

## SPECIAL ARTICLE

# Fluid vulnerability theory as a framework for understanding the association between posttraumatic stress disorder and suicide: A narrative review

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## Abstract

Suicide is a persistent issue in the United States and across the globe. A large body of published research shows that posttraumatic stress disorder (PTSD) increases the risk of suicidal ideation, suicidal behaviors, and death by suicide. However, the existing literature examining why that association might pertain is widely dispersed across disciplines (e.g., psychology, nursing) and lacks an integrative theoretical framework, making it difficult to conceptualize the current state of science in this area. Therefore, the primary aims of this narrative review were to (a) provide a comprehensive and interdisciplinary critique of the current state of knowledge regarding mechanisms that underlie the association between PTSD and suicide and (b) organize that knowledge according to a specified theoretical framework. The framework guiding this review is “fluid vulnerability theory,” a diathesis–stress model of suicide that emphasizes the dynamic nature of suicide risk across cognitive, emotional, behavioral, and physiological domains. A summary of the findings, including patterns that emerged, gaps that remain, and recommendations for the advancement of science and practice in this area are addressed in this narrative review.

Suicide has become an increasingly urgent public health crisis in the United States and across the globe (World Health Organization, 2018). In the United States, suicide is currently the 10th leading cause of death, with an estimated 1,380,000 suicide attempts and 47,511 suicide deaths reported in 2019 alone (Centers for Disease Control and Prevention, 2021). These rates have increased nearly every year for more than a decade (American Foundation for Suicide Prevention, 2021) despite the implementation of suicide prevention initiatives (Bagley et al., 2010; Bryan et al., 2012). Suicide rates also have risen among subpopulations that historically have had very low suicide rates, such as United States military personnel (Kuehn, 2009; Pruitt et al., 2019).

One factor that places individuals at higher risk for suicide is posttraumatic stress disorder (PTSD; Nock et al.,

2014; Tarrrier & Gregg, 2004). The lifetime prevalence rate of PTSD among the general adult population in the United States is 6.8% (Kessler et al., 2005), which compares to estimated prevalence rates as high as 30.9% among Vietnam War veterans (Kulka et al., 1990), 10.1% among Gulf War veterans (Kang et al., 2003), and 13.8% among veterans of the recent conflicts in Iraq and Afghanistan (Gradus, 2019; Tanelian & Jaycox, 2008). Research demonstrates strong associations between PTSD and suicidal thoughts (Boffa et al., 2017; Legarreta et al., 2015; Wisco et al., 2014), suicidal behaviors (Dube et al., 2001; Hendin & Haas, 1991), and death by suicide (Conner et al., 2014; Gradus, 2018; Hyman et al., 2012). However, the underlying reasons for this association are less clear (Rugo et al., 2020). Although comorbid depression and dysphoric symptoms of PTSD play a significant role in exacerbating suicide risk

(Livingston et al., 2020), some studies report an increased suicide risk even in the absence of depression (Ramsawh et al., 2014; Rojas et al., 2014). Therefore, in addition to comorbid depression, it is likely that other factors increase suicide risk among individuals with PTSD.

## Aims of the present review

Despite the large number of articles published on the PTSD–suicide association, two important gaps warrant attention. First, existing knowledge is widely dispersed across databases and disciplines (e.g., behavioral sciences, nursing, medicine) making it difficult to assess the state of the science. A few reviews have been published on the intersection of PTSD and suicide, but two of these reviews are more than a decade old and in need of updating (Krysinska & Lester, 2010; Panagioti et al., 2009), especially given the sharp increase in publications on this topic beginning around 2011 (see Supplementary Figure S1). Pompili and colleagues (2013) also published a review, which focused specifically on war-related PTSD and its effect on suicidal behavior among veterans only. To our knowledge, the most recent review published on this topic was a systematic review of literature published between 2010–2018 (Holliday et al., 2020). This review highlights literature regarding the prevalence of and correlations between PTSD and suicide, but the authors ultimately concluded that the associations between PTSD and suicide are complex and warrant further research on the moderators and mediators of this association. As such, the present narrative review is intended to provide a broad and flexible examination of the literature to summarize current knowledge about the mechanisms that underlie the connection between PTSD and suicide. It is our hope that such knowledge will lay the foundation for additional systematic reviews in the future.

The second gap that limits the field's understanding of the PTSD–suicide association is that most studies published on this topic lack a theoretical framework to conceptualize the reported findings. Without such a foundation, study findings lack explanatory power and are limited in their ability to extend theoretical knowledge (Labaree, 2019). Combined, these limitations present considerable barriers to the integration and practical application of scientific knowledge regarding suicidal individuals with PTSD. Thus, this narrative review had two aims: (a) to provide a comprehensive and interdisciplinary critique of the current state of knowledge regarding mechanisms that underlie the PTSD–suicide association and (b) to organize that knowledge according to a specified theoretical framework, namely “fluid vulnerability theory” (FVT; Rudd, 2006).

## FVT

FVT is a diathesis-stress model that emphasizes suicide risk as an individualized and dynamic process (Rudd, 2006). In the FVT, risk is classified across two broad dimensions: baseline and acute. Baseline risk is composed of predisposing factors that are stable, constant, and differ among individuals, such as prior suicide attempts, abuse history, impulsivity, and genetic vulnerabilities. Acute risk is used to describe the activation of the “suicidal mode,” an active suicidal episode that is triggered by an environmental stressor. Baseline and acute risk interact such that for someone with more underlying vulnerabilities (i.e., a higher baseline risk), the suicidal mode may be activated more readily than for someone with fewer underlying vulnerabilities (Wolfe-Clark & Bryan, 2017). According to FVT, an environmental stressor (i.e., job loss, relationship problems, financial distress), in the context of certain predispositions, can trigger the activation of a suicidal episode for an individual. Once the suicidal mode is activated, individuals have various combinations of risk and protective factors, which FVT classifies across four domains: cognition, emotion, behavior, and physiology (see Supplementary Figure S2; Rudd, 2000). These domains are mutually interactive and work in tandem to maintain and mitigate risk at any given time. Importantly, the FVT highlights dynamic interactions at several levels: between the individual and their history with the environment (i.e., predisposing factors that comprise baseline risk), between the individual and their current environment (i.e., environmental triggers that can activate suicidal episodes), and among the four domains of the suicidal mode (i.e., thoughts influence emotions, emotions influence behavior; Bryan & Rudd, 2006). Thus, the suicidal mode in FVT provides a useful model for organizing suicidal risk factors for individuals with PTSD given that both constructs (i.e., suicide and PTSD) involve complex components that cut across cognition, behavior, emotion, and physiology.

We chose FVT as the theoretical framework for the present review given its strong empirical basis of support and the facility with which it can be applied to a broad literature. FVT is also compatible with other contemporary theories of suicide, which can be viewed as complementary to or subsumed within FVT's broader conceptualization of suicide risk processes. For example, most theories of suicide identify specific cognitions as key catalysts in suicide risk, such as perceived burdensomeness and thwarted belongingness in the interpersonal-psychological theory of suicidal behavior (IPTS; Joiner, 2005) and defeat/humiliation and entrapment in the integrated motivational–volitional model (IMV; O'Connor &

Kirtley, 2018). The FVT's suicidal mode is congruent with these ideas but classifies those cognitions within the overarching cognitive domain of the suicidal mode. Further, FVT organizes these suicide-related cognitions under the broad umbrella of the "suicidal beliefs system," which includes burdensomeness, belongingness, defeat, humiliation, and entrapment.

The generalist nature of FVT and its suicidal mode also serves as a strength of the model. Despite over 50 years of research on suicide to date, the field is no better at predicting suicide than it was half a century ago (Franklin et al., 2017). This slow progress is due in part to the low base rate and difficulties inherent in studying suicide but also can be attributed to the fact that the combinations of predispositions, environmental triggers, and risk factors that best predict suicide are not yet known. The idea that the precise factors that best predict suicide are, as yet, unknown is a challenge for most models of suicide, including the IPTS and IMV models, which do not clearly articulate why suicide risk might *not* develop even when the necessary conditions are present or why suicide risk sometimes *does* develop even in the absence of those necessary conditions. Therefore, the broad approach the FVT brings to identifying risk and protective factors across domains, without singling out one particular factor as a necessary condition, allows the model to accommodate a wide range of pathways by which individuals arrive at suicide (Clapperton et al., 2019). This flexibility also allows the FVT to capture nonlinear trajectories of suicide risk (Bryan et al., 2019) in comparison to the more linear ideation-to-action progression represented in competing models (i.e., IMV's premotivational, motivational, and volitional phases). Whereas the FVT does indeed have limitations, as discussed later in the review, it is arguably the model best equipped to explain dynamic suicide risk processes (Klonsky et al., 2018).

## METHOD

### Defining suicide risk

One known limitation in suicide research is the inconsistent nomenclature utilized. For this review, we use the phrase "broad suicide risk" to refer to outcomes that combine suicidal thoughts and behaviors into one measure. If an outcome was identified as strictly suicidal thoughts, we refer to it as suicidal ideation (SI). If the outcome was behavioral in nature, we refer to it as suicidal behavior (SB), which includes preparatory behaviors, deliberate self-harm, and aborted attempts. If the outcome was suicide attempt (SA), it was identified as such. Finally, we demarcated the studies that included the outcome of death by suicide.

### Search strategy

A broad spectrum of online databases was searched systematically to obtain a diverse and comprehensive collection of published literature on the association between PTSD and suicide. Databases included in the electronic search were PsycINFO, CINAHL, MEDLINE, EconLit, ERIC, ProQuest Dissertations and Theses, and Google Scholar. Gray literature was surveyed within PsycINFO and Proquest. Further, reference lists of all included studies were searched manually to identify additional articles appropriate for review. Search terms included "posttraumatic stress disorder", "PTSD," and "suicide,\*" which was truncated to capture all variations of the word (i.e., suicide, suicidal, suicidality). We included all articles published through January 1, 2020.

### Inclusion and exclusion criteria

To be included, articles must have studied PTSD and either SI, SA, or death by suicide. Additionally, articles must have included at least one other variable thought to play a role in accounting for the PTSD–suicide connection within FVT. We allowed for a broad range of research questions and statistical approaches in our inclusion criteria (e.g., mediation, moderation, structural equation modeling) to capture the most comprehensive picture of the current literature; articles were included as long as the article examined putative underlying mechanisms of the PTSD–suicide relation. Eligible articles used empirically validated measures to evaluate PTSD, suicide-related constructs, and any mediating variables of interest. Exclusion criteria included review papers, editorials, case studies, articles published in a language other than English, qualitative designs, and pediatric samples. Studies that used samples of trauma-exposed participants without PTSD also were excluded given the important conceptual differences between individuals who experience trauma and do or do not develop PTSD (LeBouthillier et al., 2015; Wilcox et al., 2009).

### Study selection

We employed two rounds of screening for the present review. In the first round, article titles and abstracts were screened for all database search results ( $N = 1,691$ ). After this initial screening, 97 articles underwent a second round of examination to confirm the inclusion criteria. Nine additional articles were identified from reference lists of screened articles, for a total of 106 articles that underwent

full text review. In total, 82 articles met the inclusion criteria for the review (see Supplementary Figure S3 for a flow diagram at each stage of screening).

## RESULTS

All included articles ( $N = 82$ ) were categorized according to the FVT suicidal mode domain that best fit the underlying mechanism (i.e., cognition, emotion, behavior, or physiology), noting that in some cases, constructs fell into more than one domain. Supplementary Table 1 displays the underlying mechanisms that were reviewed mapped out across the domains of the suicidal mode. In the summary that follows, each domain of the suicidal mode is reviewed sequentially, with underlying mechanisms for each domain separated according to SI and SB. Among the 82 articles that met the inclusion criteria for the present review, none addressed underlying mechanisms of the association between PTSD and death by suicide, a notable limitation of the current literature that is further discussed later in the review.

### Cognitive domain

The cognitive domain of the suicidal mode comprises FVT's suicidal beliefs system, which includes suicide-related cognitive distortions found in many contemporary theories of suicide (e.g., burdensomeness, hopelessness, defeat, entrapment, belongingness). The cognitive domain also includes additional themes and processes, such as problem-solving style, cognitive flexibility, and cognitive appraisals (Rudd, 2006; see Supplementary Figure S2 for additional examples).

#### SI

We located 24 articles that reported on cognitive influences on SI among individuals with PTSD. The most common cognitive factor reported in the literature can be broadly described as “negative cognitions.” Cunningham et al. (2019) found that shame fully accounted for the association between PTSD and SI among treatment-seeking veterans. In turn, Kachadourian et al. (2018) reported that covert hostility was also associated with SI among veterans with both PTSD and alcohol dependence. In contrast, Arenson et al. (2018) found that hostility and anxiety did not significantly account for the increased risk of thoughts of suicide among veterans with comorbid PTSD and major depressive disorder (MDD).

Another type of negative cognition that has been found to mediate the relation between PTSD and SI is trauma-related guilt (Cunningham et al., 2017). For example, Tripp and McDevitt-Murphy (2017) found that trauma-related guilt, specifically guilt cognitions, distress, and global guilt, mediated the relation between PTSD and SI among a sample of U.S. military veterans who served following the September 11, 2001, terrorist attacks. McLean et al. (2017) similarly found that PTSD symptom severity had an indirect effect on SI through trauma-related cognitions in a study of active duty service members with PTSD. This association, however, was only significant for SI and not SA. In turn, negative posttraumatic cognitions about the self were significantly associated with SI among a sample of veterans enrolled in an intensive outpatient treatment program for PTSD (Horwitz et al., 2018).

Additionally, another salient negative self-directed cognition, self-disgust, was identified as a mechanism underlying the PTSD–suicide link among undergraduate students (Brake et al., 2017). Panagioti et al. (2015) also reported that defeat and entrapment significantly predicted SI over time in a sample of adults with PTSD, even when controlling for baseline SI, depression, and hopelessness. In keeping with the IPTS (Joiner, 2005), Poindexter et al. (2015) found that perceived burdensomeness, but not thwarted belongingness, mediated the relation between PTSD and SI in a large sample of college students. Other negative cognitions were also found to be significantly associated with an increased risk of SI among a sample of veterans participating in a residential treatment program for PTSD, including cognitions specific to religion (i.e., believing one is being punished or abandoned by a higher power) and lack of forgiveness (Kopacz et al., 2016). Finally, Nye et al. (2009) examined attachment styles and found surprising results, namely that Vietnam-era veterans with PTSD who exhibited secure attachments reported the highest levels of SI, whereas those with insecure and disorganized attachments reported lower levels of SI.

Other researchers have looked at cognitions related to anxiety sensitivity. Boffa et al. (2018) found that cognitions related to the fear that anxiety-related symptoms would cause potentially negative or catastrophic consequences fully mediated the relation between PTSD and broad suicide risk among male firefighters. Findings from other studies also have demonstrated significant associations between anxiety-sensitivity cognitive concerns and SI among individuals with PTSD, including male veterans (Raines et al., 2017) and female firefighters (Stanley et al., 2017).

There is robust literature within the cognitive domain that focuses on protective factors against SI among individuals with PTSD. A common theme revolves around

meaning-making. For example, Florez et al. (2018) found that existential well-being (i.e., “the degree to which individuals perceive that their life has significance, purpose, and meaningful goals,” p.47) significantly mediated the association between PTSD and SI over a 10-week time period among African American survivors of SA. Meaning in life partially mediated the relation between PTSD and SI in a large sample of service members and veterans enrolled in college (Sinclair et al., 2016). Straus et al. (2019) also examined protective factors, including “resilience, purpose in life, dispositional optimism and gratitude, and community integration” (p. 6) and reported that these factors partially mediated the relation between PTSD and SI. The findings on optimism are mixed, however, given that Arenson et al. (2018) failed to find a significant relation between optimism and SI among a large sample of veterans with comorbid PTSD and MDD.

Self-efficacy also has been found to be a mediator in the association between PTSD and SI. For example, higher rates of self-efficacy were associated with lower rates of SI, but not SA, in a sample of homeless adults (Kim et al., 2019). In addition to self-efficacy, Mihaljević et al. (2011) reported that higher rates of spiritual well-being were significantly associated with lower cortisol levels, which, in turn, were significantly correlated with SI in a sample of Croatian war veterans with PTSD. However, other researchers have failed to find significant relations among religion or spirituality, PTSD, and broad suicide risk. Ferrada-Noli and Sundbom (1996), for example, reported that neither nationality nor religion played a significant role in the exacerbation of broad suicide risk among a sample of asylum-seeking refugees with PTSD.

Finally, it appears that the ability to evaluate and restructure one’s cognitive processes (i.e., cognitive flexibility) is an important protective factor against SI. Evidence can be found in Amir and colleagues’ (1999) examination of coping styles in PTSD patients such that higher levels of mapping (i.e., information gathering), minimization (i.e., minimizing the importance of the problem or distress), and replacement (i.e., brainstorming alternative solutions for problems) predicted reduced suicide risk; conversely, more cognitive suppression (i.e., avoidance) was associated with higher suicide risk. In a sample of survivors of the 2008 Wenchuan earthquake in China, posttraumatic growth (i.e., positive psychological change or “benefit finding” in response to adversity) was found to be negatively correlated with suicide risk outcomes (Guo et al., 2018). Stanley et al. (2019) examined two aspects of mindfulness (i.e., non-judging of inner experience and acting with awareness) and found that both facets reduced the magnitude of the association between PTSD and SI within a large sample of

firefighters—perhaps, as proposed by the authors, because of increased cognitive diffusion and restructuring abilities for individuals who score higher on measures of mindfulness.

## SB

We located five articles that studied cognitive influences on suicidal behaviors among individuals with PTSD. Kachadourian et al. (2019) examined the protective factors reviewed previously (i.e., optimism, life purpose, curiosity) in a sample of suicide attempters, but these factors were not related to SA in that sample. Martin et al. (2017) reported a similar difference between suicide ideators and suicide attempters wherein PTSD symptom severity and difficulties in emotion regulation were found to be significantly associated with SI, but not SA, in a sample of adult psychiatric inpatients. Combat-related guilt was found to be the most significant predictor of SA among a sample of Vietnam-era combat veterans with PTSD (Hendin & Haas, 1991). In addition to the SI findings highlighted previously, Straus et al. (2019) found that protective psychosocial characteristics (i.e., resilience, purpose in life, dispositional optimism and gratitude, and community integration) partially mediated the associations among PTSD, comorbid PTSD and alcohol use, and lifetime SA. Finally, congruent with their previously described findings on the relation between defeat and entrapment and SI, Panagioti and colleagues (2013) found defeat and entrapment also mediated the relation between PTSD and suicidal behaviors in two samples of adults with PTSD.

## Behavioral domain

The behavioral domain of the suicidal mode is perhaps the broadest of all domains and includes many variables that are behavioral in nature, such as self-soothing strategies, interpersonal interactions, engagement in activities, substance use, and self-harm (Rudd, 2006; see Supplementary Figure S2 for additional examples).

## SI

We located nine articles that reported on behavioral influences on SI among individuals with PTSD. The most frequently studied constructs in this domain were social support and social functioning. Dutton et al. (2016) found that social functioning, specifically interpersonal conflict,

family support, and interpersonal apprehension, mediated the relation between PTSD and SI in a large sample of adults in the United States. Similarly, in a sample of veterans of the recent conflicts in Iraq and Afghanistan returning from deployment, low levels of postdeployment social support were found to predict increased SI risk (DeBeer et al., 2014). Social connectedness was also found to partially mediate the relation between diagnostic status and SI for both PTSD-only and PTSD–alcohol use disorder groups in a large sample of U.S. veterans (Straus et al., 2019). However, those findings only held for the SI group and were nonsignificant for SA outcomes. Among survivors of the 2008 Wenchuan earthquake in China, social support was found to be significantly negatively correlated with broad suicide risk outcomes (Guo et al., 2018). Additionally, in a sample of participants recruited from a PTSD clinic in southern Israel, Kotler et al. (2001) found that social support was associated with lower suicide risk when social support levels were high. In contrast, we located one article that reported opposite findings to those reported in the previously discussed studies. Arenson et al. (2018) found that alcohol use and social support did not significantly account for the increased risk of thoughts of suicide among veterans.

Other behavioral influences identified in the literature include broad health-promoting behaviors (e.g., nutrition, stress management, physical activity), which have been found to reduce the association between PTSD and SI among Iraq and Afghanistan war veterans (DeBeer et al., 2016). Deliberate self-harm (e.g., burning and hitting oneself) was associated with increased SI in a sample of veterans with PTSD (Kimbrel et al., 2014). Kotler et al. (2001) reported that impulsivity was predictive of broad suicide risk in a sample of Israeli adults with PTSD. Involvement in organized religion also served as a protective factor and was associated with decreased SI among veterans in a residential PTSD program (Kopacz et al., 2016).

## SB

We located three articles that reported on behavioral influences on suicidal behavior among individuals with PTSD. Although Straus et al. (2019) found a significant relation between social connectedness and SI, as previously described, this association did not hold for SA. In contrast, Panagioti et al. (2014) found that social support significantly moderated the association between PTSD and SA such that individuals with higher levels of PTSD symptoms were less likely to endorse suicidal behaviors if they also reported high levels of perceived social support. Finally, although Dutton et al. (2016) found several significant social functioning pathways for SI, as previously described,

only the perceived family support subdomain was significant for SA.

## Emotional domain

The emotional domain of the suicidal mode includes the expression and regulation of all affective experiences, regardless of valence. This includes emotions that are approach-related, such as anger, as well as withdrawal-related, such as depression and guilt (Rudd, 2006; see Supplementary Figure S2 for additional examples).

## SI

We located eight articles that identified emotional influences on SI among individuals with PTSD. McKinney et al. (2017) found that internal hostility, defined as self-directed anger, was associated with an increased risk of SI among veterans, whereas external anger was not. Wilks et al. (2019) also reported that anger was positively associated with SI in another large sample of veterans and that the relation between PTSD and SI became nonsignificant when anger was entered into the model. However, findings on anger's role in the PTSD–suicide connection are mixed. Arenson et al. (2018) reported that anger and hostility did not significantly account for an increased risk of suicidal thoughts in their study of veterans with comorbid PTSD and MDD.

In addition to anger, Zeng and colleagues (2018) reported that emotion regulation self-efficacy, or the confidence one has in their ability to regulate and express emotions, was associated with suicide risk for participants with PTSD symptoms in a sample of Chinese graduate students. In another study of inpatient psychiatric patients, perceived difficulties in emotion regulation were found to be associated with SI outcomes (Martin et al., 2017). Others have implicated a similar construct—distress tolerance—in the PTSD–suicide association. Bartlett et al. (2018) examined distress tolerance and PTSD symptom severity among firefighters and reported that lower levels of distress tolerance and higher PTSD symptom severity both independently increased suicide risk; moreover, participants with both low levels of distress tolerance and high PTSD symptom severity had the most compounded suicide risk. Vujanovic et al. (2017) found similar results, with distress tolerance mediating the relation between PTSD and SI outcomes among psychiatric inpatient adults. Finally, Griffith (2012) reported that PTSD symptoms had an indirect effect on suicide risk via self-reported negative mood in a sample of U.S. Army National Guard soldiers.

## SB

We located one article that reported on emotional influences on SA among individuals with PTSD. Kušević et al. (2015) reported that alexithymia (i.e., an inability to describe or recognize emotions) predicted suicide attempts among Croatian war veterans with PTSD.

## Physiological domain

The physiological domain of the suicidal mode includes physical and somatic experiences, such as chronic pain, autonomic arousal, sleep disturbances, motor-sensory system activation, and other biological processes (Rudd, 2006; see Supplementary Figure S2 for additional examples).

## SI

We located eight studies that focused on the physiological influences of SI among individuals with PTSD. Davis et al. (2019) examined metabotropic glutamate receptor 5 (mGluR5) and found significantly higher availability of mGluR5 in five brain regions in individuals with PTSD and MDD compared with healthy controls. Further, there was an up-regulation of mGluR5 for individuals with both PTSD and SI, which was not observed for the PTSD-only cases, suggesting that mGluR5 might play an important role in suicide risk processes for individuals with PTSD (Davis et al., 2019). In turn, Kovacic and colleagues (2008) found that lower levels of serotonin (i.e., 5-hydroxytryptamine) were associated with increased broad suicide risk among patients with PTSD. Additionally, Vilibić et al. (2014) measured total serum cholesterol among men with PTSD and found that having higher levels of total cholesterol was significantly associated with a decreased likelihood of reporting SI. In another study, body mass index (BMI) was shown to significantly moderate the relation between PTSD symptoms and SI among a sample of Iraq and Afghanistan war veterans such that those with higher BMI were at higher risk for SI, potentially due to high allostatic load and lower engagement in health-promoting behaviors (Kittel et al., 2016). Finally, Dell'Osso et al. (2014) investigated rhythmicity (i.e., circadian and seasonal rhythms) and vegetative functions and found that a lifetime history of all subdomains (i.e., rhythmicity, sleep, appetite and weight, sexual function, and physical symptoms) predicted an increased risk of SI, whereas only changes in the appetite/weight subdomain were predictive of SA.

Sleep disturbance is another commonly examined physiological factor linked to both PTSD and suicide. Krakow et al. (2000) found that individuals with sleep-related disorders had a higher risk of suicidal thoughts and behaviors when compared to those without sleep-related disorders. Further, the authors found that individuals with both breathing and movement disorders were at the highest risk of all, suggesting that sleep plays a critical role in the processes that link PTSD to suicide risk (Krakow et al., 2000). Similar results were found in a sample of Australian adults, in whom past-month sleep disturbances were associated with increased SI among those with PTSD symptoms (Betts et al., 2013). Finally, Kim and colleagues (2018) reported that insomnia partially mediated the relation between PTSD and SI in a large sample of Korean firefighters.

## SB

We located three articles that reported on physiological influences of SB among individuals with PTSD. In the first study, Butterfield and colleagues (2005) investigated the role of four neuroactive steroids in suicide risk processes among inpatient male veterans with PTSD. Two neuroactive steroids, dehydroepiandrosterone and estradiol, were significantly higher among suicide attempters with PTSD (Butterfield et al., 2005). In the second study, Zhang and colleagues (2011) measured levels of three proteins (i.e., p11, P2RX7, and S100 $\beta$ ) in peripheral blood mononuclear cells among psychiatric inpatients with comorbid PTSD and MDD. The findings showed that that suicide attempters had lower levels of p11 mRNA, whereas the SI-only subgroup demonstrated the opposite trend (i.e., higher levels of p11 mRNA), making it a potential biomarker for differentiating suicide risk among patients with comorbid PTSD and MDD. Additionally, lower levels of the P2RX7 protein were found across all subgroups of suicide risk (i.e., ideators and attempters) when compared with healthy controls. Finally, as mentioned briefly, Dell'Osso et al. (2014) reported that changes in the appetite/weight vegetative subdomain of the Mood Spectrum Self Report Questionnaire–Lifetime Version were predictive of SA among a sample of inpatient and outpatient individuals with PTSD.

## Predisposing factors

Finally, we identified 42 articles that described other factors that do not fall neatly into the four domains of the FVT

suicidal mode. Instead, the factors in this section are categorized as predisposing factors, as they generally can be best conceptualized as predispositions or activating events that precede the suicidal mode, such as psychopathological comorbidities, PTSD symptom severity, socioeconomic status, and psychosocial characteristics.

## Psychopathological comorbidities

A large number of studies have suggested that psychopathological comorbidities, including other psychiatric disorders and co-occurring characteristics (i.e., moral injury), increase the risk of suicide (Calabrese et al., 2011), possibly even when the comorbidities are subthreshold (Dell'Osso et al., 2009). MDD is the most commonly reported comorbidity that exacerbates suicide risk among individuals with PTSD. Several studies have reported increased suicide risk for individuals with comorbid PTSD and MDD above and beyond the risk conferred by PTSD alone (Brown et al., 2019; Cougle et al., 2009; Ferrada-Noli et al., 1998; Finley et al., 2015; Gradus et al., 2010; Halimi & Halimi, 2015; Kim et al., 2019; Lemaire & Graham, 2011; Ramsawh et al., 2014; Tarrier & Gregg, 2004; Zeng et al., 2018). Pukay-Martin et al. (2012) reported that the exacerbation of SI in co-occurring PTSD–MDD remained stable across veteran service era as well. However, some researchers have failed to find a significant exacerbation of SI or SA for comorbid PTSD–MDD (Rojas et al., 2014). Other comorbidities that have been implicated in suicide risk for individuals with PTSD include personality disorders (Harned et al., 2010; Oquendo et al., 2005; Zlotnick et al., 2003) and substance-related disorders (Eggleston et al., 2009; Kim et al., 2018; Rojas et al., 2014). On the other hand, one article reported that comorbid MDD or AUD did not increase the likelihood of SI in at least one sample of veterans (Guerra & Calhoun, 2011).

A few other co-occurring characteristics have been mentioned in the existing literature. In one study, individuals with co-occurring PTSD and moral injury were found to be at higher risk for suicide among a sample of U.S. National Guard service members (Bryan et al., 2018). Psychotic symptoms were also found to mediate the relation between PTSD and SI among female suicide attempters (Reviere et al., 2003). Finally, Barnes et al. (2012) reported that although PTSD and traumatic brain injury (TBI) independently predicted an increased risk of suicide, a history of mild TBI did not uniquely compound suicide risk above and beyond PTSD alone.

Although most published studies confirm that psychopathological comorbidities increase suicide risk for individuals with PTSD, other sources present mixed findings and suggest that the PTSD–suicide connection might

be entirely explained by co-occurring psychopathology. For example, Richardson et al. (2012) reported that PTSD was no longer associated with an increased risk of SI after controlling for MDD, generalized anxiety disorder, and AUD. Similarly, Suris et al. (2011) reported that PTSD was no longer a significant predictor of SI after controlling for comorbid MDD. Bryan and Corso (2011) examined depression as a mediating factor between PTSD and SI in a sample of active duty service members and reported that depression fully accounted for the PTSD–suicide exacerbation of risk. Carr et al. (2013) found similar results such that both overall depressive symptoms and, specifically, cognitive-affective symptoms fully mediated the relation between PTSD and SI among African American women.

## PTSD symptom severity

Several articles have reported that more severe PTSD symptoms are associated with increased suicide risk among individuals with PTSD. For instance, Bartlett et al. (2018) examined PTSD symptom severity in a large sample of firefighters and reported that elevated PTSD symptom severity significantly increased suicide risk independent of other variables in the model. PTSD symptom severity was similarly found to be associated with SI outcomes among a sample of adults admitted to an inpatient psychiatric facility (Martin et al., 2017). Additionally, Kachadourian et al. (2018) found that PTSD symptom severity was positively associated with SI outcomes and that depression symptoms had an exacerbating effect.

## PTSD symptom clusters

Some investigators have pinpointed specific PTSD symptom clusters as playing a significant role in the exacerbation of suicide risk in individuals with PTSD, including reexperiencing (Bell & Nye, 2007), emotional numbing (Guerra & Calhoun, 2011; Hellmuth et al., 2012), hyperarousal (Hellmuth et al., 2012; Suris et al., 2011), and avoidance (Lemaire & Graham, 2011). Hellmuth et al. (2012) found that symptoms of emotional numbing, as described in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*, were directly related to SI, whereas hyperarousal was indirectly related to SI through depression. Suris et al. (2011) also reported that hyperarousal significantly predicted SI even when controlling for depression among a sample of veterans with military sexual trauma–related PTSD. Further, Lemaire and Graham (2011) found that the avoidance cluster of PTSD symptoms was more strongly associated with SI risk in comparison to other symptom clusters. The impact of

specific PTSD symptom clusters on suicide risk might also vary according to gender; for example, Steyn (2012) found that intrusive memories were the most significant predictor of SI among South African female police officers, whereas hyperarousal was the primary predictor for their male counterparts.

## Other predisposing factors

We identified several other predisposing factors in the reviewed articles, including adverse childhood experiences (ACEs). Carroll et al. (2017) found that for every 1-point increase in ACE score, the risk for SI increased by nearly 25% among a sample of male veterans with combat-related PTSD. Additionally, LeBouthillier et al. (2015) found that individuals who reported having experienced multiple traumatic events had a significantly increased risk of both SI and SA. Further, whereas most trauma types were associated with increased suicide risk, the authors found that the three types with the highest risk were “childhood maltreatment, assaultive violence, and peacekeeping traumas,” which consisted of peacekeeping operations or relief work in war zones (LeBouthillier et al., 2015, p.183). In contrast, Bell and Nye (2007) reported that the intensity of combat experiences was not related to SI outcomes in a sample of Vietnam veterans with PTSD.

A few predisposing factors linked to socioeconomic conditions also have been found to exacerbate the PTSD–suicide association. Halimi and Halimi (2015) examined several such conditions and reported that unemployment, dissatisfaction with social or economic attainment, and dissatisfaction with living conditions all significantly increased the risk of SI in a sample of Kosovo war veterans. Panagioti et al. (2011) found two distinct paths to SB that were significantly influenced by predisposing factors. The first path involved life impairment and lower levels of occupational and social functioning, whereas the second path was marked by depressive symptoms that consequentially exacerbated PTSD symptoms (Panagioti et al., 2011). Tarrier and Gregg (2004) also reported that self-reported life impairment exacerbated the likelihood of broad suicide risk in a sample of civilians with PTSD.

Psychosocial characteristics also have added important context to the PTSD–suicide relation. In a study of veterans returning from deployment, Haller (2016) found that four specific reintegration stressors were associated with an increased risk of SI above and beyond the risk conferred by PTSD, MDD, and substance use disorder symptoms, including difficulty maintaining friendships, not getting along with relatives, feelings of unbelongingness, and a lack of meaning or purpose in life (Haller et al., 2016). Jakšić et al. (2017) also found that both characterologi-

cal cooperativeness and trait impulsivity significantly predicted SI among Croatian war veterans.

## Other trends observed

A few notable patterns emerged in the literature review. Primarily, the cognitive domain was the most commonly studied domain of the FVT suicidal mode (see Supplementary Table S1 for a full mapping of domain results). Most published studies in the cognitive domain focused on the suicide risk outcome of SI, with far fewer studies examining the effect of cognitive mechanisms on SA and none examining death by suicide. Of the cognitive mechanisms identified, about half were protective factors and half were risk factors. Protective factors primarily consisted of meaning-making cognitive processes, such as purpose in life, posttraumatic growth, resilience, gratitude, and optimism. The identified risk factors largely consisted of negative cognitions that fall within the FVT’s suicidal belief system (Rudd, 2006). This pattern of negative thinking often involved cognitions surrounding trauma-related guilt and shame, negative posttraumatic cognitions about the self, difficulties with forgiveness, defeat and humiliation, and entrapment.

In addition to the focus on cognitive domains within the established literature, SI was commonly used as the outcome measure in the included articles. Approximately 78% of the mechanisms identified in the review were predictive of SI as the outcome, with 22% predicting SB and none predicting death by suicide. Importantly, however, many articles collapsed the cognitive and behavioral dimensions of suicide risk into one broad suicide risk variable, which could limit understanding of the underlying mechanisms and their relations to suicidal thoughts and behaviors.

Among the articles included in the review, about half used a validated diagnostic interview to assess PTSD symptoms, such as the Clinician-Administered PTSD Scale (CAPS) or Structured Clinical Interview for *DSM-IV* Disorders (SCID). Among the other half of the studies that used questionnaire-based self-report measures of PTSD, only 23.9% used a cutoff score or did item analysis to screen for probable PTSD diagnoses in their samples. In total, 70.7% of the included articles established a formal PTSD diagnosis in their sample, whereas the remaining studies focused solely on posttraumatic stress symptom severity without taking specific criterion items into consideration. A detailed list of measures used in each study is provided in Supplementary Table S2.

Finally, many of the studies included in the review were based on now-outdated criteria for PTSD, including criteria from the *DSM-III* (9.8%), *DSM-IV* (68.3%), *International Classification of Diseases* (ninth rev.; *ICD-9*; 2.4%),

and *ICD-10* (4.9%). Only 13.4% of the studies included used the current criteria in the *DSM-5* for PTSD, and none of the articles included in the review used the new *ICD-11* criteria. Further, it was difficult to decipher which criteria were used in seven of the studies included given that several articles stated that a PTSD diagnosis was established via clinical interview or chart review but did not specify the diagnostic system.

## DISCUSSION

Two main conclusions can be derived from the reviewed literature. First, the constructs that are implicated in exacerbating risk among individuals with PTSD are inherently multidimensional and cannot be neatly attributed to single dimensions of functioning. For example, depression was one of the most studied factors that increases suicide risk in individuals with PTSD and, yet, depression includes dimensions that fall into the cognitive (i.e., negative thinking, SI), emotional (i.e., reduced positive affect), behavioral (i.e., social withdrawal), and physiological (i.e., serotonergic dysfunction) domains. Similarly, social support, substance use, and many other factors identified in the present review are also characterized by interconnected cognitive, emotional, behavioral, and physiological processes. Further, these domains themselves are not independent or mutually exclusive; rather, they exert a multidirectional effect upon one another.

The second key consideration to be taken from this review is that individual risk factors themselves are not discrete or absolute phenomena. Each identified construct is woven into an interconnected “network” of risk that, similar to dimensional functioning, impacts other risk factors. For example, depression, negative affectivity, and social withdrawal are all mechanisms that relate to each other (Katz et al., 2011) rather than occurring in isolation. This idea of interconnected risk networks can be expanded further to suggest that individuals who experience depression, negative affect, and social withdrawal are also likely to experience higher intensities of other related risk factors identified in the literature (e.g., substance use, negative cognitions). Thus, it is plausible that individuals with PTSD might have a multitude of risk factors specific to PTSD (e.g., negative alterations in cognition and mood, compromised prefrontal cortex) that activate and broaden other parts of the risk network (i.e., the suicidal mode), thereby exacerbating the overall extent of risk of SI and SA. In alignment with the FVT, these risk networks may comprise more than just simple combinations of risk factors that vary among individuals; rather, there may be compositions of risk networks among those with PTSD, with distinct outcomes that may help explain some inconsistent

findings in the literature. The need for more research in this area is discussed further in this section.

In sum, efforts to advance the field will require multifaceted perspectives regarding the PTSD–suicide connection. The literature reviewed across disciplines suggests a complexly interconnected network of risk at multiple levels (i.e., dimensional and individual risk factors). This idea of dimension-level and risk factor–level networking of risk is in contrast to the unidimensional and single-factor approach that has dominated research and practice to date.

One strength of the reviewed literature is the diversity of populations studied. Whereas the majority of studies examined samples of United States military personnel (i.e., active duty service members, National Guard personnel, and veterans), many other populations were also represented, including first responders in the United States, Chinese graduate students, low socioeconomic status samples, African American adults, Australian adults, undergraduate students in the United States, psychiatric inpatients, adults receiving outpatient mental health care, individuals in residential treatment programs, pregnant substance-dependent women, refugees, Danish adults, Chinese survivors of natural disaster, Croatian war veterans, Canadian Forces service members, and South African police. Further, many of the studies reported on diverse comorbid disorders and co-occurring characteristics of PTSD (i.e., MDD, AUD, psychotic-spectrum disorders, personality disorders, anxiety disorders, TBI, moral injury), which more accurately reflects the high levels of comorbidity found among those with PTSD.

Another strength is the increasing frequency with which the PTSD–suicide connection is being studied and about which articles are being published. Of the 82 articles that met the inclusion criteria for the present review, four were published between 1990 and 1999, 13 were published between 2000 and 2009, and an impressive 65 articles were published between 2010 and 2019 (see Supplementary Figure S1). It is plausible that the increase in scientific interest in this topic is due to the rise in suicide rates in the military, with research on etiology and treatment quick to follow. Another possible explanation is that scientific inquiry has begun to respond to the uptick of traumatized veterans of the recent conflicts in Iraq and Afghanistan reintegrating into civilian society following heavy combat in the United States’ longest war. In any case, the increase in scientific attention is a strength of the literature base and will continue to inform prevention and practice among suicidal individuals with PTSD.

Several important limitations exist that highlight remaining gaps in knowledge and can provide guidance for future directions of research and practice. First, over 85% of the studies included in the review used now-outdated criteria for PTSD, with only about 13% reporting

on current *DSM-5* criteria. The diagnostic changes between *DSM-IV* and *DSM-5* criteria for PTSD alone were quite considerable and pose both methodological and interpretive challenges for several reasons (Pai et al., 2017). For instance, the subjectivity of the definition of trauma in the *DSM-IV* was reduced, and several changes were made to narrow and tighten the definition of qualifying exposure to traumatic events in the *DSM-5*. Because of this, there are likely many instances in which outcomes were reported on individuals who met the criteria for PTSD per *DSM-IV* but would no longer currently qualify for the diagnosis. Additionally, several new symptoms of PTSD were added to the *DSM-5* conceptualization of the disorder, and even the *DSM-IV* symptoms that carried over were rearranged into different categories in the *DSM-5*. As such, there are discrepancies in the symptom clusters described depending on which diagnostic manual was used at the time of assessment. In a similar vein, most articles reviewed did not report the index traumatic events present in the sample, despite some literature suggesting that different types of index trauma (e.g., sexual assault) may confer an increased risk of suicide and other psychological consequences than other trauma types (e.g., noninterpersonal trauma; Blais & Monteith, 2019). Therefore, the clarity of diagnostic criteria used and elucidation of specific trauma types can both be improved even among the most commonly used measures and data collection procedures.

Additionally, the measurement of both PTSD and suicide risk is often inconsistent across studies in the literature and, at times, unclear regarding what was measured and how it was measured; for example, it can be difficult to ascertain whether *DSM* Criterion A was evaluated, whether a threshold or dimensional approach was used, or which specific facets of suicide risk were assessed. Although it would be methodologically ideal to corroborate self-report measures with additional measures (i.e., CAPS-5 interviews or other objective indicators), limited resources often make this unfeasible. Approximately half of the studies included in the present review used self-report measures of PTSD; the other half utilized clinician-administered measures. Although clinician-administered interviews are considered the gold standard for assessing PTSD, the use of self-report measures can be refined and improved to provide more accurate data when clinician-administered measures are not possible. For example, most articles included in the review used a self-report version of the PTSD Checklist (PCL) to establish PTSD status and/or severity; this measure is particularly limited by its vulnerability to yielding misleading total scores. For example, if a participant has low scores on PCL items related to reexperiencing, avoidance, and hyperarousal symptoms but, due to depression, higher scores on items related to negative alternations in cognition and

mood, their total score might meet the proposed cutoff score of 33 and falsely suggest PTSD. One way to ameliorate this risk is to perform an item analysis of the PCL to ensure that participants meet the criteria for each cluster of PTSD symptoms independently rather than simply using the total score (i.e., to utilize a dimensional approach rather than a threshold approach). However, very few studies reported completing this extra step. Another limitation of using the PCL to classify PTSD status or severity is that most versions of the PCL do not include an assessment of Criterion A, meaning that it is impossible to tell whether an individual was thinking about a qualifying index traumatic event while rating the items. The precision of measurement using the PCL can be refined by using the Criterion A assessment version of the scale to ensure that item responses are directly related to a qualifying traumatic event, but, again, this was not commonly done in the studies reviewed. As such, future research can be improved by more careful selection of PTSD assessment measures as well as consideration of whether a threshold or dimensional approach to measurement will yield the most valid data for the questions of interest.

Similarly, the measurement and classification of SI, SA, and death by suicide were highly incongruent across studies. Many studies used the term “suicidality” to describe suicide risk outcomes that varied between ideation, behaviors, nonsuicidal self-injury, and all facets combined. For example, the Suicide Behaviors Questionnaire–Revised is primarily a measure of the ideation dimension of suicide risk (i.e., lifetime and past 12-months SI, likelihood of making a suicide attempt in the future) but also includes an assessment of lifetime suicide attempts. This suggests that it is possible that proposed mechanisms of the PTSD–suicide association may relate to both SI and SA; however, collapsing all facets of suicide risk into one variable limits the interpretations that can be made. Several other studies also used a single item from the Patient Health Questionnaire–9 to represent suicide risk; however, the phrasing of that item makes it unclear whether respondents are endorsing suicidal thoughts, suicidal behaviors, nonsuicidal self-injury, or thoughts related to the death of others. Measuring and defining specific aspects of suicide risk more effectively will be critical for research going forward, especially given that multiple articles reviewed suggest that ideators and attempters are two distinct groups with differing outcomes (Dell’Osso et al., 2014; Dutton et al., 2016; Kachadourian et al., 2019; Kim et al., 2019; Martin et al., 2017; McLean et al. 2017).

Another limitation of the literature reviewed is the limited number of dimensions of suicide risk that have been studied. As noted, the overwhelming majority of studies focused on SI, whereas significantly fewer examined SB and none reported on death by suicide. Only one article we found reported on underlying mechanisms of death

by suicide, but, unfortunately, those results were from a meta-analysis of nine other studies in which PTSD was not a required diagnosis (Zhang et al., 2011). One possible explanation for this unevenness is the difficulty of studying suicidal behaviors and death by suicide. Nonetheless, collapsing death by suicide into the broader behavioral suicide risk dimension represents a limitation given that suicide attempters and individuals who actually die by suicide might differ from one another in significant ways, just as research suggests that ideators might differ from attempters, and those who attempt suicide once may be different from those who attempt multiple times (Klonsky et al., 2017).

Finally, the most mechanisms identified in the current literature on the PTSD–suicide link were risk factors. Fewer than one third of the included studies reported on protective factors that helped to mitigate suicide risk outcomes for individuals with PTSD. Given that many suicide prevention efforts have struggled to demonstrate measurable effectiveness by targeting known risk factors, it may be beneficial to incorporate protective factors into existing intervention efforts. To do this effectively, more research on protective factors for suicidal individuals with PTSD is needed.

The highly interconnected nature of suicide risk at both the individual and dimensional levels suggests the need for robust theories of suicide that are equipped to make sense of those complex processes. In light of the literature reviewed, a major strength of the FVT is that it seems equipped to explain the full spectrum of risk factors across various domains and time points (e.g., at baseline, during active episodes). The predisposing factors identified in this review of literature can be classified as both predispositions (e.g., adverse childhood experiences, trait impulsivity) and triggers (e.g., unemployment, reintegration stressors) that precede activation of the suicidal mode. Consistent with the suicidal mode conceptualization, many of the mechanisms investigated have been found to be significant for certain individuals and at certain times, whereas no single mechanism has emerged as a universal factor that promotes suicide risk. Another strength of the FVT is that it provides space for consideration of protective factors as components of the risk process, which are often absent from contemporary theories of suicide.

Although the FVT has distinct strengths for helping clinicians and scholars to understand the PTSD–suicide link, it also has several limitations to its practical application. Primarily, the FVT does not yet provide a framework for specifying which risk networks are more likely to lead to suicide. The suicidal mode identifies and organizes a host of risk and protective factors across four domains and emphasizes the interconnected nature of those factors and domains; yet, it does not elucidate which combinations of factors (i.e., risk networks) contribute most to suicide risk.

Further, there is no delineation among types of suicide risk (i.e., suicidal thoughts, behaviors, and death by suicide), which may be activated by distinct factors in specific domains. Another limitation of the FVT is that it does not clearly predict or explain *who* moves in and out of the suicidal mode or *when* this movement can occur. Indeed, the theory proposes that baseline risk varies broadly among individuals and that among individuals with higher baseline risk, the suicidal mode may be activated more easily than for those with lower baseline risk. However, it is challenging to apply this idea in clinical practice given that there are no anchoring points for an “amount” of baseline risk a person possesses, the “severity” of triggers warranted to activate the suicidal mode, or measurable reductions of the suicidal mode that are necessary to deactivate a suicidal episode.

These limitations are not entirely unique to the FVT and can be largely attributable to shortcomings in the current state of knowledge regarding suicide as a dynamic, temporal process, especially among individuals with PTSD. Nonetheless, FVT can be refined to improve how the field thinks about suicide research and practice. First, the theory can be advanced by broadening its dimensionality to include an examination of risk networks (i.e., factors that frequently appear in tandem) across various suicide risk outcomes (i.e., thoughts versus behaviors versus death by suicide). In addition to parsing out risk factors and risk outcomes at individual and dimensional levels, the FVT can build upon its foundational propositions by considering not only how the suicidal mode is activated but also how it is deactivated.

Finally, another promising avenue for the development of theory and future research in this area will be to unpack the relation between PTSD and suicide risk by examining the relative importance of specific *DSM-5* symptom clusters in this association. For example, some research suggests that aggression and disinhibition are predictive of suicide (Esposito et al., 2003), which might implicate *DSM-5* Cluster E (i.e., activations in arousal and reactivity) symptoms that involve anger and risky behavior. Alternatively, constructs in the cognitive dimension of FVT, such as thwarted belongingness and hopelessness, might relate particularly to PTSD symptoms in the negative alterations in cognitions and mood cluster. Advanced theoretical knowledge on the process of attenuating an acute suicidal episode, as well as how that process of attenuation relates to *DSM-5* PTSD mechanisms, would yield critically important insights for clinical practice.

In addition to refining the way the field approaches the theory surrounding and conceptualization of suicidal individuals, the present findings have potential implications for clinical work. Historically, clinicians have received minimal training in suicide risk assessment and intervention (Schmitz et al., 2012) and have been guided to

look for specific risk factors that were once believed to account almost entirely for suicide risk (e.g., depression). This approach has been ineffective (Franklin et al., 2017) and fails to consider suicide risk as the complex, multidimensional process it has proven to be. To improve suicide risk assessment and intervention, providers must understand suicide risk as a network of factors instead of focusing on only select variables.

One way that clinicians can improve their assessment of suicide risk among individuals with PTSD is to begin assessing risk factors beyond the stereotypical profile of a suicidal person who is simply depressed and without adequate social support. In reality, many combinations of mechanisms exist outside of the few popularized constructs that initiate and sustain suicide risk. The available literature revealed a diverse array of mechanisms that have been implicated in suicide risk among individuals with PTSD, such as trauma-related guilt, impulsivity, emotion dysregulation, low distress tolerance, alexithymia, sleep disturbances, and higher BMI, among many others (see Supplementary Table S1). A comprehensive, holistic assessment of those factors within an individual's risk network should begin upon clinical intake and continually be revisited and revised as appropriate. In addition to considering the number of risk factors and the dimensions into which they fall, it might also be important to assess the intensity of each risk factor to gauge an individual's level of distress, with the underlying assumption that risk factors themselves are not dichotomous but rather continuous, with more severe distress potentially resulting in a higher risk of suicide (Leiler et al., 2019). Several assessment tools exist to help clinicians gather comprehensive information regarding PTSD (Ellickson-Larew, 2020) and suicide risk (Oquendo & Bernanke, 2017). Yet, personal and institutional barriers exist that sometimes prevent adequate assessment of these important constructs upon intake, such as limited training in suicide assessment (Schmitz et al., 2012) and inadequate institutional resources (Tanielian et al., 2016). To overcome these barriers, organizations must collaboratively problem-solve such obstacles to allow for the best assessment practices possible.

Assessment of an individual's full network of risk (i.e., their suicidal mode) can provide clinicians with important clues for treatment planning and intervention. Although risk processes in this population are marked by dimensions that have multidirectional influences upon one another, an understanding of which dimensions carry the most risk at any given time for an individual can point toward specific interventions. For example, if a patient's cognitive domain is particularly marked by risk factors (e.g., maladaptive thoughts, rumination, cognitive rigidity), cognitive interventions can be prioritized to reduce suicidal beliefs and other distressing trauma-related cognitions

associated with increased suicide risk. Several cognitive interventions exist that target such mechanisms, including crisis response planning (CRP; Bryan & Rudd, 2011; Rudd et al., 2006; Rudd et al., 2015), brief cognitive behavioral therapy (BCBT; Rudd et al., 2015), and cognitive processing therapy (CPT; Resick et al., 2017). This same logic applies to the other domains of the suicidal mode. If a patient is particularly burdened by risk factors in the behavioral domain, interventions like behavioral activation (Judah et al., 2020) and motivational interviewing (Miller & Rollnick, 2013) may be useful. Similar implications can be articulated for the emotional domain (e.g., acceptance and commitment therapy [Hayes et al., 1999]; emotion-focused therapy [Meneses & Greenberg, 2019]) and physiological domain (e.g., physical and medical interventions). Undoubtedly, these associations are multidirectional and intertwined, but targeting the most impaired dimension may reduce suicide risk most effectively. Finally, although suicide risk has been used as an exclusionary criterion for PTSD treatment, emerging research suggests that both conditions can safely be treated concurrently (Roberge et al., 2021; Rozek et al., in press). This means that clinicians are able to target the most impaired domain of functioning across both conditions (i.e., PTSD and suicide), more efficiently.

The conclusions drawn from this narrative review should be considered within the context of its limitations. Primarily, this review was not systematic in nature and did not utilize meta-analytic techniques. It is possible that some relevant articles were missed during the literature screening despite a carefully executed search. However, a strength of this review is that its search parameters, screening procedures, and inclusion and exclusion criteria were preregistered before beginning the literature search, which minimizes the likelihood of omission by error. Whereas meta-analysis can provide useful quantitative conclusions, our decision to complete a narrative review was intended to provide flexibility in the inclusion criteria to achieve a comprehensive picture of the PTSD–suicide connection. Finally, the databases used in the review had differing criterion parameters, which could have resulted in missed articles that would have otherwise met the inclusion criteria. For example, MEDLINE and CINAHL both consider “adult” populations to be 19 years of age and older, which might have caused us to miss studies including 18-year-olds.

The present review makes a novel contribution to the literature by applying theory, namely FVT, to organize and investigate the inchoate literature on the PTSD–suicide association to date. Although the precise reasons that PTSD places individuals at higher risk for suicide remain largely unknown, the review uncovered several potential underlying mechanisms that can inform future research and practice. The current body of literature suggests that

the association between PTSD and suicide is a highly interactive, multidimensional process that is both individualized and apt to change over time. Researchers and clinicians alike can help advance the state of knowledge in this area by improving the precision of measurement and psychological assessment of PTSD and suicide. By prioritizing research and practice that is multidimensional and interconnected with all facets of the suicidal mode, the field may someday be able to identify specific risk networks that predict greater imminence of suicide among individuals with PTSD.

## Open Practices Statement

The preregistration for this review can be accessed at [osf.io/hqxyu](https://osf.io/hqxyu). Requests for the materials utilized in the empirical studies reviewed herein should be directed to the authors of those studies.

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