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### Authors

Bhardwaj, Vinnu  
Angkaw, Abigail C  
Franceschetti, Massimo  
[et al.](#)

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## Direct and Indirect Relationships among Posttraumatic Stress Disorder, Depression, Hostility, Anger, and Verbal and Physical Aggression in Returning Veterans

Vinnu Bhardwaj<sup>1</sup>, Abigail C. Angkaw<sup>1,2,3</sup>, Massimo Franceschetti<sup>1</sup>, Ramesh Rao<sup>1</sup>, Dewleen G. Baker<sup>1,2,4</sup>

<sup>1</sup>University of California, San Diego, 9500 Gilman Drive, San Diego, CA 92093, United States

<sup>2</sup>Veterans Affairs San Diego Healthcare System, 3350 La Jolla Village Drive, San Diego, CA 92161, United States

<sup>3</sup>National Center for PTSD, 215 North Main Street, White River Junction, VT 05009, United States

<sup>4</sup>VA Center of Excellence for Stress and Mental Health, 3350 La Jolla Village Drive, MC 116A, San Diego, CA 92161, United States

### Abstract

Hostility, anger, and aggression are conceptually related but unique constructs found to occur more often among veterans with PTSD than among civilians or veterans without PTSD. However, the pathways between PTSD, depression, hostility, anger, and aggression have not been comprehensively characterized. Therefore, drawing on a sample of returning Operation Enduring Freedom/Operation Iraqi Freedom combat veterans ( $N = 175$ ; 95% male; mean age 30 years), this study sought to examine the direct and indirect relationships among PTSD, depression, hostility, anger, and four types of aggression: verbal, and physical toward self, others, and objects. Functional modeling of direct effects was done using multiple least-squares regression, and bootstrapped mediation analyses were carried out to test indirect effects. Results indicate that PTSD is not the overall direct contributor to different forms of aggression, supporting the mediating role of depression and trait anger. Depression symptoms explain part of the relationships between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward self, and trait anger explains part of the relationships between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward others. Our findings support the importance of assessing for anger, depression, and different types of aggression among veterans presenting for PTSD treatment to develop individualized treatment plans that may benefit from early incorporation of interventions.

### Keywords

PTSD; depression; hostility; trait anger; verbal aggression; physical aggression

Hostility, anger, and aggression are conceptually related but unique constructs. They have been linked to negative outcomes including behavioral and physical health problems, particularly among veterans with posttraumatic stress disorder (PTSD) and/or depression. The health outcomes include acute and chronic pain (Trost, Vangronsveld, Linton, Quartana, & Sullivan, 2012), inflammation (Boylan & Ryff, 2013), headaches (Fernandez, 2005), lower cognitive function (Albanese et al., 2016), poor sleep quality (Tsuchiyama, Terao, Wang, Hoaki, & Goto, 2013), myocardial infarction and mortality (Barefoot, Larsen, von der Lieth, & Schroll, 1995; Everson et al., 1997), and poor response to mental health treatment (Forbes, Creamer, Hawthorne, Allen, & McHugh, 2003). Hostility is defined as an antagonistic attitude or evaluation of others and is associated with feelings of disgust, indignation, and resentment (Teten et al., 2010). Anger is an emotional state that consists of feelings that vary in intensity, from a mild irritation or annoyance to fury and rage (Spielberger, Jacobs, Russell, & Crane, 1983). Aggression, on the other hand, refers to the behavioral expression of anger that can take the form of physical or verbal acts (Orth & Wieland, 2006). Physical aggression can be directed toward self, objects, or others, and verbal aggression can range from shouting angrily to threatening physical violence. Understanding the impact of PTSD and depression on hostility, anger, and verbal and physical aggression has important clinical implications for assessment and the development of intervention programs for OEF/OIF (Operation Enduring Freedom/Operation Iraqi Freedom) combat veterans.

Recently, there has been an increased interest in the influence of war on aggressive behavior in OEF/OIF service members (MacManus et al., 2015). PTSD has been associated with physical aggression (Dennis et al., 2017; Wilk, Quartana, Clarke-Walper, Kok, & Riviere, 2015) as well as non-physical forms of aggression (Angkaw et al., 2013; Norman, Schmieid, & Larson, 2015; Weiss, Connolly, Gratz, & Tull, 2017). Aggression has also been linked to other mental health problems such as depression in veterans and service members (Elbogen et al., 2013; Norman et al., 2015; Teten, Miller, Bailey, Dunn, & Kent, 2008). Although both PTSD and depressive symptoms have been found to function almost identically in predicting aggression risk (Norman et al., 2015; Taft et al., 2009), Taft et al. show that when both are considered together, depression ceases to have a significant effect on the presence of aggression. However, depression has been found to partly mediate the relationship between PTSD and two forms of aggression: verbal aggression and aggression toward self (Angkaw et al., 2013). Both PTSD and depression are highly prevalent in service members returning from Afghanistan and Iraq. In a recent study, 15.8% of OEF/OIF veterans screened positive for PTSD (Dursa, Reinhard, Barth, & Schneiderman, 2014). Another study estimated that 13 to 15% of OEF/OIF service members had clinically significant symptoms of depression without PTSD, and 24% had clinically significant levels of comorbid PTSD and depression (Lapierre, Schwegler, & Labauve, 2007). Also, OEF/OIF veterans with PTSD have reported higher rates of aggression than veterans without PTSD (Jakupcak et al., 2007).

A significant limitation in most of the existing aggression research in OEF/OIF and other veterans is the reliance on global measures of aggression (Jakupcak et al., 2007; Kwan et al., 2017; Taft et al., 2007; Watkins, Sippel, Pietrzak, Hoff, & Harpaz-Rotem, 2017). It is important to view aggression as a multi-dimensional construct to gain a refined understanding of the types of aggressive behavior, and to improve prediction and

measurement of intervention outcomes. The prevalence rates and the risk factors of physical and non-physical aggression differ (Stappenbeck, Hellmuth, Simpson, & Jakupcak, 2014). Moreover, inclusion of non-physical forms of aggression in a global index can falsely escalate the observed rates of aggression. Therefore, it is necessary to examine aggression as a multi-dimensional construct in order to improve understanding of aggressive behavior in OEF/OIF veterans.

In contrast to aggressive behaviors, fewer studies have examined the relationships between PTSD and hostility in OEF/OIF veterans. Hostility has been associated with both PTSD and aggression (McCubbin et al., 2016; Van Voorhees et al., 2016; Vrana, Hughes, Dennis, Calhoun, & Beckham, 2009). PTSD symptoms are associated with higher hostility scores in both men and women (McCubbin et al., 2016). There is some evidence that hostility partially mediates the association between PTSD and physical aggression (Van Voorhees et al., 2016). Strong associations have also been found between hostility and depression (Albanese et al., 2016; Nabi et al., 2010).

Another construct that has been associated with PTSD, depression, hostility and aggression is anger (Olatunji, Ciesielski, & Tolin, 2010; Taft, Creech, & Murphy, 2017). In order to gain a better understanding of the role of anger and its relationships with other constructs such as PTSD and aggression, anger may be divided into state anger (anger in a given moment) and trait anger (the general propensity to become angry) (Spielberger, 1999). Trait anger has been associated with PTSD (Kulkarni, Porter, & Rauch, 2012; Meffert et al., 2008), aggression (Birkley & Schumm, 2016; Kulkarni et al., 2012; Meffert et al., 2008; Wilk et al., 2015), and depression (Hellmuth, Stappenbeck, Hoerster, & Jakupcak, 2012). There is also some evidence that trait anger mediates the relationships between some PTSD clusters and aggression (Hellmuth et al., 2012).

There has been scant research on hostility, anger and aggression concurrently. Moreover, no studies to date have concurrently examined the direct and indirect effects of PTSD and depression on hostility, anger, and aggression. Given the negative physical, emotional, and psychosocial outcomes associated with these constructs, an examination of the complex relationships between PTSD, depression, hostility, anger, and aggression is important and has the potential to improve the assessment and treatment of OEF/OIF combat veterans.

The aim of the present study was to gain an understanding of the direct and indirect relationships among PTSD, depression, hostility, anger and four types of aggression: (a) verbal aggression, (b) physical aggression toward self, (c) physical aggression toward objects, and (d) physical aggression toward others in a sample of returning OEF/OIF combat veterans. We hypothesized that depression, hostility, and trait anger would mediate the relationship between PTSD and aggression, and that the direct and indirect effects would vary based on type of aggression.

## Methods

### Participants

Participants were 175 OEF/OIF combat veterans (95% male, mean age = 30.36 (SD = 8.86)) who were participating in a larger cross-sectional study of genetic factors underlying vulnerability for PTSD. The study excluded participants with a self-reported Axis I disorder diagnosis before deployment (obtained at phone screen), current alcohol dependence, or current drug use. Participants' self-reported ethnicity was 30% Hispanic/Latino, 38% Non-Hispanic/Latino, 32% not reported, and race was 60% white, 6% black, 7% Asian, 2% American Indian, 2% Native Hawaiian/ Pacific Islander, 4% "other", 19% not reported. Recruitment efforts included clinician referrals from VA and Navy clinicians and posting flyers at the VA medical center. The study received local institutional review board approval. All participants provided informed consent before being included in the study.

### Procedures

Participants completed self-report questionnaires and a clinical interview to characterize the cohort demographics and to assess study-related constructs. All participants were treated in accordance with the ("Ethical principles of psychologists and code of conduct," 2002).

### Measures

**Clinician-administered PTSD scale (CAPS).**—PTSD symptoms were assessed using the CAPS, DSM-IV Version (Blake et al., 1995), a measure of the frequency and intensity of each of the 17 PTSD symptoms that shows high sensitivity and specificity, high test-retest reliability, and strong convergence with other PTSD self-report measures (Mueser et al., 2001; Weathers, Keane, & Davidson, 2001). In the current sample, internal consistency was excellent (Cronbach's alpha = 0.95).

**Beck depression inventory, second edition (BDI-II).**—The BDI-II (Beck, Steer, & Brown, 1996) contains 21 self-report items that address the cognitive, emotional, and somatic manifestations of depression. Respondents indicate the degree to which they experience symptoms such as hopelessness and irritability, cognitions such as guilt or feelings of being punished, as well as physical symptoms such as fatigue and weight loss, along a four-point Likert scale ranging from 0 to 3. The items were summed up to construct a total depression score. In the current sample, internal consistency was excellent (Cronbach's alpha = 0.94).

**Cook-Medley hostility scale.**—The Cook-Medley hostility scale (Cook & Medley, 1954) is a 50-item hostility scale derived from the Minnesota Multiphasic Personality Inventory (MMPI), that measures different aspects of hostility (Barefoot, Dodge, Peterson, Dahlstrom, & Williams, 1989). For this study, items corresponding to the Cynicism, Hostile Affect, and Hostile Attributions subscales were used. The Aggressive Responding subscale items were not included to avoid any spurious correlations with measures of anger and aggression. In the current sample, internal consistency was good (Cronbach's alpha = 0.85).

**State-Trait anger expression inventory.**—Trait anger was measured using the 10-item Trait-Anger (T-Ang) scale of the revised State-Trait anger expression inventory (Spielberger, 1999), that measures the disposition of someone to express anger with and without provocation. Respondents indicate the frequency with which they experience angry feelings on a 4-point scale, ranging from 1 (“almost never”) to 4 (“almost always”). Scores on individual items were summed up to construct a total T-Ang score. In the current sample, internal consistency was good (Cronbach’s alpha = 0.89).

**Retrospective overt aggression scale (ROAS).**—Aggression was measured using the ROAS (Sorgi, Ratey, Knoedler, Markert, & Reichman, 1991), a retrospective adaptation of the Overt Aggression Scale (Yudofsky, Silver, Jackson, Endicott, & Williams, 1986). Each of the 16 items of the ROAS falls into one of the four subscales - verbal aggression, physical aggression toward objects, physical aggression toward others, and physical aggression toward self, with subscale scoring weighted based on the severity of the aggressive behavior. Respondents indicate the frequency with which they engaged in specific aggressive acts in the past month on a 5-point scale, ranging from 0 (“never / 0 times”) to 4 (“always / greater than 10 times”). The ROAS shows excellent inter-rater reliability ( $r = 0.96$ ), and high intra-class correlations (Goldberg et al., 2007; Serper, Beech, Harvey, & Dill, 2008). In the current sample, internal consistency was good (Cronbach’s alpha = 0.88).

## Data Analysis

Descriptive statistics were computed to examine the sample means and standard deviations on each study measure. Zero-order correlations were computed to examine basic associations between study variables.

Given a dependent variable and its predictor variables, modeling was performed using least-squares regression. The model was constructed as follows: depression was modeled as a function of PTSD, and hostility was modeled as a function of both depression and PTSD. Direct paths were added from PTSD, depression, and hostility to trait anger, and from these four variables to aggression. Four separate analyses were conducted to examine models of the four types of aggression: verbal aggression, physical aggression toward objects, physical aggression toward others, and physical aggression toward self. A direct effect was deemed significant if the corresponding p-value in the linear regression model was smaller than 0.05.

The significance of mediated (or indirect) effects was tested via bootstrapped confidence intervals. Bootstrapping is a non-parametric procedure that, unlike the conventional tests of mediation such as the Sobel test, does not rely on the assumption of normality of the indirect effects’ coefficients and generates the distribution empirically by resampling the data with replacement many times (Preacher & Hayes, 2008). The bootstrapped confidence intervals were generated using 5000 resamples of the data with replacement. An indirect effect was considered significant if the corresponding bootstrapped 95% confidence interval did not contain zero. Age and sex were included as covariates in all direct and indirect effect models.

## Results

### Descriptive Statistics and Correlations

The study variable means and standard deviations, and zero-order correlations among them, are presented in Table 1. All the variables were positively correlated,  $p < 0.001$ .

### Least Squares Regression Modeling

The standardized direct effects among PTSD, depression, hostility, and trait anger are shown in Figure 1. PTSD was a significant predictor of depression ( $p < 0.001$ ). When both PTSD and depression were included as predictors for the criterion variable hostility, the effect of PTSD failed to reach significance ( $p = 0.35$ ), whereas that of depression was significant ( $p < 0.001$ ). Further, each of the variables PTSD, depression, and hostility had a significant effect on trait anger when the other two variables were present in the model.

The direct effects of PTSD, depression, hostility, and trait anger on verbal aggression, physical aggression toward objects, physical aggression toward others, and physical aggression toward self are also reported in Figure 1. In the models of verbal aggression and physical aggression toward objects, depression and trait anger had significant direct effects. In contrast, direct effects of PTSD ( $p = 0.55$  for verbal aggression,  $p = 0.47$  for physical aggression toward objects) and hostility ( $p = 0.95$  for verbal aggression,  $p = 0.51$  for physical aggression toward objects) failed to reach significance in both models. In the model for physical aggression toward others, trait anger had a significant effect, whereas PTSD ( $p = 0.11$ ), depression ( $p = 0.96$ ), and hostility ( $p = 0.73$ ) did not. However, in the model for physical aggression toward self, only depression had a significant direct effect; the effects of PTSD ( $p = 0.93$ ), hostility ( $p = 0.86$ ) and trait anger ( $p = 0.07$ ) were deemed insignificant. Overall, 56% of the variance in depression, 33% of the variance in hostility, 51% of the variance in trait anger, 46% of the variance in verbal aggression, 31% of the variance in physical aggression toward objects, 18% of the variance in physical aggression toward others, and 25% of the variance in physical aggression toward self was explained by the models.

### Bootstrapped mediation analyses

The results of the bootstrapped mediation analyses are presented in tables 2–3. Depression completely mediated the relationship between PTSD and hostility and moderately mediated the relationship between PTSD and trait anger.

As hypothesized, depression also mediated the associations between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward self. However, it did not mediate the relationship between PTSD and physical aggression toward others. Trait anger also mediated the associations between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward others, but not physical aggression toward self.

Furthermore, trait anger completely mediated the association between depression and physical aggression toward others, modestly mediated the relationships between depression

and verbal aggression as well as depression and physical aggression toward objects, but did not mediate the relationship between depression and physical aggression toward self.

Trait anger also completely mediated the relationships between hostility and verbal aggression, physical aggression toward objects, and physical aggression toward others. However, for physical aggression toward self, neither hostility nor trait anger had significant direct or indirect effects.

## Discussion

This was the first study to investigate the direct and indirect relationships among PTSD, depression, hostility, anger and four types of aggression: (a) verbal aggression, (b) physical aggression toward self, (c) physical aggression toward objects, and (d) physical aggression toward others in a sample of returning OEF/OIF combat veterans. PTSD, depression, hostility, and anger behaved differently while predicting different forms of aggression, corroborating the recognition of aggression as a multi-dimensional construct. Based on linear regression analysis, only depression had a significant direct effect on physical aggression toward self, whereas in the models for verbal aggression and physical aggression toward objects, depression and trait anger had significant effects. In contrast, in the model of physical aggression toward others, only trait anger had a significant direct effect.

Although the bootstrapped analysis was only used to test the significance of indirect effects, the 95% bootstrapped confidence intervals for direct effects are also reported in Tables 2 and 3 for the sake of completeness. It is important to mention that the bootstrapped confidence interval for the direct effect of PTSD on physical aggression toward others (95% CI: 0.003–0.335) does not contain zero even though the effect is non-significant based on linear regression analysis ( $p = 0.11$ ). For all other direct effects, there is consistency between the significance as determined by least squares regression and the 95% bootstrapped confidence interval not containing zero.

In support of our study hypothesis, depression mediated the associations between PTSD and physical aggression toward self, verbal aggression, and physical aggression toward objects, when hostility and trait anger were in the model. This is partly consistent with the findings of one study (Angkaw et al., 2013), where depressive symptoms partly mediated the relationship between PTSD and two forms of aggression: verbal aggression and physical aggression toward self. In the study, however, the authors only considered PTSD, depression, and aggression, whereas in this study, hostility and trait anger were also in the model. Contrary to our hypothesis, depression did not mediate the association between PTSD and physical aggression toward others. This is also consistent with the findings of two studies (Angkaw et al., 2013; Taft et al., 2009), that observed that although depression and PTSD both uniquely predicted physical aggression, when considered together, depression ceased to have a significant effect.

To the best of our knowledge, no studies have investigated whether trait anger mediates the associations between PTSD and different forms of aggression, although one study (Hellmuth et al., 2012) showed that trait anger mediated the relationships between some PTSD clusters



and general aggression, which was measured only using three items related to verbal and physical aggression. In this study, as hypothesized, trait anger mediated the associations between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward others, when depression and hostility were in the model. It did not, however, mediate the relationship between PTSD and physical aggression toward self. This study, therefore, provides a unique contribution to the literature by providing the relationships between PTSD, trait anger, and different forms of aggression.

In contrast to trait anger, the indirect effect of PTSD on aggression via hostility alone was not significant for any type of aggression. This is contrary to a study (Van Voorhees et al., 2016), where hostility partially mediated the association between PTSD and physical aggression, measured by items corresponding mostly to physical aggression toward others. One reason why the findings differ could be the inclusion of depression and trait anger in our models of aggression. In our study, PTSD had no significant direct effect on hostility when depression was in the model, and hostility had no significant direct effect on physical aggression towards others when trait anger was in the model.

Current results highlight that PTSD is not the overall direct contributor to different forms of aggression, and clearly show the role of depression and trait anger. Depression symptoms explain part of the relationships between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward self, and trait anger explains part of the relationships between PTSD and verbal aggression, physical aggression toward objects, and physical aggression toward others. Concurrent PTSD symptoms and higher trait anger in veterans may warrant close monitoring of veterans for being physically aggressive toward others. On the other hand, veterans with high depressive symptoms should be closely monitored for self-harm. Although evidence-based treatments for PTSD can help reduce depressive symptoms (Resick, Nishith, Weaver, Astin, & Feuer, 2002), explicitly treating depression among OEF/OIF veterans with PTSD may reduce acts of physical aggression toward self. Similarly, explicitly addressing trait anger along with PTSD symptoms among OEF/OIF veterans may help reduce incidents of physical aggression toward others.

The findings of this study should be viewed in the context of some limitations. First, our sample is predominantly male and white, which might limit generalizability of the findings. However, white males constitute majority of the US veterans (“US Department of Veterans Affairs,”), suggesting that the findings are applicable to the general population of interest. Second, participants may not have accurately reported aggressive acts on the retrospective self-report aggression scale. Finally, these data were cross-sectional, and hence, any purported causal pathways must be cautiously considered. Although future research on the relationships between PTSD, depression, hostility, anger, and aggression is needed for validation, our findings suggest that clinicians working with veterans should consider a multifaceted approach to treatment that not only addresses PTSD, but also depression and trait anger.

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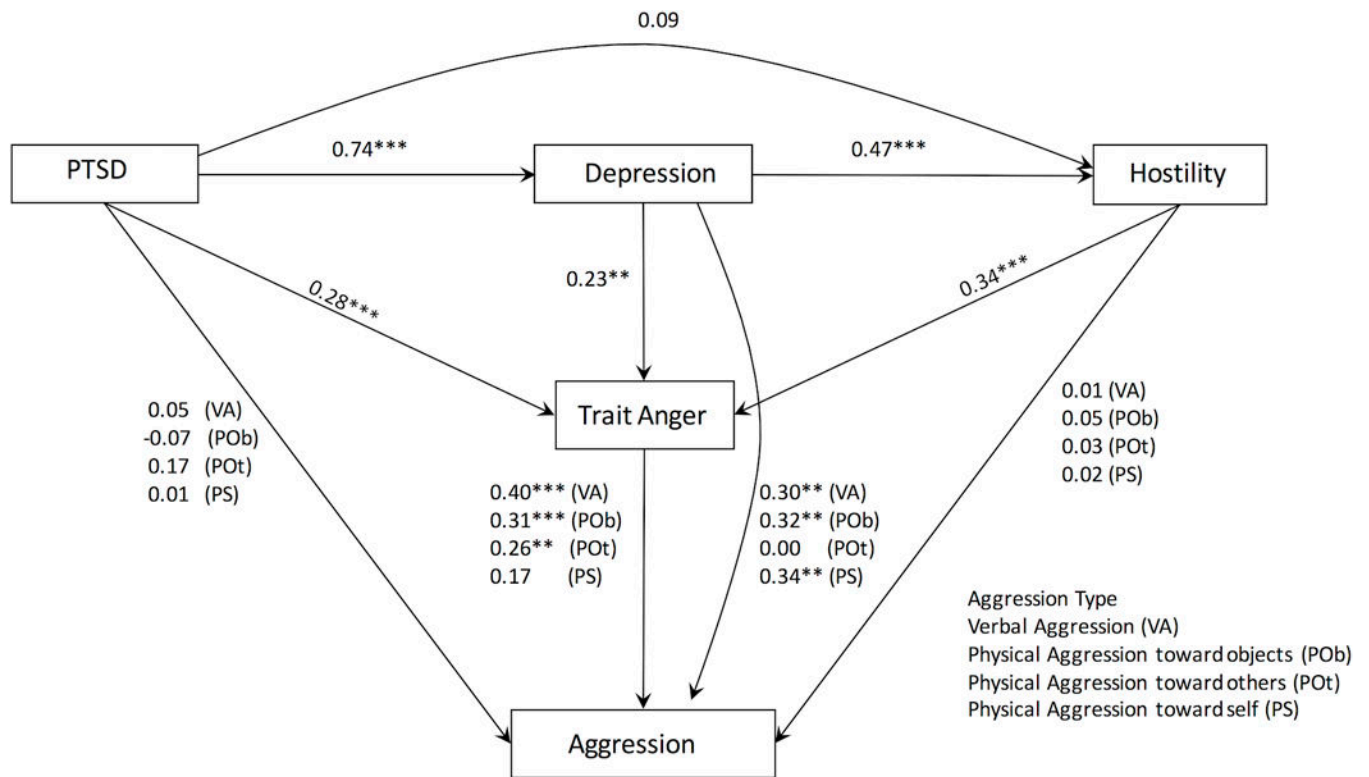
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**Figure 1:** Graphical illustration of the direct and indirect effects model of PTSD, depression, hostility, trait anger, and aggression. Numerical values are standardized direct effects. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table 1:**

Scale means, standard deviations (SD), and zero-order correlations

	Mean (SD)	PTSD	TA	Depression	Hostility	VA	POb	POt
PTSD	55.16 (30.44)	-						
TA	20.76 (7.04)	0.59	-					
Depression	15.66 (12.32)	0.74	0.61	-				
Hostility	14.61 (6.13)	0.45	0.57	0.53	-			
VA	8.11 (8.04)	0.52	0.61	0.58	0.43	-		
POb	5.01 (8.41)	0.38	0.49	0.48	0.38	0.65	-	
POt	2.82 (6.98)	0.34	0.38	0.29	0.27	0.48	0.37	-
PS	2.56 (6.09)	0.38	0.40	0.47	0.31	0.48	0.53	0.31

Notes: TA = Trait Anger, VA = Verbal aggression, POb = physical aggression toward objects, POt = physical aggression toward others, PS = physical aggression toward self. All correlations were significant with  $p < 0.001$ .

**Table 2:**

Standardized direct and indirect effects on depression, hostility, and trait anger.

Pathway	Direct Effect (95% CI)	Indirect Effect (95% CI)
PTSD → Depression	<b>0.74 (0.64 to 0.84)</b>	
PTSD → Hostility	0.09 (-0.11 to 0.30)	<b>0.34 (0.21 to 0.48)</b>
PTSD → Depression → Hostility		<b>0.34 (0.21 to 0.48)</b>
Depression → Hostility	<b>0.47 (0.29 to 0.63)</b>	
PTSD → TA	<b>0.28 (0.13 to 0.44)</b>	<b>0.32 (0.18 to 0.45)</b>
PTSD → Depression → TA		<b>0.17 (0.04 to 0.3)</b>
PTSD → Hostility → TA		0.03 (-0.04 to 0.1)
PTSD → Depression → Hostility → TA		<b>0.12 (0.06 to 0.19)</b>
Depression → TA	<b>0.23 (0.05 to 0.4)</b>	<b>0.16 (0.08 to 0.26)</b>
Depression → Hostility → TA		<b>0.16 (0.08 to 0.26)</b>
Hostility → TA	<b>0.34 (0.21 to 0.48)</b>	

Notes: Significant effects (based on 95% confidence intervals) are bolded. PTSD = Post-traumatic stress disorder, TA = Trait Anger.



**Table 3:**

Standardized direct and indirect effects on verbal aggression, physical aggression toward objects, physical aggression toward others, and physical aggression toward self.

Pathway	Direct Effect (95% CI)	Indirect Effect (95% CI)
<b>Verbal Aggression (VA)</b>		
PTSD → VA	0.05 (−0.12 to 0.21)	<b>0.46 (0.28 to 0.67)</b>
PTSD → Depression → VA		<b>0.22 (0.06 to 0.4)</b>
PTSD → Hostility → VA		0.0 (−0.02 to 0.02)
PTSD → TA → VA		<b>0.11 (0.04 to 0.2)</b>
PTSD → Depression → Hostility → VA		0.0 (−0.05 to 0.04)
PTSD → Depression → TA → VA		<b>0.07 (0.01 to 0.14)</b>
PTSD → Hostility → TA → VA		0.01 (−0.02 to 0.04)
PTSD → Depression → Hostility → TA → VA		<b>0.05 (0.02 to 0.08)</b>
Depression → VA	<b>0.30 (0.09 to 0.51)</b>	<b>0.16 (0.06 to 0.27)</b>
Depression → TA → VA		<b>0.09 (0.02 to 0.19)</b>
Depression → Hostility → VA		0.00 (−0.06 to 0.06)
Depression → Hostility → TA → VA		<b>0.06 (0.03 to 0.11)</b>
Hostility → VA	0.01 (−0.12 to 0.13)	<b>0.13 (0.07 to 0.22)</b>
Hostility → TA → VA		<b>0.13 (0.07 to 0.22)</b>
TA → VA	<b>0.40 (0.24 to 0.58)</b>	
<b>Physical Aggression toward objects (POb)</b>		
PTSD → POb	−0.07 (−0.27 to 0.11)	<b>0.44 (0.25 to 0.67)</b>
PTSD → Depression → POb		<b>0.24 (0.03 to 0.48)</b>
PTSD → Hostility → POb		0.0 (−0.01 to 0.03)
PTSD → TA → POb		<b>0.09 (0.03 to 0.17)</b>
PTSD → Depression → Hostility → POb		0.02 (−0.02 to 0.06)
PTSD → Depression → TA → POb		<b>0.05 (0.01 to 0.11)</b>
PTSD → Hostility → TA → POb		0.01 (−0.01 to 0.04)
PTSD → Depression → Hostility → TA → POb		<b>0.04 (0.01 to 0.07)</b>
Depression → POb	<b>0.32 (0.04 to 0.62)</b>	<b>0.14 (0.06 to 0.26)</b>
Depression → TA → POb		<b>0.07 (0.01 to 0.15)</b>
Depression → Hostility → POb		0.03 (−0.03 to 0.08)
Depression → Hostility → TA → POb		<b>0.05 (0.02 to 0.1)</b>
Hostility → POb	0.05 (−0.06 to 0.17)	<b>0.10 (0.04 to 0.19)</b>
Hostility → TA → POb		<b>0.10 (0.04 to 0.19)</b>
TA → POb	<b>0.31 (0.13 to 0.51)</b>	
<b>Physical Aggression toward others (POt)</b>		
PTSD → POt	<b>0.17 (0.00 to 0.34)</b>	0.16 (−0.01 to 0.38)
PTSD → Depression → POt		0.0 (−0.14 to 0.15)
PTSD → Hostility → POt		0.0 (−0.02 to 0.03)
PTSD → TA → POt		<b>0.07 (0.01 to 0.17)</b>
PTSD → Depression → Hostility → POt		0.01 (−0.04 to 0.07)

Pathway	Direct Effect (95% CI)	Indirect Effect (95% CI)
PTSD → Depression → TA → POt		<b>0.04 (0.00 to 0.11)</b>
PTSD → Hostility → TA → POt		0.01 (−0.01 to 0.03)
PTSD → Depression → Hostility → TA → POt		<b>0.03 (0.01 to 0.07)</b>
Depression → POt	0.0 (−0.19 to 0.2)	<b>0.11 (0.02 to 0.25)</b>
Depression → TA → POt		<b>0.06 (0.01 to 0.15)</b>
Depression → Hostility → POt		0.01 (−0.05 to 0.09)
Depression → Hostility → TA → POt		<b>0.04 (0.01 to 0.1)</b>
Hostility → POt	0.03 (−0.12 to 0.18)	<b>0.09 (0.02 to 0.18)</b>
Hostility → TA → POt		<b>0.09 (0.02 to 0.18)</b>
TA → POt	<b>0.26 (0.06 to 0.51)</b>	
<b>Physical Aggression toward self (PS)</b>		
PTSD → PS	0.01 (−0.19 to 0.17)	<b>0.37 (0.10 to 0.70)</b>
PTSD → Depression → PS		<b>0.25 (0.04 to 0.53)</b>
PTSD → Hostility → PS		0.0 (−0.02 to 0.02)
PTSD → TA → PS		0.05 (−0.01 to 0.13)
PTSD → Depression → Hostility → PS		0.01 (−0.05 to 0.05)
PTSD → Depression → TA → PS		0.03 (−0.01 to 0.09)
PTSD → Hostility → TA → PS		0.01 (−0.01 to 0.03)
PTSD → Depression → Hostility → TA → PS		0.02 (−0.01 to 0.06)
Depression → PS	<b>0.34 (0.06 to 0.67)</b>	<b>0.07 (0.00 to 0.18)</b>
Depression → TA → PS		0.04 (−0.01 to 0.12)
Depression → Hostility → PS		0.01 (−0.06 to 0.07)
Depression → Hostility → TA → PS		0.03 (−0.01 to 0.08)
Hostility → PS	0.02 (−0.13 to 0.15)	0.06 (−0.02 to 0.15)
Hostility → TA → PS		0.06 (−0.02 to 0.15)
TA → PS	0.18 (−0.05 to 0.42)	

Notes: Significant effects (based on 95% confidence intervals) are bolded. PTSD = Post-traumatic stress disorder, TA = Trait Anger, VA = Verbal Aggression, POB = Physical Aggression toward objects, POt = Physical Aggression toward others, PS = Physical Aggression toward self.