### Title

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# Anger mediates the relationship between posttraumatic stress disorder and suicidal ideation in veterans

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## Abstract

**Background—**Theoretical models and cross-sectional empirical studies of suicide indicate that anger is a factor that may help explain the association between posttraumatic stress disorder (PTSD) and suicide, but to date no longitudinal studies have examined this relationship. The current study used longitudinal data to examine whether changes in anger mediated the association between changes in PTSD symptomatology and suicidal ideation (SI).

**Methods—**Post 9/11-era veterans ($N$ = 298) were assessed at baseline, 6-months, and 12-month time points on PTSD symptoms, anger, and SI. Analyses covaried for age, sex, and depressive symptoms. Multilevel structural equation modeling was used to examine the three waves of data.

**Results—**The effect of change in PTSD symptoms on SI was reduced from $B$ = 0.02 ($p$ = .008) to $B$ = −0.01 ($p$ = .67) when change in anger was added to the model. Moreover, the indirect effect of changes in PTSD symptoms on suicidal ideation via changes in anger was significant, $B$ = 0.02, $p$ = .034. The model explained 31.1% of the within-person variance in SI.

**Limitation—**Focus on predicting SI rather than suicidal behavior. Sample was primarily male.

**Conclusions—**Findings suggest that the association between PTSD and SI is accounted for, in part, by anger. This study further highlights the importance of anger as a risk factor for veteran suicide. Additional research on clinical interventions to reduce anger among veterans with PTSD may be useful in reducing suicide risk.

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Contributors

K.D., J.G., E.E., C.W., and L.M. played roles in conceptualization of the study. P.D. completed the formal analysis. E.E. and J.B. were responsible for funding acquisition. K.D., E.V., P.D., and J.G., were responsible for writing the original draft. C.W, L.M., J.B, and E.E. played roles in reviewing and editing the writing. All authors approved the final draft of the manuscript.

Declaration of Competing Interest

The authors declare no conflicts of interest.

[1]Although it is labeled as a hostility scale, the construct that is measured by the SCL-90 Hostility scale more closely approximates the emotional and behavioral aspects of anger.

**Keywords**

suicidal ideation; Veterans; Posttraumatic stress disorder; Anger

## 1. Introduction

Suicide is the 10th leading cause of death in the United States, with rates continuing to increase (Centers for Disease Control and Prevention, 2018). Risk for suicide is 22% higher among U.S. veterans as compared to U.S. non-veteran adults (Department of Veterans Affairs, 2016). The increased risk for suicide among military veterans has prompted the Department of Veterans Affairs to designate suicide prevention as a top clinical and research priority (Department of Veterans Affairs, 2017).

A well-established risk factor for suicide is posttraumatic stress disorder (PTSD; Gradus et al., 2010; Lemaire and Graham, 2011; Nock et al., 2009; Panagioti et al., 2009; Ramsawh et al., 2014). PTSD is one of the few conditions that differentiates those who ideate from those who go on to attempt suicide (May and Klonsky, 2016; Nock et al., 2009). As many as 23% of post-9/11-era veterans meet criteria for PTSD (Fulton et al., 2015), and one study found that post-9/ 11 era veterans who screen positive for PTSD were more than 4 times as likely to endorse suicidal ideation relative to those without PTSD (Jakupcak et al., 2009). Despite considerable evidence of the association between PTSD and suicide, the mechanisms by which these two variables are linked remains unclear (Bryan et al., 2017; Panagioti et al., 2009).

One potential pathway between PTSD and suicidality could involve anger, given the prominence of anger in PTSD symptoms. Anger is a key hyperarousal symptom of PTSD (American Psychological Association, 2013), and it is among the most commonly reported post-deployment reintegration concerns among post 9/11-era veterans (Sayer et al., 2010). A nationally representative survey revealed that 61.2% of U.S. veterans reported experiencing difficulties controlling anger, and 23.9% reported experiencing aggressive urges over a two-year period (Sippel et al., 2016). Meta-analytic research has consistently established evidence of strong associations between anger problems and PTSD across samples (Olatunji et al., 2010; Orth and Wieland, 2006), with the largest effect sizes found in military samples (Orth and Wieland, 2006).

Research has suggested a significant interconnection between PTSD, anger, and suicide. Longitudinal studies have found that, compared to the other PTSD symptom clusters, the hyperarousal symptom cluster of PTSD is most predictive of subsequent suicidal ideation (Panagioti et al., 2017) and suicide attempts (Stanley et al., 2019). Anger has been found to be associated with suicidal thoughts and behaviors in both civilian (Hawkins and Cougle, 2013; Hawkins et al., 2014; Horesh et al., 1997; Jang et al., 2014; Kotler et al., 1993; Morgan and Priest, 1984) and veteran samples (Dobscha et al., 2014; Kachadourian et al., 2018; Novaco et al., 2012; Wilks et al., 2019). Several recent studies using cross-sectional samples of veterans in the community have supported the potentially mediating role of anger in the relationship between PTSD and suicide. McKinney and colleagues (2017) found that PTSD was indirectly related to suicide risk *via* depression and inner-directed, but not

externally-directed, anger. In a recent paper examining the association between anger and suicidal ideation among 2467 post 9/11-era veterans, Wilks and colleagues (2019) found that anger was uniquely and strongly associated with suicidal ideation, even when accounting for depression, PTSD, and other established risk and protective factors. When anger was added to the logistical regression model predicting suicidal ideation, PTSD was no longer a significant predictor in the model. Taken together, these findings suggest that anger may be a particularly important trans-diagnostic factor for evaluation when examining suicide risk in veterans. However, these studies were all limited to cross-sectional data, and evaluating these relationships prospectively is needed to better understand the temporal order of the relationships between these variables. The current study will examine whether changes in anger mediate the relationship between changes in PTSD and suicidal ideation. Examining the role of anger over time on subsequent SI may provide important insights for clinicians who treat PTSD, suggesting that anger be monitored and attended to over the course of treatment.

That anger is empirically linked to suicidality in PTSD is consistent with two conceptual models of suicide. First, the fluid vulnerability theory (FVT; Rudd, 2006) proposes that risk for suicide fluctuates as function of both chronic and acute risk factors. According to this theory, individuals have relatively stable, chronic baseline levels of suicide risk. However, some individuals are triggered by situational factors to acute periods of suicidal ideation more quickly than others, and there are individual differences in capacity to recover from urges to die by suicide. Consistent with this model, individuals with PTSD may have elevated levels of baseline suicide risk due to symptoms that cut across domains (Bryan et al., 2017). Longitudinal (Orth et al., 2008) and ecological momentary assessment (Van Voorhees et al., 2018) research has found evidence that PTSD symptoms predict subsequent anger, but not vice versa, suggesting that increases in PTSD symptoms over time may lead to increased anger, which subsequently could result in greater suicidal ideation. That is, those with elevated baseline risk may encounter situational triggers which serve to increase PTSD symptoms and associated increases in anger cognitions, hostility, irritability, and aggressive urges, which elevate suicide risk. Increased anger may also serve to push others away, increase isolation, relationship distress, shame, self-blame, and self-hatred, further increasing suicide risk. Finally, high emotional arousal, difficulties with emotion regulation, and ruminative cognitive style associated with both PTSD and anger (Ehring and Quack, 2010; Martin and Dahlen, 2005; Orth et al., 2008; Tull et al., 2007) may make it more difficult to recover from these acute episodes.

Second, that anger potentially mediates the relationship between PTSD and suicidal ideation is consistent with the interpersonal-psychological theory of suicide (IPTS; Joiner, 2005). According to the IPTS, two factors are necessary for an individual to move toward suicide: *thwarted belongingness* (a lack of connection with others) and *perceived burdensomeness* (a belief that one is a burden on others). Individuals with PTSD who experience increased anger may be at higher risk of experiencing thwarted belongingness and perceived burdensomeness due to increased interpersonal conflicts and relationship difficulties. Previous research has found evidence that the relationship between anger and suicide is mediated by both of these factors (Hawkins et al., 2014; Rogers et al., 2017). Importantly, the FVT and IPT models are not mutually exclusive, and recently researchers have suggested

integrating these two theoretical approaches to better understand and prevent veteran suicide (Wolfe-Clark and Bryan, 2017).

In summary, theoretical models of suicide support the hypothesis that anger mediates the relationship between PTSD and suicide. Cross-sectional empirical studies further provide tentative support for this hypothesis; however, the relationship between anger, suicidal ideation, and PTSD has yet to be tested in a mediation analysis employing a longitudinal sampling frame. The current study made use of secondary longitudinal data to examine whether anger mediated the relationship between PTSD and suicidal ideation in a sample of post 9/11-era veterans followed over a 12-month period. We hypothesized that changes in anger would mediate the relationship between changes in PTSD symptoms and suicidal ideation, even when covarying for demographic variables and distinct but related mood symptoms such as depression. Pending significant mediation, an additional exploratory analysis sought to clarify the specific components of anger accounting for the mediating effect.

## 2. Methods

### 2.1. Participants and procedures

The present analyses were conducted on data from a larger, three-wave longitudinal study of veterans' psychological health. In the parent study, data were collected from 319 participants at baseline, 6-month, and 12-month time points between June of 2009 and March of 2013. Participants included English-speaking veterans between the ages of 18 and 70 who served in the military after September 11, 2001. No psychiatric or medical exclusionary criteria were imposed. Participants were recruited through advertisements, mailings to Veterans Affairs-registered veterans who had served in the military after September 11, 2001, clinician referrals, and enrollment in the Veterans Affairs Registry Database for the Study of Post-Deployment Mental Health (Brancu et al., 2017). Institutional Review Board approval was obtained prior to data collection. Veterans initiated participation by calling the study phone line, at which time they were underwent a brief telephone screening. If eligible, veterans were scheduled for in-person data collection at the Durham VA Healthcare System. After providing written informed consent, veterans were administered clinical interviews and self-report measures. Compensation was provided for participation at each assessment session.

### 2.2. Measures

Analyses for this investigation utilized a subset of the measures included in the larger study

**Davidson Trauma Scale (DTS; Davidson et al., 1997)—**PTSD, the predictor variable in these analyses, was evaluated using the DTS. The DTS is 17-item self-report measure of DSM-IV PTSD symptoms that has been found to have good reliability and validity and to be sensitive to treatment effects over time (Davidson et al., 1997; McDonald et al., 2009). Participants rated each of the 17 PTSD symptoms on a 5-point Likert scale with respect to frequency (0 = "not at all" to 4 = "everyday") and severity (0 = "not at all distressing" to 4 = "extremely distressing"). Items were summed to create a total score. The total DTS score for

the analyses presented here did not include the item assessing PTSD-related anger ("Have you been irritable or had outbursts of anger?").

**Symptom Checklist-90-R (SCL-90-R; Derogatis, 1994)—**Anger, the proposed mediator, was evaluated using the six-item hostility subscale of the SCR-90-R. Participants rated how distressing each item had been over the past weeks on a 5-point Likert scale ranging from 0 ("not at all") to 4 ("extremely"). Items were summed to create a total score. The SCL-90-R has evidenced good test-retest reliability, construct validity, and internal consistency (Derogatis, 1994). Prior research has suggested that the hostility subscale may tap two potentially dissociable constructs. The first appears to reflect aggressive impulses or urges ("having urges to break or smash things;" "having urges to beat, injure, or harm someone"), with these two items having good internal consistency (Cronbach alpha = 0.85). The second construct includes 4 items that reflect difficulty managing anger ("feeling easily annoyed or irritated;" "temper outbursts that you could not control;" "getting into frequent arguments;" and "shouting or throwing things"), with a similarly high internal consistency (Cronbach alpha = 0.89; Elbogen et al., 2010). In the current study, primary analyses included the hostility subscale as the potential mediator of the association between PTSD and suicidal ideation. Exploratory analyses were conducted to compare the parallel mediating effects of these subcomponents (aggressive impulses and difficulty managing anger).

**Beck Scale for Suicide Ideation (BSI; Beck and Steer, 1991)—**Suicidal ideation, the outcome variable, was assessed via the self-report form of the BSI. The self-report version of the BSI includes 19 items reflecting severity of suicide ideation on a 3-point scale ranging from 0 to 2. Items are summed to create a total score. High reliability for the self-report version of the BSI has been found in both adult and adolescent inpatient samples, and correlations between self-report and clinician ratings have been found to be greater than $r = 0.90$ in adult outpatient and inpatient samples (Beck et al., 1988). This version of the BSI has been found to be stable over a 3-month period in psychiatric inpatients and outpatients (de Beurs, Fokkema, de Groot, de Keijser, and Kerkhof, 2015)

**Covariates included age, sex, and depressive symptoms as measured by the *Beck Depression Inventory, Second Edition (BDI-II*; Beck et al., 1996)—**Covariates included age, sex, and depressive symptoms as measured by the BDI-II. The BDI-II is a 21-item self-report scale measures depressive symptoms including sadness, pessimism, punishment feelings, and changes in sleep pattern. Statements are rated from 4-point Likert scale (0 to 3) ranging from normal functioning (i.e. "I get as much pleasure as I ever did from the things I enjoy") to strongly consistent with depression (i.e. "I can't get any pleasure from the things I used to enjoy"). Items are summed to create a total score. The measure has been found to have strong psychometric characteristics in a range of samples (Beck et al., 1996). The item reflecting suicidal ideation was removed from these analyses.

### 2.3. Data analysis

Descriptive statistics were first computed for all of the baseline (wave 1) variables. Independent-samples t-tests and contingency-table analysis were used to examine potential

biases in the wave 2 and wave 3 data due to systematic patterns of missing data. Bivariate correlations were computed, first between all of the baseline variables and then between the baseline variables and BSI at waves 2 and waves 3 to examine the association between the baseline variables and subsequent SI.

To examine whether changes in anger mediate the association between changes in PTSD symptomatology and suicidal ideation, multilevel structural equation modeling (MSEM) was used. Multilevel modeling (MLM) is a technique for analyzing repeated observations of data across multiple individuals (Searle et al., 1992). The present dataset was considered to be multilevel given multiple waves (Level 1) nested within each individual participant (Level 2). Unlike repeated-measures ANOVA, MLM can incorporate time-varying (Level 1) and time-invariant (Level 2) predictors. Given that MLM can be estimated using maximum likelihood, it can also accommodate data missing at random. MSEM can apply path analysis to multilevel data, thus making it possible to examine mediation hypotheses within a single model. In the present analyses, lagged scores were used to create change scores, representing changes in PTSD symptomatology and anger from wave *t−1* to wave *t*, and to control for prior levels of primary variables. Although alternative approaches to using change scores are available, change scores provide the most readily interpretable results *vis-à-vis* estimates of adjusted change (Dalecki and Willits, 1991).

Given the used of lagged values, the mediation analyses only modeled outcomes at waves 2 and 3. The first part of the mediation model assessed the effect of changes in PTSD symptomatology from wave *t−1* to wave *t* on concurrent changes in anger (Path A) while controlling for PTSD symptomatology and anger measured at wave *t−1*. The second part of the mediation model estimated the effect of changes in anger from wave *t−1* to wave *t* on suicidal ideation measured at wave *t* (Path B) while controlling for concurrent changes in PTSD symptomatology (Path C'), PTSD symptomatology and anger levels at wave *t−1*, and suicidal ideation at wave *t−1*. The assumption of the mediation analysis is that the direct effect of the primary predictor, changes in PTSD symptomatology, on the outcome variable, suicidal ideation at wave *t*, will diminish in the presence of the mediator, changes in anger. In addition, significance of the mediation effect was tested by calculating the indirect effect of the predictor on the outcome via the mediator using the delta method, which entails multiplying Paths A and B. Total effects of the predictor on the outcome were then calculated by adding the indirect effect to Path C'. Model fit was evaluated using standard fit criteria (Hoyle, 1995; Hu and Bentler, 1999): root mean square error of approximation (RMSEA) ≤ 0.05, comparative fit index (CFI) ≥ 0.90, and standardized root mean square residual (SRMR) ≤ 0.08, calculated for both levels of the model (i.e., within- and between-person). Snijders and Bosker's (1999) pseudo-$R^2$ calculation was used to estimate how much variance in the mediator and outcome variables were explained by the model.

Pending significant mediation of the effect of changes in PTSD symptomatology on suicidal ideation by changes in anger, we further aimed to compare the two subcomponents of the anger scale—aggressive impulses and difficulty managing anger—*vis-à-vis* their simultaneous indirect effects to determine which of the two may drive the hypothesized anger mediation effect. All analyses were conducted using Mplus 7. Change scores were calculated by subtracting wave *t−1* scores from wave *t* scores, such that a positive change

score would reflect an increase over time. Age, gender, and wave *t−1* depression were covaried in all analyses to mitigate potential confounding effects.

## 3. Results

Two hundred ninety-eight veterans ($n$ = 49 females, 16.4%) had complete data at baseline. Of these, 235 (78.9%) had complete data at the 6-month follow-up, and 198 (66.4%) had complete data at the 12-month follow-up. Mean age at baseline was 39.92 ($SD$ = 10.53) years and ranged from 22 to 67 years. One hundred and fifty-six (52.7%) identified as African-American, 116 (39.2%) identified as Caucasian, and 24 (8.1%) identified as another race (i.e., Asian, Native American, or Pacific Islander). Participants with any missing wave 2 data corresponding to the primary variables (i.e., DTS scores, SCL-90-R scores, BSI score, and BDI-II scores) did not differ from those without missing data with regard to age, gender, SCL-90-R scores, BSI scores, or BDI-II scores (all $ps > 0.18$). However, there was a trend suggesting that participants with missing wave 2 data had lower DTS scores ($M$ = 27.07, $SD$ = 16.32) than participants without missing wave 2 data ($M$ = 39.07, $SD$ = 34.52), $t(270)$ = 1.94, $p$ = .054. Participants with any missing wave 3 data did not differ from those without missing data with regard to age, SCL-90-R scores, DTS scores, or BSI scores (all $ps > 0.30$). However, participants with missing wave 3 data had lower BDI-II scores ($M$ = 8.65, $SD$ = 8.61) and were more likely to be female (27.7%) than participants without missing data (BDI-II $M$ = 12.54, $SD$ = 11.21), $t(87.2) = 2.61$, $p$ = .011; (15.2% female), $X^2(1) = 4.11$, $p$ = .043.

Descriptive data and intercorrelations for all study variables at baseline (wave 1) variables are shown in Table 1. Baseline BSI was significantly associated with BDI-II, DTS, and SCL-90-R scores. Of all study variables, baseline BSI was most highly associated with the aggressive impulse subscale of the SCL-90-R ($r$ = 0.44, $p < .001$), followed by anger ($r$ = 0.41, $p < .001$). Table 2 presents bivariate correlations between the baseline variables and BSI scores at waves 2 and 3. Again, BSI scores were significantly associated with BDI-II, DTS, and SCL-90-R scores. BSI at waves 2 and 3 was most highly associated with baseline BDI-II ($r$ = 0.33, $p < .001$ and $r$ = 0.23, $p < .001$, respectively).

As depicted in Fig. 1, results of the MSEM indicated that changes in PTSD symptoms from wave *t−1* to wave t were associated with concurrent changes in anger from wave *t−1* to wave *t*, controlling for levels of PTSD symptoms and anger at wave *t−1*. Moreover, changes in anger from wave *t−1* to *t* were associated with levels of suicidal ideation at wave *t*, independent of levels of suicidal ideation at wave *t−1*. Consequently, the effect of changes in PTSD symptoms on suicidal ideation was reduced from $B$ = 0.02 ($p$ = .008) to $B = -0.01$ ($p$ = .67) with change in anger in the model. Moreover, the indirect effect of changes in PTSD symptoms on suicidal ideation via changes in anger was significant ($p$ = .034). Overall, the fit indices indicated that the model fit the data well, although, unsurprisingly, this was driven by the strength of the within-person associations more so than the between-person associations: RMSEA = 0.00, CFI = 1.00, within-person SRMR = 0.00, between-person SRMR = 0.08. The pseudo-$R^2$ calculation indicated that the path model explained 31.1% of the within-person variance in suicidal ideation and 0.0% of the between-person variance. It

also explained 41.7% of the within-person variance in change in anger and 0.0% of the between-person variance.

Results of the follow-up analysis to determine whether aggressive impulses or difficulty managing anger was primarily responsible for the above results are depicted in Fig. 2. According to that analysis, changes in PTSD symptoms from wave *t−1* to wave *t* were associated with changes in both aggressive impulses and difficulty managing anger from wave *t−1* to wave *t*. However, only change in aggressive impulses was associated with suicidal ideation at wave t. In turn, the indirect effect of changes in PTSD symptoms on suicidal ideation via changes in aggressive impulses was marginally significant, $p = .054$, whereas the indirect effect via changes in difficulty managing anger failed to be significant, $p = .66$. Likely given the degree of multicollinearity between the two subscales, model fit was poor: RMSEA = 0.21, CFI = 0.84, within-person SRMR = 0.05, between-person SRMR = 0.29. The pseudo-$R^2$ calculation indicated that the path model explained 31.1% of the within-person variance in suicidal ideation and 0.0% of the between-person variance. It also explained 30.2% of the within-person variance in change in aggressive impulses and 0.0% of the between-person variance as well as 43.7% of the within-person variance in difficulty managing anger and 0.0% of the between-person variance.

## 4. Discussion

Suicide is a leading cause of death among veterans, and, while PTSD is risk factor for suicide, the nature of this relationship is unclear. Both theory (Rudd, 2006; Joiner, 2005) and empirical findings (McKinney et al., 2017; Wilks et al., 2019) have suggested that anger is a factor that may help explain the link between PTSD and suicidality, but to date no longitudinal studies have been done to examine this relationship over time. Using a longitudinal design with post 9/11-era veterans, we found that anger mediated the relationship between PTSD and suicide, even after accounting for demographic factors and depression. Specifically, we found that, at either subsequent time point (i.e., 6 months or 12 month), suicidal ideation was prospectively associated with changes in PTSD symptoms from the prior time point, and that this association was driven by concurrent changes in anger over the same time period.

The current study suggests that PTSD may exert its effects on suicidal ideation, at least in part, by way of anger. By using a longitudinal sample we were able to establish temporal order in the relationship between these variables. Although prior research had found associations between PTSD, anger, and suicide, we were able to examine whether changes over time were associated with subsequent suicidal ideation, which is a strength of our study. To date, much of the research on the association between PTSD and suicide has been theory-neutral, making it difficult to test theory-driven hypotheses to move the field toward a deeper and more nuanced understanding of this relationship. In contrast, our findings are consistent with the fluid vulnerability theory of suicide (Rudd, 2006), as they suggest that veterans with PTSD may be at increased levels of baseline risk for suicide, which is then further increased by way of changes in anger and anger-related behavior that puts individual at especially high risk. For example, increases in anger may lead to interpersonal conflict, avoidant coping, and diminished social support (Diong et al., 2005), thereby decreasing the resources an

individual can draw upon to recover from a period of heightened distress and suicidality. Findings are also consistent with the interpersonal-psychological theory of suicide (Joiner, 2005). Given that anger has been found to be specifically related to the key suicidal ideation predictors of increased thwarted belongingness and perceived burdensomeness (Hawkins et al., 2014), increases in anger may result in increases in these risk factors as well.

Exploratory analyses also tentatively suggested that aggressive urges (e.g., “urges to beat, injure or harm someone”) may drive the association between PTSD and suicidal ideation to a greater degree than difficulties in managing anger (e.g., “getting in frequent arguments”), although these findings did not reach statistical significance. Though further research is needed to replicate these findings, this may suggest that a more detailed evaluation of which aspects of anger may be particularly problematic for suicide risk is warranted. Items in the “aggressive impulses” cluster reflect urges to break things and harm others, which may have the effect of “scaring off” potential sources of social support and lead to isolation. These urges may also result in greater feelings of guilt, shame, and internally-directed anger. Another way to interpret this finding is that particularly in individuals with PTSD or trauma, aggressive urges directed outward (toward harming others) may reflect a similar construct as aggressive urges directed inward (toward harming oneself). This would be consistent with research that has found a link between aggression and suicidality in adults with histories of childhood abuse (Harford et al., 2014; Swogger et al., 2011). It may be that the urges represented in these items appear more severe than behaviors reflected in the anger management factor, so presence of these urges may represent a more significantly elevated level of anger. These findings are consistent with research that has found that intermittent explosive disorder (IED)—a disorder characterized by a failure to control aggressive urges (APA, 2013)—was associated with higher odds of suicidal ideation and attempt among servicemembers (Nock et al., 2014). These findings are also consistent with research demonstrating a relationship between The suicide risk and impulsivity, which shares similarities with anger (see Gvion and Apter, 2011 for more detailed discussion). Taken together, our results tentatively suggest that aggressive or impulsive anger may be a particularly important variable to examine among veterans with PTSD.

It is also noteworthy that, unlike difficulty managing anger, the presence of aggressive urges may not be readily apparent to other people (e.g., treatment providers), given that the individuals are not necessarily acting upon them. Interestingly, our finding is similar to that of Kachadourian et al. (2018) who found that covert, but not overt, hostility was associated with suicidal ideation when covarying for PTSD severity and depressive symptoms in veterans with PTSD and alcohol dependence. We also know that failure to control these urges may be predictive of heightened suicide risk: In a large study of servicemembers, post-enlistment IED was the only mental disorder that predicted the transition from ideation to attempts (Nock et al., 2014). Taken together, this research highlights the potential importance of including questions about aggressive urges towards others in suicide risk assessments.

This study is not without limitations. Although the use of multiple time points for assessment allowed us to determine direction of the relationships between the variables, the period between time points was lengthy (6 months). This limits our ability to determine how

quickly, or at what rate, changes in PTSD contribute to suicidal ideation via changes in anger and how stable these symptoms and relationships are over time. In future research, ecological momentary assessment (EMA) designs, utilizing more frequent measures (e.g., hourly or daily assessment points), may help to clarify more precisely the time course of momentary/state anger as a mediator between PTSD and suicide. Additionally, the current study focused on suicide ideation rather than suicidal behaviors (e.g., attempts), limiting the ability to infer the role of anger and PTSD in suicide attempts. Given that suicidal ideation is a robust predictor of suicide, the findings of our study are an important step in investigating the role of anger as a risk factor for suicide. However, considering that the majority of ideators do not make a suicide attempt, it is important to identify risk factors that differentiate those who only ideate from those who attempt (Klonsky and May 2014). Additional longitudinal studies focused on predictors of suicidal behaviors/attempts could serve to reduce this limitation in future research. The study sample was primarily male, which limits our ability to generalize results to female veterans. Additionally, the sample was not necessarily representative of the current veteran population. The percentage of female veterans was equal to the percentage in the military at that time. Minorities were over-represented based on national averages, but were consistent with local demographics. These findings should be replicated using nationally-representative samples.

Findings from this study further highlight the importance of assessing anger and aggression when conducting suicide risk assessments with veterans. We found that changes in anger mediated the relationship between changes in PTSD symptoms and subsequent suicidal ideation. This suggests that increased anger and presence of aggressive impulses may be a particularly useful and temporally sensitive marker of suicide risk among veterans with PTSD. Many of the existing, commonly used suicide risk assessment tools do not ask about anger (e.g., Columbia-Suicide Severity Rating Scale; Posner et al., 2011). In fact, in a systematic review of suicide risk factors and risk assessment tools for veterans prepared for the Department of Veterans Affairs, neither anger nor any related constructs (i.e., irritability, hostility) were mentioned in the document (Haney et al., 2012).

Additionally, the current findings suggest that treatment for anger may reduce suicide risk among veterans with PTSD. Anger is a malleable and, therefore, potentially useful treatment target when attempting to reduce suicidal ideation. Veterans may benefit from receiving treatments for anger as an adjunctive treatment to trauma-focused treatments, or perhaps efforts can be made to target anger to a greater extent within these empirically-supported treatments for PTSD. Current research has found that reductions in anger following PTSD treatment are often quite modest, and that many patients are left with clinically significant residual anger symptoms (Schnurr and Lunney, 2019; Stapleton et al., 2006). Further research on the treatment of anger in PTSD may be necessary to reduce suicide risk. Additionally, given social support as a protective factor for suicide (Kleiman and Lui, 2013), interventions intended to enhance social support (e.g., couple/family therapy) may target anger and encourage more constructive ways of coping with such feelings while maintaining social support. It will be important in future studies to evaluate the study results in civilians, and also to identify which aspects of anger (and its reduction) may reduce suicide risk among veterans with PTSD.

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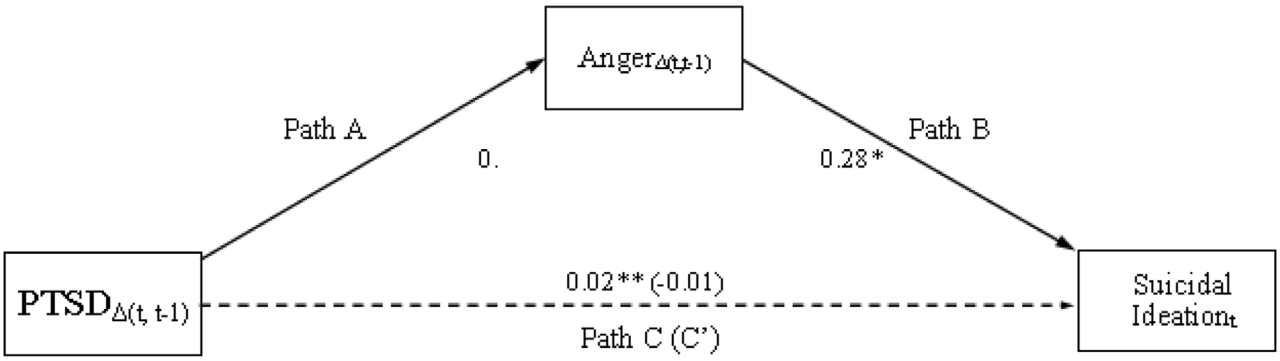
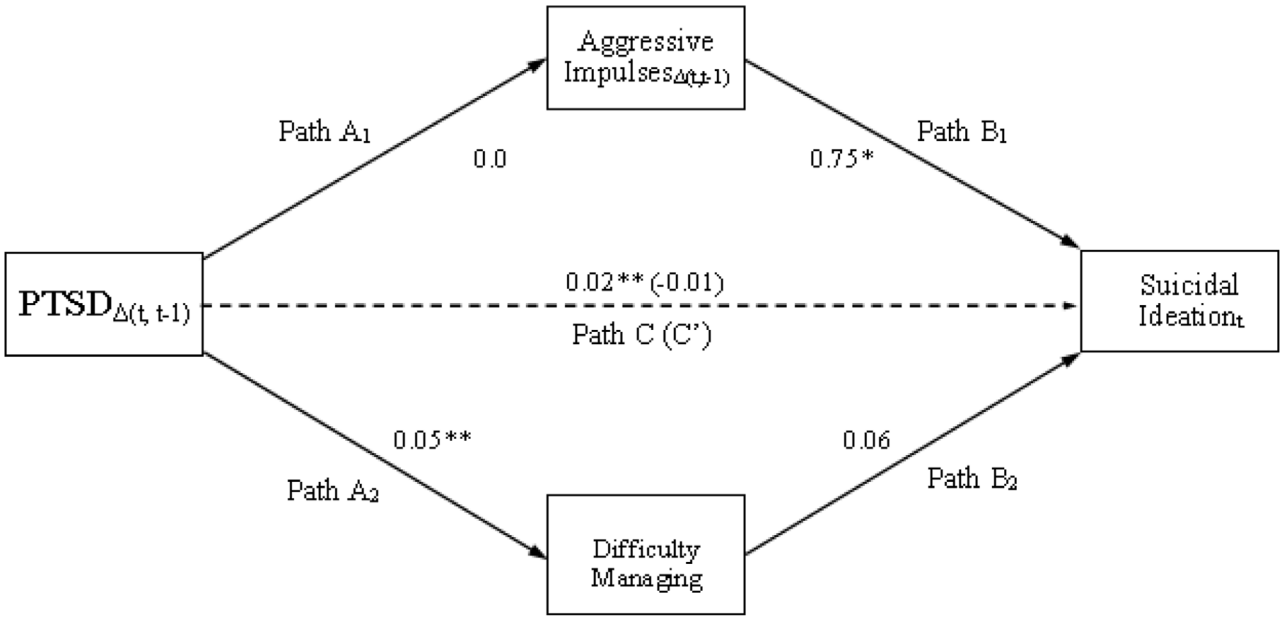



| Covariates | Anger$_{\Delta(t,t-1)}$ | Suicidal Ideation$_t$ |
|---|---|---|
| Age | -0.01 | -0.01 |
| Male Sex | 0.17 | -0.05 |
| Suicidal Ideation$_{t-1}$ | - | 0.28 |
| PTSD$_{t-1}$ | 0.05** | 0.01 |
| Anger$_{t-1}$ | -0.51** | 0.17† |
| Depression$_{t-1}$ | -0.02 | -0.01 |

**Fig. 1.**

Multilevel mediation model of the effect of changes in PTSD symptomatology on suicidal ideation via changes in anger. Changes scores were calculated by subtracting scores measured at wave *t−1* from those measured at wave *t*. Unstandardized regression coefficients are reported in the figure and table. The total and direct effect (in parentheses) of changes in PTSD symptomatology on suicidal ideation are reported above the dotted line, which represents the mediated effect. Covariate effects on the mediator and outcome variables are reported in the table. $^{\dagger}p < .10$, $*p < .05$, $**p < .01$.




| Covariates | Aggressive Impulses$_{\Delta(t,t-1)}$ | Difficulty Managing Anger$_{\Delta(t,t-1)}$ | Suicidal Ideation$_t$ |
|---|---|---|---|
| Age | -0.01 | -0.01 | -0.01 |
| Male Sex | 0.11 | 0.14 | -0.02 |
| Suicidal Ideation$_{t-1}$ | - | - | 0.26 |
| PTSD$_{t-1}$ | 0.02** | 0.05** | 0.01 |
| Aggressive Impulses$_{\Delta t-1}$ | -0.74** | - | 0.51 |
| Difficulty Managing Anger$_{\Delta t-1}$ | - | -0.70** | 0.03 |
| Depression$_{t-1}$ | -0.00 | 0.00 | -0.01 |

**Fig. 2.**

Multilevel mediation model of the effect of changes in PTSD symptomatology on suicidal ideation via changes in aggressive impulses and difficulty managing anger. Changes scores were calculated by subtracting scores measured at wave *t−1* from those measured at wave t. Unstandardized regression coefficients are reported in the figure and table. The total and direct effect (in parentheses) of changes in PTSD symptomatology on suicidal ideation are reported above the dotted line, which represents the mediated effect. Covariate effects on the mediator and outcome variables are reported in the table. *$p < .05$, **$p < .01$.

**Table. 1**

Baseline descriptive statistics and zero-order intercorrelations.

| Variable | *M* (*SD*) | 1. | 2. | 3. | 4. | 5. | 6. | 7. |
|---|---|---|---|---|---|---|---|---|
| 1. Age | 39.92 (10.53) | – | – | – | – | – | – | – |
| 2. Male gender (male=1) | 0.84 (0.37) | .08 | – | – | – | – | – | – |
| 3. BDI-II[a] | 13.97 (12.02) | −.14* | −.05 | – | – | – | – | – |
| 4. DTS[b] | 37.35 (34.96) | −.13* | −.05 | .79*** | – | – | – | – |
| 5. SCL-Hostility | 4.19 (5.02) | −.23*** | .02 | .76*** | .67*** | – | – | – |
| 6. Aggressive Impulses | 0.85 (1.60) | −.20*** | .05 | .60*** | .50*** | .83*** | – | – |
| 7. Difficulty managing anger | 3.34 (3.79) | −.22*** | .00 | .75*** | .68*** | .97*** | .68*** | – |
| 8. BSI | 0.77 (2.73) | −.06 | .07 | .39*** | .33*** | .41*** | .44*** | .36*** |

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**Table. 2**

Correlations between baseline variables and SI at 6 and 12 months.

| Baseline variable | SI at 6 months | SI at 12 months |
|---|---|---|
| Age | −.05 | −.11 |
| Gender | −.01 | .08 |
| Depression[a] | .33*** | .23*** |
| PTSD[b] | .32*** | .22*** |
| Anger | .29*** | .22*** |
| Aggressive impulses | .26*** | .22*** |
| Difficulty managing anger | .27*** | .20** |