American Psychological Association
Division 56 Trauma Psychology American Psychological Association

Psychological Trauma:
Theory, Research, Practice, and Policy

ISSN: 1942-9681

2020, Vol. 12, No. 6, 619–626
http://dx.doi.org/10.1037/tra0000579

The Mediating Effect of Rumination Between Posttraumatic Stress Disorder Symptoms and Anger Reactions

Nicole M. Christ
University of Toledo

Ateka A. Contractor
University of North Texas

Xin Wang
University of Toledo

Jon D. Elhai
University of Toledo

Objective: The relationship between posttraumatic stress disorder (PTSD) and anger is well established. However, further investigation into the underlying mechanisms of this PTSD–anger relationship is needed. Rumination, a construct with a known association to PTSD symptoms, theoretically may mediate this PTSD–anger relationship. ***Design:*** We conducted a mediational model using self-report measures of PTSD symptoms, rumination, and anger reactions from a nonclinical, trauma-exposed sample ($N = 339$) through Amazon's Mechanical Turk. ***Results:*** Rumination mediated overall PTSD symptoms and anger reactions, controlling for age and gender identity. Further analyses examined this mediating role between PTSD subscale scores and anger. Rumination mediated all PTSD subscales and anger when modeled separately. After adjusting for other PTSD symptoms, only 2 subscales' relationship with anger remained mediated by rumination: negative alterations in cognitions/mood and physiological arousal. ***Conclusions:*** Rumination should be assessed in the context of PTSD and anger symptoms, specifically physiological arousal and negative moods/cognitions symptoms in PTSD.

Clinical Impact Statement

The findings of this study suggest that rumination is important in understanding the relationship between posttraumatic stress disorder (PTSD) symptoms and elevated experiences of anger and problematic anger reactions. While rumination affects the relationship between global PTSD symptoms and problematic anger, it appears to be particularly salient in those experiencing elevated PTSD symptoms of physiological arousal and negative alterations in cognitions/mood. Therefore, interventions for individuals who experience more pervasive negative cognitions and moods and/or physiological arousal may benefit from additional emphasis on altering cognitive patterns of rumination directly, as doing so may result in a more enduring reduction in problematic anger reactions.

Keywords: rumination, anger, PTSD, psychological trauma, mediation

Anger is a natural emotion that has functional and adaptive value, and as such, experiencing feelings of anger does not automatically denote a clinical problem. Instead, it is the contextual nature of anger reactions, such as frequency, intensity, and expression, that may result in negative consequences or otherwise maladaptively interfere in an individual's functioning that may indicate clinical or problematic anger. To illustrate, while anger is commonly experienced during a traumatic event, elevated trait anger following trauma exposure inhibited recovery outcomes in trauma-focused exposure treatment (Foa, Riggs, Massie, & Yarczower, 1995).

The relationship between posttraumatic stress disorder (PTSD) symptoms and enduring problematic anger, specifically concerning the role anger plays in aggression and externalizing behaviors, is well established (Durham, Byllesby, Armour, Forbes, & Elhai, 2016; Durham, Byllesby, Lv, Elhai, & Wang, 2018; Taft, Creech, & Murphy, 2017). This relationship is found in veterans and civilians (Taft et al., 2017), as well as clinical (Claycomb et al., 2016; Germain, Kangas, Taylor, & Forbes, 2016) and nonclinical (Durham et al., 2016) samples demonstrating PTSD symptoms. Further, trait anger is shown to predict other externalizing or risky

This article was published Online First April 16, 2020.

Nicole M. Christ, Department of Psychology, University of Toledo; Ateka A. Contractor, Department of Psychology, University of North Texas; Xin Wang, Department of Psychiatry, University of Toledo; Jon D. Elhai, Department of Psychology and Department of Psychiatry, University of Toledo.

The data reported in this article have been previously published and/or were collected as part of a larger data collection at one point in time. Findings from the data collection have been reported in separate manuscripts. MS 1 (published) focuses on PTSD symptoms and anger, while MS 2 (published) focuses on PTSD symptoms and dissociation. MS 3 (the current article) focuses on variables PTSD symptoms, anger, and rumination.

Correspondence concerning this article should be addressed to Jon D. Elhai, Department of Psychology and Department of Psychiatry, University of Toledo, 2801 West Bancroft Street, Toledo, OH 43606. E-mail: contact@jon-elhai.com

behaviors (e.g., impulsivity, hostility, violence) in PTSD (Armour, Contractor, Shea, Elhai, & Pietrzak, 2016; Contractor, Armour, Wang, Forbes, & Elhai, 2015; Jakupcak et al., 2007; Novaco & Chemtob, 2015).

Given this link between PTSD symptoms, anger, and externalizing behaviors, there has been emerging research exploring the role of cognitive processes among these constructs and other experiences comorbid with PTSD. Recently, externalized risky behaviors were associated with higher scores on measures of psychopathology and cognitive processes, including PTSD and rumination (Contractor, Weiss, Dranger, Ruggero, & Armour, 2017). Rumination is often defined as repetitive focus on the experience of distress, as well as related causes and consequences of the distress (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Evidence suggests that rumination may have an important role in the development and maintenance of internal emotional experiences and emotion-driven behaviors, including anger and anger expression (Novaco, 1979; Simpson & Papageorgiou, 2003). Further, studies have examined trauma-related rumination and efforts to control anger in the context of PTSD (Germain et al., 2016). While findings suggest ruminative tendencies impact the PTSD–anger relationship (Ehlers, Mayou, & Bryant, 1998), no studies have examined general or trait rumination and resulting anger reactions as outcomes of PTSD symptom severity. Given the association of PTSD and rumination, as well as the role of rumination in maintaining anger, we propose anger could be related to PTSD through excessive rumination, which may lengthen the duration of the anger experience. Thus, the current study explores how ruminative thought style may explain the relationship between self-reported PTSD symptoms and anger reactions.

PTSD and Anger

Several theoretical models have been proposed to explain the significant relationship between PTSD and anger. We discuss two notable theories relevant to this study. First, Foa and colleagues (1995) suggest anger in PTSD acts as fear avoidance, stating that anger is used as an avoidant coping strategy in place of trauma-related fear. As such, individuals who reported more anger prior to treatment more often engaged in anger expressions to cope with distress from trauma-related stimuli without confronting and processing vulnerable emotions, such as fear.

Another important theory explaining the PTSD–anger relationship assumes regulatory deficits in anger-related domains for an individual with PTSD due to the survival value of anger in life-threatening situations (Chemtob, Novaco, Hamada, Gross, & Smith, 1997). This "survival mode" theory explains that while an individual's experience of anger and subsequent engagement in anger-related behavior in a threatening situation (such as trauma exposure) may be adaptive, it becomes maladaptive when the individual perceives threat in nonthreatening situations, as is common in PTSD. Based on a physiological–cognitive–behavioral model of anger (Novaco, 1994), in these instances, individuals with PTSD may respond with physiological arousal, hostile appraisal, and aggressive or harmful behaviors, thereby failing to regulate their anger intensity and expression. This anger dysregulation becomes a pattern due to an increased vulnerability of individuals with PTSD to perceive more situations are threatening, thereby activating a "survival mode" anger response and reinforcing further perception of their environment as threatening (Chemtob et al., 1997; Novaco & Chemtob, 2002).

PTSD and Rumination

The cognitive model of PTSD according to Ehlers and Clark (2000) postulates that PTSD symptoms are developed and maintained by negative appraisals of the traumatic event and/or trauma sequelae. These appraisals can include interpretations of PTSD symptoms, others' reactions following the trauma, or perceived consequences of the trauma, generating a sense of serious current threat even though the trauma event is over (Ehlers & Clark, 2000). A similar cognitive construct, rumination, is linked to the development and maintenance of various types of psychopathology, specifically anxiety and mood-related disorders (Nolen-Hoeksema et al., 2008; Ruscio, Seitchik, Gentes, Jones, & Hallion, 2011; Wisco & Nolen-Hoeksema, 2008), including the maintenance of PTSD (Birrer & Michael, 2011; Borders, McAndrew, Quigley, & Chandler, 2012; Michael, Halligan, Clark, & Ehlers, 2007).

Given this association, and based on the aforementioned cognitive model, it is possible that individuals engage in rumination in an attempt to reduce their distress or prevent repeated trauma, which they expect to occur due to the persistent negative appraisals of trauma-related stimuli. Such appraisals may be based on external cues in the environment or internal cues by thoughts, sensations, or emotions that serve to warn of impending threat. Additionally, rumination is associated with PTSD and various comorbid symptoms, such as symptoms of depression (Roley et al., 2015), anxiety, and risky behaviors (Borders et al., 2012).

Rumination and Anger

While directional effects can be difficult to establish, rumination has been implicated as a developing and maintaining factor in anger and anger expression (Novaco, 1979; Simpson & Papageorgiou, 2003). In PTSD, content-specific rumination, such as anger- or trauma-related rumination, predicts anger and aggression (Germain et al., 2016). Further, rumination is associated with other externalized and risky behaviors, such as self-harm and binge drinking (Collins & Bell, 1997; Nolen-Hoeksema et al., 2008). In veterans, there was a significant interaction effect of psychiatric symptoms and moderate to severe rumination on various risky behaviors (Borders et al., 2012). These findings suggest individuals with elevated PTSD symptoms and general ruminative thought styles may be acutely vulnerable to experience feelings of anger, which may result in externalizing and potentially harmful behaviors. Examining this hypothesized relationship is the primary aim of the current study.

Study Aims: The Role of Rumination in the PTSD–Anger Relationship

As described above, individuals with elevated PTSD symptoms experience more problematic anger reactions than those with lower PTSD symptoms (Forbes, Alkemade, Hopcraft, et al., 2014; Jakupcak et al., 2007). They also engage in more ruminative thought (Birrer & Michael, 2011; Borders et al., 2012; Germain et al., 2016). Existing studies exploring the association among all three

constructs are limited in their generalizability, though, due to narrow sample demographics (e.g., veterans) and use of construct-limited measures (Borders et al., 2012; Germain et al., 2016). Further, underlying mechanisms of these relationships are poorly understood, and while previous research found rumination interacts with psychiatric symptoms on risky behaviors (Borders et al., 2012), an explanatory role of rumination in the PTSD–anger relationship has not been explicitly investigated. In this study, we aimed to address this gap by examining rumination's mediating role in relation to PTSD and anger reactions.

We first hypothesized that PTSD symptoms would be positively associated with anger reactions. Second, we hypothesized that general rumination would mediate the relationship between global PTSD symptoms and anger reactions. Because age (Schieman, 1999) and gender identity (Kopper & Epperson, 1996; Milovchevich, Howells, Drew, & Day, 2001; Worthen et al., 2014) are associated with PTSD, rumination, and anger, they were included as covariates. Third, we assessed whether rumination explains the relationship between symptom clusters of PTSD and anger. Finally, we examined if rumination accounted for the relationship between one or more PTSD subscales and anger above others by accounting for the effects of all other PTSD subscales.

Method

Participants and Procedure

With approval from a midwestern U.S. university's institutional review board, we recruited participants from Amazon's Mechanical Turk (Mturk) Internet labor market, often used for data collection in social science research (Shapiro, Chandler, & Mueller, 2013). While often considered to introduce selection bias, collecting data via Mturk allows several advantages over other sampling approaches (Landers & Behrend, 2015), including a slightly more diverse sample than traditional Internet or college sampling methods (Buhrmester, Kwang, & Gosling, 2011; Mishra & Carleton, 2017), while representing overall mental health prevalence in the general population (Shapiro et al., 2013; van Stolk-Cooke et al., 2018). Data collected via this online platform are at least as reliable as traditional data collection methods (Buhrmester et al., 2011; Shapiro et al., 2013). In exchange for a 15- to 25-min web survey, we offered 75 cents to participants' Amazon Payment accounts. Interested participants were routed to a web-based consent statement and, for those who agreed to continue, a web survey hosted on psychdata.com.

Only North American respondents who spoke English were eligible for the study, which we verified using online screening. Study participants were at least age 18 and required an Mturk account, verified by credit check and identity verification. After screening for trauma (see below in the Instruments section), data were collected from a total of 394 trauma-exposed adults.

Instruments

Stressful Life Events Screening Questionnaire. Participants were screened for lifetime exposure to potential traumatic experiences (PTEs) using the Stressful Life Events Screening Questionnaire (SLESQ; Goodman, Corcoran, Turner, Yuan, & Green, 1998), adapted for *DSM–5* (American Psychiatric Association [APA], 2013) PSTD criteria (Elhai et al., 2012). Participants were instructed to respond "yes" or "no" regarding whether they previously experienced 12 PTEs or any additional PTE described as "other." If they endorsed more than one PTE, they were asked to indicate which event has been most distressing to them in the past month (i.e., the index trauma) and to rate symptoms in the next questionnaire (PTSD Checklist–5 [PCL-5]) based on that PTE.

PCL-5. The PCL-5 (Weathers et al., 2013) consists of 20 self-report items designed to assess symptoms in accordance with the changes in *DSM–5* (APA, 2013) criteria for PTSD. The PCL-5 uses a scale from 0 (*not at all*) to 4 (*extremely*). Overall, the PCL-5 demonstrates excellent validity and reliability. An evaluation of its psychometric properties (Blevins, Weathers, Davis, Witte, & Domino, 2015) found that, compared to other measures of PTSD, the PCL-5 demonstrated high internal consistency (Cronbach's $\alpha = .94$; current study $\alpha = .96$) and good test–retest reliability ($r = .82$).

Ruminative Thought Style Questionnaire. The Ruminative Thought Style Questionnaire (RTSQ; Brinker & Dozois, 2009) is a 20-item self-report measure that assesses a unitary construct of general ruminative thinking. It utilizes a 7-point Likert scale for each item, ranging from 1 (*does not describe me at all*) to 7 (*describes me very well*). Higher scores on this measure are indicative of more rumination. This measure shows high internal consistency (Cronbach's $\alpha = .95$; current study $\alpha = .91$; Brinker & Dozois, 2009), as well as good convergent validity with scales measuring similar constructs (Brinker & Dozois, 2009).

Dimensions of Anger Reactions–5. The Dimensions of Anger Reactions–5 (DAR-5; Forbes, Alkemade, Mitchell, et al., 2014) scale is a five-item self-report measure that assesses dimensions of anger reactions, particularly the experience of anger in individuals who have been exposed to traumatic events. Rather than recording a unitary measure regarding the level of anger as an emotion, this scale assesses the construct of problematic anger by employing items with content pertaining to anger reactions over the past 4 weeks, such as its frequency, intensity, duration, interpersonal aggression, and interference in social functioning (Forbes, Alkemade, Mitchell, et al., 2014). Each item is rated on a 5-point Likert scale ranging from 1 (*none of the time*) to 5 (*all of the time*). The DAR-5 has consistently demonstrated high internal consistency (Cronbach's α ranging from .88 to .94; current study $\alpha = .96$; Durham et al., 2016; Forbes, Alkemade, Hopcraft, et al., 2014; Forbes, Alkemade, Mitchell, et al., 2014). The utility of the DAR-5 as a reliable and valid measure of trait anger has been replicated in a sample of combat veterans with PTSD (Forbes, Alkemade, Hopcraft, et al., 2014). Although anger is included in assessments for PTSD, such as evaluating negative mood states such as anger and hyperarousal, including irritability, in our study, DAR-5 and PTSD anger (PCL-5 Item 15) were significantly correlated, $r = .64$, $p < .001$, yet distinct, supporting previous research that the DAR-5 and PCL-5 measure separate, independent, but correlated constructs of anger (Forbes, Alkemade, Hopcraft, et al., 2014; Forbes, Alkemade, Mitchell, et al., 2014; Forbes, Hawthorne, et al., 2004).

Exclusions and Treatment of Missing Data

Of the 394 participants, we excluded 55 individuals from analysis: 32 for invalid responses to screening questions, 13 providing

no gender identity, and 10 skipping multiple survey instruments or missing more than 30% of the items on more than two instruments. The remaining 339 subjects served as the effective sample.

We first estimated missing item-level data using maximum likelihood (ML) procedures with the expectation-maximization algorithm (Graham, 2009) in respondents missing less than 30% of the items on all three measures. We then summed item responses to derive total scores. Subjects missing more than 30% on one or two primary measures were included, and total scores for these participants were estimated with the same procedures as used for item-level data.

Effective Sample Characteristics

Demographic characteristics were reported. Among the effective sample, 215 participants (63.4%) were female. The average age was 36.53 years (SD = 12.76; range = 18–74). The sample approximated current U.S. race and ethnic origin population estimates (U.S. Census Bureau, 2018), as the majority were White (77.6%), with 34 individuals identifying as Asian, 25 as African American, 23 as American Indian or Alaskan Native, and 47 as Hispanic or Latino (rates are nonmutually exclusive). More than half of the sample completed at least a bachelor's degree (53%) or had some college education (35%). Most participants reported full-time (53%) or part-time (14%) employment. Annual household income was less than $25,000 for 33.0%, between $25,000 and $50,000 for 30%, $50,000–$80,000 for 22%, and $80,000+ for 15% of individuals, demonstrating approximately two thirds of our sample reported household income below the national average (U.S. Census Bureau, 2018). Slightly below half of the sample reported being currently married (45%).

Statistical Analyses

Primary analyses. All total scores were assessed for normality (Curran, West, & Finch, 1996). Descriptive statistics for the primary measures' total scores and PCL-5 subscale scores are included in Table 1, along with Pearson correlations and coefficient alpha values. We conducted mediation analyses as path analysis models in Mplus v.8, using ML estimation for the model. We employed the Delta method to estimate the standard error of the indirect effect by calculating the cross-product of two direct path coefficients (MacKinnon, Fairchild, & Fritz, 2007) and used nonparametric bootstrapping of standard errors across 1,000 samples (MacKinnon, 2008). Reported model fit indices were assessed in relation to the conventional standards of goodness of fit (Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999) demonstrated by the comparative fit index (CFI), Tucker–Lewis Index (TLI), root mean square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR).

Mediation analyses. Total scores on the PCL-5, RTSQ, and DAR-5 were used to reflect PTSD symptoms, rumination, and anger, respectively. PCL-5 subscales based on *DSM*-5 (APA 2013) criteria were used as observed variables. Six mediational analyses were conducted. Direct effects included relationships between (a) PTSD symptoms (overall and subscale scores) and rumination, (b) rumination and anger, and (c) PTSD symptoms (overall and subscale scores) and anger. The effect of PTSD symptoms on anger accounting for rumination was the analyzed indirect effect in all models. PTSD Criterion E1 was not removed from analyses as previous literature has demonstrated that a strong relationship between PTSD symptoms and anger persisted even with the removal of PTSD's anger criterion (Durham et al., 2016; Forbes, Hawthorne, et al., 2004; Novaco & Chemtob, 2002). Furthermore, as the PTSD anger criterion is a limited, unitary construct of externalized expressed anger, the DAR-5 allows for a more comprehensive view of an individual's experience of anger. We modeled age and gender identity as covariates in all analyses to control for their effects on anger, based on findings that higher levels of anger relate to younger age (Schieman, 1999) and mixed results on gender identity and experiences of anger (Kopper & Epperson, 1996; Milovchevich et al., 2001; Worthen et al., 2014).

Our primary analysis examined rumination as a mediator in the relationship between total PTSD symptoms and anger reactions (see Figure 1). Secondary and tertiary mediational analyses were conducted, examining rumination mediating PTSD subscales and anger. Secondary analyses consisted of four independent multiple regression analyses (see Table 2), one for each of the *DSM–5* PTSD subscales modeled as the predictor variable. Tertiary analyses examined multivariate effects by regressing anger on each of the four subscales concurrently, to adjust for all PTSD

Table 1
Descriptive Statistics, Zero-Order Intercorrelations, and Coefficient Alphas for the Primary Measure Summed Scores

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. PCL-5	31.85	20.58	(.960)						
2. PCL-B	13.03	5.55	.905*	(.903)					
3. PCL-C	5.82	2.52	.777*	.733*	(.853)				
4. PCL-D	17.57	7.86	.934*	.764*	.641*	(.912)			
5. PCL-E	15.00	6.78	.927*	.774	.647*	.815*	(.897)		
6. RTSQ	82.92	29.81	0.568*	.492*	.444*	.548*	.543*	(0.911)	
7. DAR-5	11.41	5.22	0.614*	.510*	.411*	.604*	.609*	0.548*	(0.963)

Note. Coefficient alpha values appear in parentheses on the diagonal. PCL-5 = PTSD Checklist–5 Total Score; PCL-B = Re-experiencing Subscale of PCL-5; PCL-C = Avoidance Subscale of PCL-5; PCL-D = Negative Alterations in Cognitions/Mood Subscale of PCL-5; PCL-E = Physiological Arousal Subscale of PCL-5; RTSQ = Ruminative Thought Style Questionnaire; DAR-5 = Dimensions of Anger Reactions–5.
* $p < .001$.

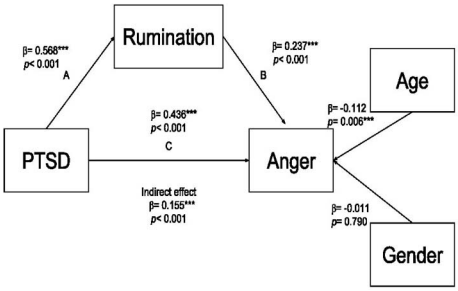

Figure 1. Mediating effect of rumination on posttraumatic stress disorder (PTSD) symptom severity and anger reactions. Standardized path coefficients are reported. *** $p < .001$.

symptoms, while accounting for mediating effects of rumination (see Figure 2).

Results

Descriptive Statistics

The three most commonly endorsed PTEs were sudden and/or violent death (49%), physical assault (47%), and sexual assault (42%). The most commonly endorsed index PTEs were sudden and/or violent death (20%), life-threatening illness (14%), and life-threatening accident (11%). Overall, participants endorsed an average of 4.71 (SD = 2.87; range = 1–13) lifetime PTEs. No primary measures violated assumptions of normality. Significant bivariate Pearson correlations were found among all measures, including PCL-5 subscales. According to cutoff criteria, 136 (39%) of trauma-exposed participants met a score for probable PTSD (Bovin et al., 2016; Wortmann et al., 2016) with a total score of 33 or greater on the PCL-5.

Mediation Analyses

The structural model (see Figure 1) demonstrated good model fit, although the goodness-of-fit indices were mixed as some suggested excellent fit (CFI = .972; SRMR = .034), some were adequate (TLI = .901), and others suggested poorer model fit, $\chi^2(2, N = 339) = 11.516$, $p = .003$, and RMSEA = 0.118, 90% CI [0.059, 0.189]. There was a significant inverse association between age and anger ($\beta = -0.112$, $SE = 0.04$, $p = .006$), indicating more severe anger reactions were reported in younger ages. In other words, an increase of 1 SD units in anger is associated with .112 SD units lower in age. Gender identity was not a significant covariate for its effects on anger ($\beta = -0.023$, $SE = 0.002$, $p = .79$). Adjusting for age and gender identity, there were significant direct effects (all ps $< .001$) of PTSD on rumination ($\beta = 0.568$, $SE = 0.042$), rumination on anger ($\beta = 0.273$, $SE = 0.049$), and PTSD on anger ($\beta = 0.436$, $SE = 0.048$). The indirect effect was significant, indicating that rumination mediated the relationship between PTSD and anger ($\beta = 0.155$, $SE = 0.029$, $p < .001$).

Next, individual mediation analyses between each PTSD subscale and anger were conducted. Direct and indirect effects for each model are reported in Table 2. Rumination significantly mediated the relationship between each PTSD subscale and anger (all ps $< .001$). Age remained a significant covariate in all mediation analyses (ps ranged from .001 to .018).

Finally, multivariate effects were examined (see Figure 2). By modeling all subscale scores as predictors, we examined mediation across multiple independent variables simultaneously while adjusting for the effects of other PTSD symptoms. Our results show rumination mediated the relationship between PTSD's arousal subscale and anger ($\beta = 0.060$, $SE = 0.024$, $p = .014$) and PTSD's negative alterations in cognitions and moods subscale and anger ($\beta = 0.073$, $SE = 0.026$, $p = .004$). Results indicated the following significant direct effects: PTSD's arousal subscale on rumination ($\beta = 0.224$, $SE = 0.082$, $p = .006$) and on anger ($\beta = 0.296$, $SE = 0.086$, $p = .001$), PTSD's moods/cognitions scale on rumination ($\beta = 0.274$, $SE = 0.078$, $p < .001$) and on anger ($\beta = 0.212$, $SE = 0.084$, $p = .012$), and rumination on anger ($\beta = 0.267$, $SE = 0.048$, $p < .001$). All direct and indirect effects for the reexperiencing and avoidance subscales of PTSD were nonsignificant. Age remained a significant covariate in this model ($\beta = -0.099$, $SE = 0.041$, $p = .016$).

Discussion

Consistent with prior research, individuals who endorsed higher PTSD symptom severity also reported elevated anger reactions. We found this association was mediated by the cognitive process of rumination, supporting our main hypothesis. Although cross-sectional, these findings are consistent with theory (Beck, 1970) as well as biological findings (Ochsner & Gross, 2008) that cognitive processes influence emotional and behavioral responses. Importantly, this justifies our use of a mediational model despite the cross-sectional nature of the data according to the guidelines of mediation set forth by Baron and Kenny (1986), as it demonstrates the directional influence of the mediator variable (i.e., rumination) on the outcome variable (i.e., anger reactions) despite the lack of temporal differences. Notably, our use of structural equation mod-

Table 2
Mediating Role of Rumination Between Posttraumatic Stress Disorder Clusters and Anger

	Path A		Path B		Path C		Indirect effect	
Model by symptom cluster	β	p	β	p	β	p	β	p
B. Intrusions → Rumination → Anger	0.486	<.001	0.367	<.001	0.310	<.001	0.178	<.001
C. Avoidance → Rumination → Anger	0.440	<.001	0.418	<.001	0.225	<.001	0.184	<.001
D. NACM → Rumination → Anger	0.544	<.001	0.301	<.001	0.411	<.001	0.164	<.001
E. AAR → Rumination → Anger	0.536	<.001	0.291	<.001	0.428	<.001	0.156	<.001

Note. NACM = negative alterations in cognition and mood; AAR = alterations in arousal and reactivity.

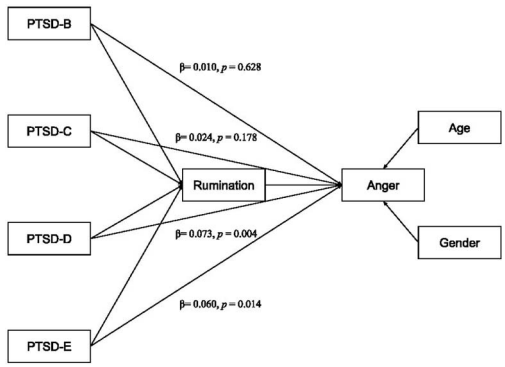

Figure 2. Multivariate effects on the mediating role of rumination in the relationship between *DSM–5* posttraumatic stress disorder (PTSD) subscales and anger.

eling in lieu of standard regression methods for mediation analyses allowed us to extend our analyses to examine multivariate effects of multiple independent variables (Gunzler, Chen, Wu, & Zhang, 2013).

Our first hypothesis was supported, as we found increased PTSD symptom severity was associated with increased severity of anger reactions. This finding is consistent with previous literature (Armour et al., 2016; Durham et al., 2016; Taft et al., 2017), highlighting the importance of assessing and treating externalizing symptoms of PTSD, such as anger, which is conceptualized as a mobilizing emotion (Chemtob et al., 1997). This relationship suggests these individuals may be at greater risk for other externalizing behaviors commonly associated with anger, including problematic behaviors such as impulsivity (Contractor et al., 2015; Heinz, Makin-Byrd, Blonigen, Reilly, & Timko, 2015), aggression and hostility (Jakupcak et al., 2007), substance use (Forbes et al., 2008), and other reckless and/or self-destructive behaviors (Dyer et al., 2009; Kuhn, Drescher, Ruzek, & Rosen, 2010). Externalized behaviors such as these are often life-interfering, as they diverge from societal norms and can have a negative impact on both physical and mental health (Chen et al., 2006).

Given this established relationship between PTSD symptom severity and anger, our second hypothesis was supported by a significant mediating effect of ruminative tendencies. While the literature has examined relationships between PTSD and both anger and rumination (Borders et al., 2012; Germain et al., 2016), our study takes a novel approach by illustrating that general rumination accounts for significant variance in the relationship between PTSD and problematic anger. Independently, all subscales were significantly associated with anger, which supports subscale-level models of PTSD and anger (Claycomb et al., 2016; Durham et al., 2018; Hellmuth, Stappenbeck, Hoerster, & Jakupcak, 2012). While Hellmuth and colleagues (2012) found significant paths from all *DSM–IV* (American Psychiatric Association, 2000) PTSD clusters to trait anger or aggression, our results showed that when accounting for all other *DSM–5* PTSD clusters, only negative moods/cognitions and hyperarousal were directly predictive of anger reactions.

These findings have clinical implications such that interventions may benefit from placing additional emphasis on altering cognitive patterns and internal behaviors, such as an individual's tendency to engage in ruminative and perseverative thought patterns, in order to enhance the effectiveness of treatment by reducing interfering externalized behaviors. Thus, in clinical samples, it may be imperative to reduce rumination in treatment in order to achieve optimal and enduring reductions of problematic anger and related behaviors, rather than targeting those behaviors without cognitive intervention. Therefore, at the onset of treatment, if it is identified that an individual who has elevated PTSD symptoms engages in ruminative thought and problematic anger reactions, treatment can be adapted to simultaneously target these symptoms, which may result in better physical and mental health outcomes. Of note, as the mean PCL-5 score in our sample was below the cutoff for probable PTSD, our findings demonstrate that these relationships are not bound by diagnostic restrictions and suggest that rumination mediates the relationship between subthreshold PTSD symptoms and anger reactions as well.

This study holds a few limitations. First, the data were collected via self-report measures through online collection instead of through clinical interviewing to assess for symptom presence and severity. As such, we did not examine information regarding the timing or severity of subject PTEs. Further, no information regarding psychosocial or psychiatric history was formally collected (i.e., via clinical interview), including information on comorbid conditions, history of aggression, violence, or antisocial behavior. This study used cross-sectional sampling, and thus longitudinal studies should be conducted to replicate and expand our findings as no conclusions about causality can be drawn based on a correlational research design. Finally, the resulting model was acceptable, although the reported goodness-of-fit indices were mixed, suggesting the model was not optimal in analyzing our data, and these results should be replicated to determine if model fit improves.

The findings and advantages of this study provide a strong foundation for further investigation into the function and influence cognitive factors have on externalizing symptoms of PTSD. Specifically, these findings suggest that rumination may be a mechanism of clinical interest that could be an effective intervention target. Targeting this pathway could disrupt the mechanisms that lead to problematic anger reactions and thus reduce externalized behavior in this population while simultaneously improving trauma-related coping mechanisms.

References

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5)*. Washington, DC: American Psychiatric Pub.

Armour, C., Contractor, A., Shea, T., Elhai, J. D., & Pietrzak, R. H. (2016). Factor structure of the PTSD checklist for *DSM–5:* Relationships among symptom clusters, anger, and impulsivity. *Journal of Nervous and Mental Disease, 204,* 108–115. http://dx.doi.org/10.1097/NMD.0000000000000430

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173–1182. http://dx.doi.org/10.1037/0022-3514.51.6.1173

Beck, A. T. (1970). Cognitive therapy: Nature and relation to behavior therapy. *Behavior Therapy, 1,* 184–200. http://dx.doi.org/10.1016/S0005-7894(70)80030-2

Birrer, E., & Michael, T. (2011). Rumination in PTSD as well as in traumatized and non-traumatized depressed patients: A cross-sectional clinical study. *Behavioural and Cognitive Psychotherapy, 39,* 381–397. http://dx.doi.org/10.1017/S1352465811000087

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The Posttraumatic Stress Disorder Checklist for *DSM–5* (PCL-5): Development and initial psychometric evaluation. *Journal of Traumatic Stress, 28,* 489–498. http://dx.doi.org/10.1002/jts.22059

Borders, A., McAndrew, L. M., Quigley, K. S., & Chandler, H. K. (2012). Rumination moderates the associations between PTSD and depressive symptoms and risky behaviors in U.S. veterans. *Journal of Traumatic Stress, 25,* 583–586. http://dx.doi.org/10.1002/jts.21733

Bovin, M. J., Marx, B. P., Weathers, F. W., Gallagher, M. W., Rodriguez, P., Schnurr, P. P., & Keane, T. M. (2016). Psychometric properties of the PTSD Checklist for *Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition* (PCL-5) in veterans. *Psychological Assessment, 28,* 1379–1391. http://dx.doi.org/10.1037/pas0000254

Brinker, J. K., & Dozois, D. J. A. (2009). Ruminative thought style and depressed mood. *Journal of Clinical Psychology, 65,* 1–19. http://dx.doi.org/10.1002/jclp.20542

Buhrmester, M., Kwang, T., & Gosling, S. D. (2011). Amazon's Mechanical Turk: A new source of inexpensive, yet high-quality, data? *Perspectives on Psychological Science, 6,* 3–5. http://dx.doi.org/10.1177/1745691610393980

Chemtob, C. M., Novaco, R. W., Hamada, R. S., Gross, D. M., & Smith, G. (1997). Anger regulation deficits in combat-related posttraumatic stress disorder. *Journal of Traumatic Stress, 10,* 17–36. http://dx.doi.org/10.1002/jts.2490100104

Chen, L., Evans, D., Evans, T., Sadana, R., Stilwell, B., Travis, P., . . . Zurn, P. (2006). Working together for health. *World Health Report*. Geneva, Switzerland: World Health Organization.

Claycomb, M., Roley, M. E., Contractor, A. A., Armour, C., Dranger, P., Wang, L., & Elhai, J. D. (2016). The relationship between negative expressivity, anger, and PTSD symptom clusters. *Psychiatry Research, 243,* 1–4. http://dx.doi.org/10.1016/j.psychres.2016.06.012

Collins, K., & Bell, R. (1997). Personality and aggression: The Dissipation-Rumination Scale. *Personality and Individual Differences, 22,* 751–755. http://dx.doi.org/10.1016/S0191-8869(96)00248-6

Contractor, A. A., Armour, C., Wang, X., Forbes, D., & Elhai, J. D. (2015). The mediating role of anger in the relationship between PTSD symptoms and impulsivity. *Psychological Trauma: Theory, Research, Practice and Policy, 7,* 138–145. http://dx.doi.org/10.1037/a0037112

Contractor, A. A., Weiss, N. H., Dranger, P., Ruggero, C., & Armour, C. (2017). PTSD's risky behavior criterion: Relation with *DSM–5* PTSD symptom clusters and psychopathology. *Psychiatry Research, 252,* 215–222. http://dx.doi.org/10.1016/j.psychres.2017.03.008

Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods, 1,* 16–29. http://dx.doi.org/10.1037/1082-989X.1.1.16

Durham, T. A., Byllesby, B. M., Armour, C., Forbes, D., & Elhai, J. D. (2016). Relations between anger and *DSM–5* posttraumatic stress disorder symptoms. *Psychiatry Research, 244,* 403–409. http://dx.doi.org/10.1016/j.psychres.2016.08.004

Durham, T. A., Byllesby, B. M., Lv, X., Elhai, J. D., & Wang, L. (2018). Anger as an underlying dimension of posttraumatic stress disorder. *Psychiatry Research, 267,* 535–540. http://dx.doi.org/10.1016/j.psychres.2018.06.011

Dyer, K. F. W., Dorahy, M. J., Hamilton, G., Corry, M., Shannon, M., MacSherry, A., . . . McElhill, B. (2009). Anger, aggression, and self-harm in PTSD and complex PTSD. *Journal of Clinical Psychology, 65,* 1099–1114. http://dx.doi.org/10.1002/jclp.20619

Ehlers, A., & Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. *Behaviour Research and Therapy, 38,* 319–345. http://dx.doi.org/10.1016/S0005-7967(99)00123-0

Ehlers, A., Mayou, R. A., & Bryant, B. (1998). Psychological predictors of chronic posttraumatic stress disorder after motor vehicle accidents. *Journal of Abnormal Psychology, 107,* 508–519. http://dx.doi.org/10.1037/0021-843X.107.3.508

Elhai, J. D., Miller, M. E., Ford, J. D., Biehn, T. L., Palmieri, P. A., & Frueh, B. C. (2012). Posttraumatic stress disorder in *DSM–5:* Estimates of prevalence and symptom structure in a nonclinical sample of college students. *Journal of Anxiety Disorders, 26,* 58–64. http://dx.doi.org/10.1016/j.janxdis.2011.08.013

Foa, E. B., Riggs, D. S., Massie, E. D., & Yarczower, M. (1995). The impact of fear activation and anger on the efficacy of exposure treatment for posttraumatic stress disorder. *Behavior Therapy, 26,* 487–499. http://dx.doi.org/10.1016/S0005-7894(05)80096-6

Forbes, D., Alkemade, N., Hopcraft, D., Hawthorne, G., O'Halloran, P., Elhai, J. D., . . . Lewis, V. (2014). Evaluation of the Dimensions of Anger Reactions–5 (DAR-5) scale in combat veterans with posttraumatic stress disorder. *Journal of Anxiety Disorders, 28,* 830–835. http://dx.doi.org/10.1016/j.janxdis.2014.09.015

Forbes, D., Alkemade, N., Mitchell, D., Elhai, J. D., McHugh, T., Bates, G., . . . Lewis, V. (2014). Utility of the Dimensions of Anger Reactions–5 (DAR-5) scale as a brief anger measure. *Depression and Anxiety, 31,* 166–173. http://dx.doi.org/10.1002/da.22148

Forbes, D., Hawthorne, G., Elliott, P., McHugh, T., Biddle, D., Creamer, M., & Novaco, R. W. (2004). A concise measure of anger in combat-related posttraumatic stress disorder. *Journal of Traumatic Stress, 17,* 249–256. http://dx.doi.org/10.1023/B:JOTS.0000029268.22161.bd

Forbes, D., Parslow, R., Creamer, M., Allen, N., McHugh, T., & Hopwood, M. (2008). Mechanisms of anger and treatment outcome in combat veterans with posttraumatic stress disorder. *Journal of Traumatic Stress, 21,* 142–149. http://dx.doi.org/10.1002/jts.20315

Germain, C. L., Kangas, M., Taylor, A., & Forbes, D. (2016). The role of trauma-related cognitive processes in the relationship between combat-PTSD symptom severity and anger expression and control. *Australian Journal of Psychology, 68,* 73–81. http://dx.doi.org/10.1111/ajpy.12097

Goodman, L. A., Corcoran, C., Turner, K., Yuan, N., & Green, B. L. (1998). Assessing traumatic event exposure: General issues and preliminary findings for the Stressful Life Events Screening Questionnaire. *Journal of Traumatic Stress, 11,* 521–542. http://dx.doi.org/10.1023/A:1024456713321

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60,* 549–576. http://dx.doi.org/10.1146/annurev.psych.58.110405.085530

Gunzler, D., Chen, T., Wu, P., & Zhang, H. (2013). Introduction to mediation analysis with structural equation modeling. *Shanghai Archives of Psychiatry, 25,* 390–394.

Heinz, A. J., Makin-Byrd, K., Blonigen, D. M., Reilly, P., & Timko, C. (2015). Aggressive behavior among military veterans in substance use disorder treatment: The roles of posttraumatic stress and impulsivity. *Journal of Substance Abuse Treatment, 50,* 59–66. http://dx.doi.org/10.1016/j.jsat.2014.10.014

Hellmuth, J. C., Stappenbeck, C. A., Hoerster, K. D., & Jakupcak, M. (2012). Modeling PTSD symptom clusters, alcohol misuse, anger, and depression as they relate to aggression and suicidality in returning U.S. veterans. *Journal of Traumatic Stress, 25,* 527–534. http://dx.doi.org/10.1002/jts.21732

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6,* 53–60.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struc-*

tural Equation Modeling, 6, 1–55. http://dx.doi.org/10.1080/10705519909540118

Jakupcak, M., Conybeare, D., Phelps, L., Hunt, S., Holmes, H. A., Felker, B., . . . McFall, M. E. (2007). Anger, hostility, and aggression among Iraq and Afghanistan War veterans reporting PTSD and subthreshold PTSD. *Journal of Traumatic Stress, 20,* 945–954. http://dx.doi.org/10.1002/jts.20258

Kopper, B. A., & Epperson, D. L. (1996). The experience and expression of anger: Relationships with gender, gender role socialization, depression, and mental health functioning. *Journal of Counseling Psychology, 43,* 158–165. http://dx.doi.org/10.1037/0022-0167.43.2.158

Kuhn, E., Drescher, K., Ruzek, J., & Rosen, C. (2010). Aggressive and unsafe driving in male veterans receiving residential treatment for PTSD. *Journal of Traumatic Stress, 23,* 399–402. http://dx.doi.org/10.1002/jts.20536

Landers, R. N., & Behrend, T. S. (2015). An inconvenient truth: Arbitrary distinctions between organizational, Mechanical Turk, and other convenience samples. *Industrial and Organizational Psychology, 8,* 142–164.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. Mahwah, NJ: Erlbaum.

MacKinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation analysis. *Annual Review of Psychology, 58,* 593–614. http://dx.doi.org/10.1146/annurev.psych.58.110405.085542

Michael, T., Halligan, S. L., Clark, D. M., & Ehlers, A. (2007). Rumination in posttraumatic stress disorder. *Depression and Anxiety, 24,* 307–317. http://dx.doi.org/10.1002/da.20228

Milovchevich, D., Howells, K., Drew, N., & Day, A. (2001). Sex and gender role differences in anger: An Australian community study. *Personality and Individual Differences, 31,* 117–127. http://dx.doi.org/10.1016/S0191-8869(00)00122-7

Mishra, S., & Carleton, R. N. (2017). Use of online crowdsourcing platforms for gambling research. *International Gambling Studies, 17,* 125–143. http://dx.doi.org/10.1080/14459795.2017.1284250

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science, 3,* 400–424. http://dx.doi.org/10.1111/j.1745-6924.2008.00088.x

Novaco, R. W. (1979). The cognitive regulation of anger and stress. In P. C. Kendell, & S. D. Hollon (Eds.), *Cognitive-behavioral interventions: Theory, research, and procedures* (pp. 241–285). New York, NY: Academic Press.

Novaco, R. W. (1994). Anger as a risk factor for violence among the mentally disordered. In J. Monahan & H. J. Steadman (Eds.), *Violence and mental disorder: Developments in risk assessment* (pp. 21–59). Chicago, IL: University of Chicago Press.

Novaco, R. W., & Chemtob, C. M. (2002). Anger and combat-related posttraumatic stress disorder. *Journal of Traumatic Stress, 15,* 123–132. http://dx.doi.org/10.1023/A:1014855924072

Novaco, R. W., & Chemtob, C. M. (2015). Violence associated with combat-related posttraumatic stress disorder: The importance of anger. *Psychological Trauma: Theory, Research, Practice and Policy, 7,* 485–492. http://dx.doi.org/10.1037/tra0000067

Ochsner, K. N., & Gross, J. J. (2008). Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current Directions in Psychological Science, 17,* 153–158. http://dx.doi.org/10.1111/j.1467-8721.2008.00566.x

Roley, M. E., Claycomb, M. A., Contractor, A. A., Dranger, P., Armour, C., & Elhai, J. D. (2015). The relationship between rumination, PTSD, and depression symptoms. *Journal of Affective Disorders, 180,* 116–121. http://dx.doi.org/10.1016/j.jad.2015.04.006

Ruscio, A. M., Seitchik, A. E., Gentes, E. L., Jones, J. D., & Hallion, L. S. (2011). Perseverative thought: A robust predictor of response to emotional challenge in generalized anxiety disorder and major depressive disorder. *Behaviour Research and Therapy, 49,* 867–874. http://dx.doi.org/10.1016/j.brat.2011.10.001

Schieman, S. (1999). Age and anger. *Journal of Health and Social Behavior, 40,* 273–289. http://dx.doi.org/10.2307/2676352

Shapiro, D. N., Chandler, J., & Mueller, P. A. (2013). Using Mechanical Turk to study clinical populations. *Clinical Psychological Science, 1,* 213–220. http://dx.doi.org/10.1177/2167702612469015

Simpson, C., & Papageorgiou, C. (2003). Metacognitive beliefs about rumination in anger. *Cognitive and Behavioral Practice, 10,* 91–94. http://dx.doi.org/10.1016/S1077-7229(03)80012-3

Taft, C. T., Creech, S. K., & Murphy, C. M. (2017). Anger and aggression in PTSD. *Current Opinion in Psychology, 14,* 67–71. http://dx.doi.org/10.1016/j.copsyc.2016.11.008

U.S. Census Bureau. (2018). *Quick facts*. Retrieved from https://www.census.gov/quickfacts/fact/table/US/PST045218

van Stolk-Cooke, K., Brown, A., Maheux, A., Parent, J., Forehand, R., & Price, M. (2018). Crowdsourcing trauma: Psychopathology in a trauma-exposed sample recruited via Mechanical Turk. *Journal of Traumatic Stress, 31,* 549–557. http://dx.doi.org/10.1002/jts.22303

Weathers, F., Litz, B., Keane, T., Palmieri, P., Marx, B., & Schnurr, P. (2013). *The PTSD Checklist for DSM–5 (PCL-5)*. Boston, MA: National Center for PTSD.

Wisco, B. E., & Nolen-Hoeksema, S. (2008). Ruminative response style. In K. S. Dobson & D. J. A. Dozois (Eds.), *Risk factors in depression* (pp. 221–236). San Diego, CA: Academic Press. http://dx.doi.org/10.1016/B978-0-08-045078-0.00010-1

Worthen, M., Rathod, S. D., Cohen, G., Sampson, L., Ursano, R., Gifford, R., . . . Ahern, J. (2014). Anger problems and posttraumatic stress disorder in male and female National Guard and Reserve Service members. *Journal of Psychiatric Research, 55,* 52–58. http://dx.doi.org/10.1016/j.jpsychires.2014.04.004

Wortmann, J. H., Jordan, A. H., Weathers, F. W., Resick, P. A., Dondanville, K. A., Hall-Clark, B., . . . Litz, B. T. (2016). Psychometric analysis of the PTSD Checklist–5 (PCL-5) among treatment-seeking military service members. *Psychological Assessment, 28,* 1392–1403. http://dx.doi.org/10.1037/pas0000260

Received August 5, 2019
Revision received March 8, 2020
Accepted March 10, 2020 ■