to CAMS. It is also important to note the number of comparisons that were made in this meta-analysis, both for the number of different outcomes that were assessed as well as the number of moderators that were tested. Given the small number of included studies, we believed that the use of a corrected-alpha would create an overly stringent criterion. Thus, it is possible that some of the significant differences represent chance findings and should be interpreted with caution. Last, it is possible that the search strategies did not identify all articles that would have met study inclusion criteria for the present meta-analysis. However, based on the strategies that were used, we believe that the results accurately represent findings from studies that would have been missed. Further, calculation of the fail-safe *N* for each of the significant findings suggests that a relatively large number of missing studies would be needed to nullify the results.

FUTURE DIRECTIONS

Additional studies investigating the effectiveness of CAMS are needed. Given the limitations associated with using TAU as a comparison group, researchers may consider using alternative active control groups (e.g., DBT, brief cognitive-behavioral therapy) in future studies. Further, evaluating CAMS in more diverse samples is needed, as the effectiveness of CAMS in certain populations that may be at elevated suicide risk remains unknown (e.g., older adults, individuals with diverse gender identities, and those of racial/ethnic minorities). In addition, future studies should seek to include relatively larger sample sizes. Such sample sizes are, for example, necessary to have sufficient statistical power to better understand the effects of CAMS on low base-rate outcomes like suicide attempts and to detect significant moderators of intervention effectiveness. Relatedly, recent research identifying significant moderators of CAMS effectiveness (e.g., marital status and baseline distress; Huh et al., 2018) that may be used to *predict* treatment response to CAMS (e.g., Kessler et al., 2020) underscores the need to further identify when, with whom, and under what conditions CAMS is most effective. Studies may also explore whether utilizing methods that leverage such moderators (e.g., Kessler et al., 2020) to determine optimal approaches for individual patients (e.g., CAMS versus an alternative intervention like DBT) improve treatment outcomes for those who are matched to their optimal approach. Researchers should also seek to incorporate repeated assessments of potential mechanisms of change (e.g., therapeutic alliance, increasing hope) in future studies, given that it is unclear the degree to which CAMS components individually contribute to enhanced treatment outcomes, which is also a concern with research on other suicide interventions (Fox et al., 2020); dismantling studies may also help clarify which components of CAMS are most effective in producing change. Last, compared to research evaluating individual formats of CAMS, less is known about the effectiveness of group (Johnson et al., 2019) and computerized (Dimeff et al., 2021) formats. Evaluating such alternative modalities that may optimize cost effectiveness could facilitate implementation and dissemination efforts while enhancing clinical outcomes.

CONCLUSION

In conclusion, the results of this meta-analysis provide strong evidence for CAMS as an intervention for suicidal ideation. The results suggest that not only does CAMS outperform alternative active interventions in treating suicidal ideation, but it can also result in greater improvements in general levels of distress and hopelessness/hope. Further, the results suggest that patients who receive CAMS are less likely to drop out of treatment prematurely and report greater levels of satisfaction compared to alternative treatment options. These findings seem to be stable across time, settings, patient age, and patient ethnicity.

The significant findings in support of CAMS are particularly notable given the nature of the comparison conditions. Although typically labeled as TAU interventions, the comparison conditions were made up of active, established treatments delivered by on-site licensed professionals. No inactive or waitlist control conditions were included. Thus, findings of equivalence for suicide attempts, self-harm, other suicide-related correlates, and cost effectiveness between CAMS and the comparison conditions still support the use of CAMS as an evidence-based intervention. Further, given that CAMS

outperformed the alternative interventions on several of the included outcomes (suicide ideation, general distress, hope/hopelessness, and treatment acceptability) provides strong empirical support for CAMS. Based on the findings from this meta-analysis, CAMS meets Center for Disease Control and Prevention's Continuum of Evidence of Effectiveness criteria (Puddy & Wilkins, 2011) for being a *Well Supported* intervention for suicide ideation.

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