THWARTED BELONGINGNESS AND PTSD SYMPTOM SEVERITY AMONG FIREFIGHTERS: THE ROLE OF EMOTION REGULATION DIFFICULTIES

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A thesis submitted to the Department of Psychology,
College of Liberal Arts and Social Sciences
in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

in Psychology

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University of Houston
December 2020

ABSTRACT

The prevalence of trauma exposure and posttraumatic stress disorder (PTSD) symptoms among firefighters has been well-documented. Thwarted belongingness and emotion regulation difficulties present two factors with demonstrated relevance to the etiology and maintenance of PTSD symptoms. Few studies have examined these constructs, or their associations with PTSD symptomatology among firefighters. The present investigation examines the indirect effect of thwarted belongingness (TB) on PTSD symptom severity through emotion regulation difficulties (ERD). This study was a secondary analysis of data from a larger ongoing project. The sample was comprised of 246 trauma-exposed firefighters (*M* age = 40.21, *SD* = 9.93, 93.1% male), recruited from various departments in the southern U.S., who completed an online survey. Results demonstrate a significant indirect effect of TB on PTSD symptom severity through heightened ERD (β = 0.17; CI [0.08, 0.29]). All effects were evident after accounting for years of fire service, relationship status, and trauma load. These findings suggest that there is merit in investigating the role of interpersonal factors and emotion regulation difficulties among firefighter populations to better understand PTSD symptomatology. This line of inquiry has potential to inform evidence-based PTSD prevention and intervention efforts. Clinical and empirical implications are discussed.

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Introduction

Firefighters are at elevated risk for experiencing potentially traumatic events (PTEs) as well as developing posttraumatic stress disorder (PTSD) symptoms, as compared to the general population (Beaton & Murphy, 1993; Berger et al., 2012). It is estimated that approximately 91.5% of firefighters have experienced a PTE, including events such as life-threatening fires, medical emergencies, and witnessing the death of others (Beaton et al., 1998; Meyer et al., 2012). Rates of PTSD among firefighters are estimated as high as 32.4%, and many more endure subclinical PTSD symptoms (Tomaka, Magoc, Morales-Monks, & Reyes, 2017). To inform PTSD prevention and treatment for firefighters, it is important to understand the psychological processes that are associated with PTSD symptoms.

Social disconnectedness is one such factor with relevance to understanding PTSD among firefighters. Social disconnectedness broadly refers to limited interpersonal relationships and/or difficulties associating with a broader social group (Stanley, Hom, Gai, & Joiner, 2018; Van Orden, Cukrowicz, Witte, & Joiner, 2012). Thwarted belongingness (TB), a dimension of social disconnectedness, is defined as a perceived unmet need of affiliation with others (Van Orden et al., 2010; Van Orden, Cukrowicz, Witte, & Joiner, 2012). Although TB was originally conceptualized as a facet of the interpersonal psychological theory of suicide (Joiner, 2007), it has been explored as an independent construct in an emergent literature not focused exclusively on suicidal ideation or behavior (Cardi et al., 2017; Hom, et al., 2017; Perry et al., 2015; Stanley et al., 2018). For example, positive associations of moderate magnitude between TB and PTSD symptomatology have been documented in cross-sectional studies across populations, including adult outpatients, college students, and US military samples (Brake et al., 2019; Martin et al., 2019; Poindexter et al., 2015; Silva, Ribeiro, & Joiner, 2015). Emerging research among

firefighters has demonstrated that TB and related constructs (e.g., low perceived social support) are associated with higher PTSD symptom severity (Hom et al., 2017; Hom et al., 2018; Stanley et al., 2018). Given the emergent literature documenting TB-PTSD symptom associations, it is clinically relevant to understand emotional mechanisms that may account for the documented associations.

Emotion regulation difficulties (ERD) offer one explanatory avenue for understanding the established association between TB and PTSD symptomatology. The positive association between PTSD symptom severity and ERD has been well-established in the literature, including among firefighter populations (Bartlett, Gallagher, Tran, & Vujanovic, 2019; Boden et al., 2013; Ehring & Quack, 2010; Hom et al., 2016). Individuals with diagnostic and subclinical PTSD manifest greater ERD, as demonstrated by self-report and experimental paradigms (Badour & Feldner, 2013; Mazloom et al., 2016; Sippel et al., 2016; Weiss, et al., 2012), and these relations are considered to be bidirectional. Interpersonal factors such as insecure adult attachment style (i.e., patterns of cognition and behavior that are associated with difficulty in forming close relationships, including mistrust of others, troubles with intimacy, and fear that others will not be accessible in stressful times; Ainsworth, 1991; Collins & Read, 1990), low perceived social support, and other related social cognitive factors (e.g., empathy) have been directly implicated in ERD in cross-sectional, longitudinal, and experimental research (Charuvastra & Cloitre, 2008; Preckel, Kanske, & Singer, 2018; Stevens et al., 2013; Vrticka et al., 2012). Indeed, various interpersonal factors are thought to be associated with ERD, and interpersonal factors in general have been theorized to be mechanistically implicated in emotion regulation and ERD (Coan, 2011; Coan & Maresh, 2014), such as within the framework of social baseline theory.

According to social baseline theory, humans are innately driven to attain closeness to others in their social groups, and they utilize social proximity and interaction as a baseline emotion regulation strategy (Coan, 2011). Human emotions have been theorized to possess the evolutionary function of fostering and promoting behaviors that result in survival or reproduction, and these processes -- from a tribal evolutionary perspective -- are dependent upon the relationships we have within our social groups (Coan & Maresh, 2014; Ochsner & Gross, 2008). Thus, emotion regulation is conceptualized as both an individual and interpersonal process in this framework, and it is conceptualized as initiating with early attachment figures and then continuing into adulthood with peer and romantic relationships (Coan, 2011; Hughes et al., 2012). There has been extensive experimental research within the field of social neuroscience showing how individual's perceptions of interpersonal relationships are directly related to emotion regulation, with perceptions of greater closeness related to increased emotion regulation (Coan & Maresh, 2014; Mikulincer, & Shaver, 2008; Reeck, Ames, & Ochsner, 2016; Vrticka et al., 2012). Factors that interfere with social relationships result in ERD, and ERD may manifest in greater impairment in interpersonal relationships (e.g., Coan & Maresh, 2014; Hughes et al., 2012). Interestingly, research focused on relations between TB, specifically, and ERD has been limited, although many studies have documented the positive association between related interpersonal factors (e.g. low social support, social exclusion, and loneliness) and ERD (Besser & Priel, 2010; DeWall et al., 2011; Shi et al., 2016). Furthermore, significant relations between TB and ERD as well as TB and ERD-related constructs, such as distress tolerance (i.e., ability to withstand negative emotional states; Leyro et al., 2010; Linehan, 1993) and high negative urgency (i.e., level to which a person displays impulsive behaviors in the context of negative emotional experiences; Cyders and Smith, 2007; Whiteside and Lynam, 2001), have been

documented (Anestis et al., 2011; Heffer & Willoughby, 2018). Utilizing social baseline theory as a model for the social regulation of emotions might provide more insight into the relationship between TB and ERD.

Theoretically, risk and resilience trajectories following trauma are significantly shaped by social phenomena (Charuvastra & Cloitre, 2008). Within this theoretical framework, trauma-related outcomes are examined in the context of social processes, and one of the primary hypothesized mediating factors between social mechanisms and PTSD severity is an individual's ability to regulate emotions (Bryant, 2016; Charuvastra & Cloitre, 2008). Indeed, social support following trauma is a well-established protective factor as it can provide emotional validation, reduce stigma, and enhance safety and trust (Bryant, 2016; Charuvastra & Cloitre, 2008). Thus, problems with social affiliation following trauma exposure (e.g., social disconnectedness and TB) might lead to increased ERD, and in turn, greater PTSD symptom severity. Clinically, trauma-exposed firefighters who experience elevated social isolation or TB thus may manifest difficulty regulating negative emotions due to daily or occupational stress or trauma-related emotional reactivity, which would in turn, elevate their experience of PTSD symptomatology.

Taken together, several gaps were identified in the extant literature. First, no studies to date have evaluated associations among TB, ERD, and PTSD symptom severity, generally, or among firefighter populations, specifically. This line of work has potential to inform policy and intervention among firefighter populations. Second, although TB has been conceptualized as a distinct interpersonal construct in the broader literature (Cardi et al., 2017; Hom, et al., 2017; Perry et al., 2015; Stanley et al., 2018), demonstrating its relevance to various psychological disturbances (e.g., depression, insomnia, eating disorders, PTSD), associations between TB and ERD have been examined only in the context of the interpersonal theory of suicide (see Van

Orden et al., 2010). This is unfortunate since TB is an important concept in firefighter culture. Indeed, associations between TB and PTSD have been studied among firefighters and the importance of camaraderie and social support in firefighter culture has been emphasized as a protective factor with regard to various negative mental health outcomes (Hom et al., 2017; Hom et al., 2018; Stanley et al., 2018). Third, although PTSD severity and ERD have been preliminarily studied among firefighters (Bartlett, Gallagher, Tran, & Vujanovic, 2019), the association has not been examined in the context of interpersonal factors, such as social disconnectedness. This limits our ability to understand how elevations in perceived social isolation, or TB, may be associated with ERD and ultimately to greater PTSD symptoms in trauma-exposed firefighters.

Therefore, the objective of the present study was to investigate the relations of TB with ERD and PTSD symptom severity among firefighters. First, it was hypothesized that TB will be positively associated with ERD and PTSD symptom severity. Second, it was hypothesized that ERD will be positively associated with PTSD symptom severity. Finally, it was hypothesized that TB will be indirectly related to PTSD symptom severity through heightened ERD (See Figure 1). Effects were expected after accounting for theoretically relevant covariates including years of fire service, relationship status, and trauma load. The covariates were selected based on their associations with PTSD symptom severity in previous research among firefighter samples (Bartlett et al., 2019; Bartlett, Gallagher, Tran, & Vujanovic, 2019; Stanley et al., 2018). To examine whether TB is related to specific PTSD symptom clusters through ERD, exploratory analyses were conducted to evaluate each of the PTSD symptom clusters (i.e., intrusion, avoidance, negative alterations in cognitions and mood, arousal and reactivity) as outcomes.

METHOD

Participants

Sample characteristics are summarized in Table 1. This study was a secondary analysis of data from a larger ongoing project examining stress, resilience, and overall well-being among firefighters. The sample included 246 career and volunteer firefighters recruited online from career, combination (i.e., volunteer and career), and volunteer departments in Houston, Texas, and the surrounding area. Thus, participants are full- or part-time career or volunteer firefighters, including firefighters who are Emergency Medical Services (EMS) personnel. To be included in the larger ongoing study, participants had to: be 18 years of age or older, be current firefighters in career, combination, or volunteer fire departments, and consent to participating in the completion of all online questionnaires. Exclusionary criteria were comprised of inability or unwillingness to provide informed consent for the completion of the online questionnaires. For the current analysis, participants must have endorsed at least one PTSD Criterion A traumatic life event (American Psychiatric Association [APA], 2013). Please see Procedures section for more information.

Measures

Demographic questionnaire. Participants were asked to self-report demographic information including sociodemographic characteristics and firefighter service history. Years in the fire service will be included as a covariate in the present analyses.

Life Events Checklist for DSM-5 (LEC-5; Weathers et al., 2013). The LEC-5 is a self-report questionnaire used to screen for potentially traumatic events experienced at any time. Respondents are presented with a list of 16 potentially traumatic events (e.g., combat, sexual assault, transportation accident) as well as an additional item assessing for 'other' potentially

traumatic events not listed. Respondents are asked to indicate (via check mark) whether each listed event "happened to me", "witnessed it", "learned about it", "part of my job", or "not sure". If participants endorsed that an event "happened to me", "witnessed it", or "part of my job", this was coded as positive exposure to that particular type of traumatic event. Total exposures were summed to produce a 'trauma load' variable indicating the total number of traumatic life event types experienced. The total number of trauma exposure types was summed to produce the LEC-5 total score (i.e., trauma load), a covariate in the current analyses.

PTSD Checklist for DSM-5 (PCL-5; Blevins et al., 2015). The PCL-5 is a 20-item self-report measure designed to measure PTSD symptom severity over the past month. Respondents were asked to complete the PCL-5 with regard to the "worst" traumatic event endorsed on the LEC-5. Each of the 20 items reflects a symptom of PTSD according to *DSM-5* criteria (American Psychiatric Association, 2013). Participants are asked to rate each item on a 5-point scale (0 = *Not at all* to 4 = *Extremely*) to indicate how much they have been bothered by the symptom in the past month. Total symptom severity scores range from 0 to 80, with higher scores indicating greater symptom severity. The measure can be divided into four subscales corresponding to the PTSD symptom clusters B–E in the DSM-5: Intrusion (five items), Avoidance (two items), negative alterations in cognitions and mood (seven items), and alterations in arousal and reactivity (six items).The PCL-5 has demonstrated strong psychometric properties (Blevins et al., 2015). The internal consistency of the PCL-5 total score in the current sample was excellent ($\alpha = .96$). The internal consistency of each of the PTSD symptom clusters, including intrusions ($\alpha = .89$), avoidance ($\alpha = .89$), negative alterations in cognitions and mood ($\alpha = .91$), and arousal and reactivity ($\alpha = .89$), ranged from good to excellent. The PCL-5 total

score was evaluated as the main outcome, and the symptom clusters were each evaluated as outcomes in post hoc exploratory analyses.

Interpersonal Needs Questionnaire-15 (INQ-15; Van Orden, Cukrowicz, Witte, & Joiner, 2012). The INQ-15 measures recent unmet interpersonal needs. The INQ has two subscales, TB (consisting of nine items) and perceived burdensomeness (PB) (consisting of six items). The TB subscale is defined as the unmet need of social connectedness and the PB subscale is defined as an unmet need of social competence. Levels of TB and PB are measured on a Likert scale from 1 (Not at all true for me) to 7 (Very true for me) where higher scores indicate higher levels of TB or PB. Previous research has shown that this version of the INQ has adequate construct validity and reliability (Van Orden et al., 2012). Internal consistency of the INQ-15 TB subscale total score in the current sample was good ($\alpha = .89$; Cronbach, 1951). The TB subscale, an index of social disconnection, was evaluated as the predictor variable in the proposed analyses.

Difficulties in Emotion Regulation Scale–16 (DERS-16; Bjureberg et al., 2016). The DERS-16 consists of 16 items measuring general ERD. Respondents indicate how often each item applies to them using a 5-point scale (1 = almost never to 5 = almost always), with scores ranging from 16 to 80 (higher scores indicate greater emotion regulation difficulties). The scale measures various facets of ERD (e.g., lack of emotional clarity, difficulties engaging in goal-directed behavior, impulse control difficulties, limited access to effective emotion regulation strategies, and nonacceptance of emotional responses) that when combined, yield a total score. The DERS-16 has demonstrated adequate psychometric properties (e.g., Hallion et al., 2018; Paulus et al., 2018) Internal consistency of the DERS-16 total score in the current sample was excellent ($\alpha = .97$; Cronbach, 1951). As consistent with past work (Hallion et al., 2018; Paltell et al., 2019), the DERS-16 total score was used as an index of ERD.

Procedure

All firefighters were recruited for participation in the parent study through career, combination, or volunteer fire departments throughout Texas. A department-wide email was sent to current firefighters in participating combination or volunteer fire departments notifying them of the opportunity to complete an online research survey for a chance to win one of several raffle prizes (e.g., assorted gift cards). Current firefighters in the career fire department were notified of the study when accessing their continuing education (CE) online portal. All notifications across departments indicated that the purpose of the survey is to better understand strength and resilience characteristics among firefighters, and how these positive characteristics may influence overall well-being. Firefighters who received an e-mail were given access to the informed consent form and survey through a link accessible in the department-wide e-mail; firefighters being recruited from the career department were given access through the online CE portal. Once firefighters accessed the portal, they were provided with a description of the survey and the choice to review the informed consent form, which delineates all aspects of the study. Across all departments, firefighters who did not wish to participate and consent to the study were given the option to indicate (by clicking 'no') that they did not wish to participate. Participants who indicated that they were interested in participating (by clicking 'yes') were directed to the beginning of the survey. Once firefighters electronically sign off on the consent form, they were presented with the online survey in Qualtrics for which they could complete at a time and place of their choosing. The total amount of time required for participation in this study was estimated to be 30-45 minutes. Firefighters could discontinue participation at any time without penalty. The study protocol was approved by the University of Houston Institutional Review Board and approved and endorsed by all participating fire departments.

Data Analytic Plan

Statistical analyses were conducted using IBM SPSS version 26.0 (IBM, 2019). First, data were examined for multivariate outliers, normality, and missingness. Missing variables were handled via list-wise deletion. Second, preliminary analyses evaluated descriptive statistics and bivariate correlations (Meng, Rosenthal, & Rubin, 1992) among all study variables. Third, regression coefficients for each hypothesized path in the models were evaluated. These analyses used PROCESS Macro for SPSS (Hayes, 2012) to examine the indirect association between TB (INQ-15) and PTSD symptom severity (PCL-5) through heightened ERD (DERS-16). A visual representation of this model is displayed in Figure 1. Path "a" examined the direct effect of TB (INQ-15) on ERD (DERS-16). Path "b" examined the direct effect of ERD (DERS-16) on PTSD symptom severity (PCL-5). Path "c" examined the total effect of TB (INQ-15) on PTSD symptom severity (PCL-5), and path "c'" examined the direct effect of TB (INQ-15) on PTSD symptom severity (PCL-5) controlling for ERD (DERS-16). The model used 10,000 bootstrap re-samplings to detect the indirect effects of the predictor (TB) on the outcome variable (PTSD symptom severity) via the mediator (heightened ERD) (Hayes, 2013; Preacher & Hayes, 2004). It has been found that bootstrapping can overcome the issue of power due to nonnormality in the sampling distribution (Bollen & Stine, 1990). A bootstrap confidence interval (CI) that does not include zero provides evidence of a significant indirect effect (Preacher & Hayes, 2008). The indirect effect was computed as the product of the beta coefficients of the "a" and "b" paths. A bootstrap confidence interval that does not include zero provides evidence of a significant indirect effect (Preacher & Hayes, 2008). Effect sizes (R^2) were calculated for each indirect effect (small, 0.01; medium, 0.09; large, 0.25; Preacher & Kelley, 2011). Years of fire service, relationship status, and trauma load (LEC-5) were included as covariates in the models as well.

Post hoc exploratory analyses were conducted, following the same procedures as the main analysis, to examine the indirect association between TB (INQ-15) and each of the four PTSD symptom clusters (PCL-5; intrusion, avoidance, negative alterations in cognitions and mood, arousal and reactivity) through heightened ERD (DERS-16). Finally, to test the specificity of the theoretical models and per recommendations for cross-sectional designs, two alternative models were tested. The predictor and explanatory variables were reversed (alternative model 1), and then the criterion and explanatory variable were reversed (alternative model 2) (Kraemer, Kiernan, Essex, & Kupfer, 2008; Preacher & Hayes, 2008).

RESULTS

Descriptive Statistics and Bivariate Correlations

Descriptive statistics and bivariate correlations among all study variables are shown in Tables 1 and 2, respectively. TB was positively and significantly associated with ERD ($r = .36$, $p < .01$), PTSD symptom severity ($r = .44$, $p < .01$), and all individual PTSD symptom clusters (B = .25, $p < .01$; C = .35, $p < .01$; D = .45, $p < .01$; E = .46, $p < .01$). ERD was also positively and significantly associated with PTSD symptom severity ($r = .53$, $p < .01$) and all individual PTSD symptom clusters (B = .37, $p < .01$; C = .42, $p < .01$; D = .57, $p < .01$; E = .50, $p < .01$). Relationship status (1= married / living with a partner vs. 0 = single / divorced / widowed) was negatively and significantly associated with TB ($r = -.17$, $p < .01$), such that being in a current relationship was associated with lower TB. Years of fire service was positively and significantly associated with current relationship endorsement ($r = .26$, $p < .01$) and trauma load ($r = .22$, $p < .05$), and negatively and significantly associated with TB ($r = -.13$, $p < .05$). Trauma load was positively and significantly associated with ERD ($r = .19$, $p < .01$), PTSD symptom severity ($r =$

.17, $p < .01$), and all individual PTSD symptom clusters (r's = .13 to .20, p's < .05) except for PTSD Intrusion symptoms.

Indirect Effect Analyses

Indirect effect analyses are presented in Table 3 (Model 1). Controlling for all covariates, TB (i.e., predictor) was positively and significantly associated with ERD ($\beta = 0.34$; CI [0.22, 0.46]). ERD was positively and significantly associated with PTSD symptom severity ($\beta = 0.50$; CI [0.37, 0.64]). Regarding the association between TB and PTSD symptom severity, the total effects and the direct effects were statistically significant, as well ($\beta = 0.52$; CI [0.38, 0.67]; ($\beta = 0.36$; CI [0.22, 0.49], respectively). Through ERD, TB exerted a significant indirect effect on PTSD symptom severity ($\beta = 0.17$; CI [0.08, 0.29]).

Post Hoc Exploratory Analyses

Post hoc exploratory analyses were conducted to examine the indirect effects of TB on each of the PTSD symptom clusters (i.e., intrusions, avoidance, negative alterations in cognitions and mood, and alterations in arousal and reactivity) through ERD, as shown in Table 3 (Models 2-5). Controlling for all covariates, ERD was positively and significantly associated with all of the PTSD symptom clusters, including PCL-5 Intrusion ($\beta = 0.09$; CI [0.05, 0.13]), PCL-5 Avoidance ($\beta = 0.05$; CI [0.03, 0.07]), PCL-5 Negative Alterations in Cognitions and Mood ($\beta = 0.20$; CI[0.15, 0.25]), and PCL-5 Arousal and Reactivity ($\beta = 0.16$; CI[0.11, 0.20]). The total effects and the direct effects were statistically significant regarding the association between TB and all of the PTSD symptom clusters: PCL-5 Intrusion ($\beta = 0.07$; CI [0.03, 0.11]); $\beta = 0.04$; CI [0.004, 0.08]), PCL-5 Avoidance ($\beta = 0.06$; CI [0.04, 0.08]; ($\beta = 0.04$; CI [0.02, 0.06], respectively), PCL-5 Negative Alterations in Cognitions and Mood ($\beta = 0.20$; CI [0.15, 0.25]; ($\beta = 0.13$; CI [0.08, 0.18], respectively), PCL-5 Arousal and Reactivity ($\beta = 0.20$; CI [0.15, 0.25];

(β = 0.14; CI [0.09, 0.19], respectively). The indirect effects models were significant with regard to all of the PTSD symptom clusters, including PCL-5 Intrusion (β = 0.03; CI [0.01, 0.06]), PCL-5 Avoidance (β = 0.02; CI[0.01, 0.03]), PCL-5 Negative Alterations in Cognitions and Mood (β = 0.07; CI[0.03, 0.12]), and PCL-5 Arousal and Reactivity (β = 0.05; CI[0.03, 0.09]).

Alternative Indirect Effect Analyses

The indirect effect analyses for the two alternative models are presented in Table 4 (Models 1 and 2). In the first alternative model, controlling for all covariates, ERD (i.e., predictor) was positively and significantly associated with TB (β = 0.33; CI [0.21, 0.45]). TB was positively associated with PTSD symptom severity (β = 0.36; CI [0.22, 0.49]). Regarding the association between ERD and PTSD symptom severity, the total effects and the direct effects were statistically significant (β = 0.62; CI [0.49, 0.75]; (β = 0.50; CI [0.37, 0.64], respectively). Through TB, ERD exerted a significant indirect effect on PTSD symptom severity (β = 0.12; CI [0.06, 0.18]).

In the second alternative model, controlling for all covariates, TB (i.e., predictor) was positively associated with PTSD symptom severity (β = 0.53; CI [0.38, 0.67]). PTSD symptom severity was positively associated with ERD (β = 0.37; CI [0.27, 0.47]). Regarding the association between TB and ERD, the total effects and the direct effects were statistically significant (β = 0.34; CI [0.22, 0.46]; (β = 0.15; CI [0.03, 0.27], respectively). Through PTSD symptom severity, TB exerted a significant indirect effect on ERD (β = 0.19; CI [0.10, 0.32]).

DISCUSSION

The present study examined, among trauma-exposed firefighters, associations of TB and ERD with PTSD symptom severity. Hypotheses were supported after controlling for theoretically relevant covariates of years of fire service, relationship status, and trauma load.

First, TB was positively, incrementally associated with ERD and PTSD symptom severity. This is consistent with previous literature showing the association between TB and related social-emotional factors (e.g. low social support, social exclusion, and loneliness) with both ERD and PTSD (Besser & Priel, 2010; DeWall et al., 2011; Heffer & Willoughby, 2018; Poindexter et al., 2015; Stanley et al., 2018). Findings indicate that perceived or actual social isolation among trauma-exposed firefighters is related to greater emotion regulation difficulties and higher levels of PTSD symptoms. Although these findings are cross-sectional and neither directionality nor temporality can be assumed, results are consistent with a growing body of work postulating that perceived or actual social isolation among trauma-exposed individuals is related to both ERD and increased PTSD symptom severity due to lower levels of social bonds that innately protect against these maladaptive emotion modulation processes (Charuvastra & Cloitre, 2008; Shallcross, Frazier, & Anders, 2014). Replication and extension, using longitudinal and experimental designs, with various measures of social isolation, are necessary before more conclusive determinations can be drawn regarding temporality, causality, or the nature of social isolation or exclusion (e.g., exclusion from peers or co-workers; romantic or familial estrangement) most relevant to ERD or PTSD.

Second, ERD was positively, incrementally associated with PTSD symptom severity, consistent with a well-established body of past research (Bartlett, Gallagher, Tran, & Vujanovic, 2019; Boden et al., 2013; Ehring & Quack, 2010; Hom et al., 2016). Indeed, studies have shown that individuals with diagnostic and subclinical PTSD exhibit increased ERD, and this has been demonstrated in cross-sectional studies (Ehring & Quack, 2010; Mazloom et al., 2016; Tull, Bardeen, DiLillo, Messman-Moore, & Gratz, 2015), experimental studies (Badour & Feldner, 2013; Mazloom et al., 2016; Sippel et al., 2016; Weiss, et al., 2012; Weiss et al., 2014), and

longitudinal designs (e.g., Bardeen et al., 2013; Tull et al., 2007). Furthermore, ERD has been directly implicated in subsequent negative cognition and mood in individuals with PTSD (Boden et al., 2013; Ehring & Quack, 2010). These results support a burgeoning literature among firefighters (e.g., Bartlett et al., 2019; Levy-Gigi et al., 2016; Wagner & Martin, 2020) demonstrating that ERD are robustly related with PTSD symptoms. Future work should continue to explore this empirical avenue to better understand the temporal relations between ERD and PTSD in firefighters so as to inform evidence-based cognitive-behavioral interventions to prevent and treat PTSD in this chronically trauma-exposed population.

Third, consistent with hypothesis, TB was indirectly related to PTSD symptom severity through heightened ERD. These results are consistent with previous literature examining similar associations between social-emotional constructs and PTSD, and this work fits well within the theoretical models of Social Baseline Theory and the Social Ecology of PTSD (Bryant, 2016; Charuvastra & Cloitre, 2008; Coan, 2011; Coan & Maresh, 2014). In these theoretical models, the ability to regulate emotions is proposed as a mediating factor between social bonding factors and PTSD symptom severity (Bryant, 2016; Charuvastra & Cloitre, 2008). This model appears to support extant frameworks, showing that problems with social affiliation following trauma exposure (i.e., TB) could lead to increased ERD, and in turn, greater PTSD symptom severity. The model supports an emergent literature associating insecure (avoidant and anxious) attachment styles with both increased PTSD symptom severity and ERD (e.g. Benoit et al., 2010; Brenning & Braet, 2013; Woodhouse, Ayers, & Field, 2015), as well as emerging literature on associations of insecure attachment with increased TB (Lev-Ari & Levi-Belz, 2019; Venta, Mellick, Schatte, & Sharp, 2014). Thus, individuals with avoidant or anxious attachment styles might be more likely to experience TB and to demonstrate ERD in the aftermath of trauma,

resulting in increased PTSD symptoms. As firefighters represent a population chronically exposed to trauma, these results suggest that social connectedness and emotion regulation may be clinically important factors to consider in evidence-based intervention and prevention efforts for PTSD.

Furthermore, post hoc exploratory analyses revealed that TB is related to each of the PTSD symptom clusters (i.e., intrusion, avoidance, negative alterations in cognitions and mood, arousal and reactivity) through ERD. Exploratory analyses thus failed to demonstrate any specificity of TB or ERD relations with regard to specific PTSD symptom clusters. Indeed, all four PTSD symptom clusters have been individually correlated with either TB or ERD in past work (Seligowski, Rogers, & Orcutt, 2016; Stanley et al., 2018), and all are related to both constructs at the bivariate level in the present study. Limited work has considered these constructs in one overarching model. Although there has not been specific research on the associations among TB, ERD, and PTSD symptom clusters, emergent research suggests that social bonds and emotion regulation may be implicated in PTSD through attachment mechanisms (Bryant, 2016; Charuvastra & Cloitre, 2008). Furthermore, at the neurobiological level, one of the primary modulating mechanisms of the human stress response, the oxytocin system, has been associated with social-emotional regulation (Kim et al., 2011; Olff et al., 2013: Wuirin, Kuhl, & Dusing, 2011). Indeed, oxytocin has been identified as a potentially key neurochemical component linking low social support with PTSD symptom severity, suggesting that social support is associated with PTSD symptom severity through emotion modulation. Additional work is necessary to bridge the present model with such biological systems to create a more comprehensive biopsychosocial framework for understanding these relations.

Results of the indirect effect analyses of the two alternative models showed that reversing the predictor and explanatory variables (alternative model 1) and reversing the criterion and explanatory variables (alternative model 2) yielded significant results. This may highlight the potential bidirectional and transactional associations of TB, ERD, and PTSD symptomatology, but the cross-sectional design of the current study precludes any determinations about temporality or causality. Just as greater TB might lead to ERD and PTSD symptom severity, ERD might lead to elevated TB and PTSD; and TB might lead to greater PTSD symptoms and thus higher ERD. Finally, it is also possible that PTSD symptoms in the aftermath of trauma might lead to greater ERD and TB. While the bidirectionally of ERD and PTSD has been established (Badour & Feldner, 2013; Mazloom et al., 2016; Sippel et al., 2016; Weiss, et al., 2012; Weiss et al., 2014), there has been no research examining the potential bidirectional association between TB and ERD, specifically. Future research might employ experimental paradigms, such as trauma-related cue reactivity or fear condition paradigms, to explore whether higher TB leads to greater emotion modulation or higher trauma reactivity in a laboratory setting.

While not the main objectives of the current study, there are several additional noteworthy findings. First, approximately 11.0% of the sample met self-report screening criteria for a probable PTSD diagnosis per the recommended PCL-5 diagnostic cut-off of 33 (e.g., Bovin et al. 2016). These rates are broadly consistent with prior research on the prevalence of PTSD among firefighters (Del Ben et al., 2006; Meyer et al., 2012). Second, relationship status was negatively and significantly associated with TB, and being in a romantic relationship was related to lower TB, as consistent with previous research (Rashid et al., 2016; Riley & McLaren, 2019). Future work might explore how relationship satisfaction, conflict, or longevity might affect associations between TB and relationship status. Third, trauma load was positively and

significantly associated with ERD, indicating that more experiences with potentially traumatic life events are related to greater ERD, consistent with previous research with firefighter populations (Bartlett, Gallagher, Tran, & Vujanovic, 2019; Paltell et al., 2019).

Findings should be considered in light of study limitations. First, this investigation used a cross-sectional design, which inhibits our ability to determine causality or temporality of associations among study variables. Bi-directional and/or transactional associations are possible, as possibly indicated by the significant indirect effects documented in the post hoc alternative models. Future research should utilize longitudinal and experimental designs to better understand the directionality of associations among TB, ERD, and PTSD symptomatology in firefighters. Second, the study relied exclusively on self-report measures for all of the study variables. Issues of method variance and social desirability bias thus cannot be ruled out. Future research directions might include replication and extension utilizing interview-based measures of PTSD symptoms and behavioral or physiological indices of TB and ERD, respectively. Finally, the current study included a sample of career and volunteer firefighters recruited from fire departments in Texas, and the sample was socio-demographically homogeneous, comprised of mostly white (81.3%) and male (93.1%) firefighters. To ensure that findings generalize across all firefighter populations, future research should focus on national samples that include and/or over-sample women as well as racial and ethnic minorities. Such research will illuminate the role that sociocultural influences (e.g., sexual harassment, racial discrimination, racism) might have on TB, ERD, and PTSD symptomatology.

Despite these limitations, this investigation has multiple strengths. As the first study to examine associations among TB, ERD, and PTSD symptom severity, the findings provide an incremental contribution to the emergent literature. The social context of fire culture is a

clinically meaningful area for further study, particularly given its relevance to trauma-relevant risk and resilience processes and the camaraderie inherent to and sustaining of the fire service (Chu et al., 2016; Regehr et al., 2003). Thus, replication and extension of this work with more rigorous methodologies and more representative samples is imperative. Ultimately, this line of inquiry has the potential to meaningfully inform evidence-based intervention and prevention efforts for PTSD among firefighters.

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Table 1

Sample Characteristics (N = 246)

Variable	*n*	Valid Percent
Gender	--	--
Male	229	93.1%
Female	16	6.5%
Transgender	1	0.4%
Race	--	--
White	200	81.3%
African American	12	4.9%
American Indian or Alaskan Native	11	4.5%
Asian	6	2.4%
Native Hawaiian/Pacific Islander	1	0.4%
Other	16	6.5%
Ethnicity	--	--
Hispanic/Latino	45	18.3%
Non-Hispanic/Latino	201	81.7%
Education	--	--
Some High School (or GED equivalent)	1	0.4%
High School Graduate	22	8.9%
Some College	102	41.5%
College Graduate	121	49.2%
Relationship Status	--	--
Married / Living with a Partner	191	77.6%
Single / Divorced / Widowed	55	22.4%
Probable PTSD (PCL-5)	27	11.0%
	Mean	*SD*
Age	40.21	9.93
Years of service in department	14.86	8.90

Note. All reported variables were derived from the Demographics Questionnaire except where PCL-5 (PTSD Checklist for DSM-5) is noted.

Table 2

Bivariate Correlations for Study Variables

Variables	1.	2.	3.	4.	5.	*Mean*	*SD*	*Range*
1. Fire Service Years	-					14.86	8.90	1-43
2. Relationship Status	.26**	-				-	-	-
3. Trauma Load	.22**	-.04	-			11.8	3.65	1-17
4. TB	-.13*	-.17**	.03	-		21.2	12.1	9-62
5. ERD	-.10	-.11	.19**	.36**	-	25.7	12.5	16-80
6. PTSD Symptom Severity	-.07	-.09	.17**	.44**	.53**	12.2	15.0	0-80
7. PTSD-Intrusions	-.06	-.08	.11	.25**	.37**	2.62	3.62	0-20
8. PTSD-Avoidance	-.03	-.08	.16**	.35**	.42**	1.54	2.10	0-8
9. PTSD-Neg Alterations in Cog/Mood	-.06	-.10	.14*	.45**	.57**	3.85	5.55	0-28
10.PTSD-Alterations in Arousal/Reactivity	-.07	-.07	.19**	.46**	.50**	4.18	5.31	0-24

Note. * $p < .05$; ** $p < .01$; Fire Service Years = Years of service in fire department; Relationship Status = Relationship Status (0 = single/ divorced/widowed; 1 = married / living with partner); Trauma Load = LEC-5 total score; TB = INQ-TB subscale total score; ERD = DERS-16 total score; PTSD Symptom Severity = PCL-5 total score; PTSD-Intrusions = PCL-B subscale total score; PTSD-Avoidance = PCL-C subscale total score; PTSD-Neg Alterations in Cog/Mood = PCL-D subscale total score; Alterations in Arousal/Reactivity = PCL-E subscale total score

Table 3

Standard regression coefficients: main analysis and exploratory indirect effect models

Y	Model	Model R^2	β	p	Bootstrapped 95% CI
1	INQ-TB → DERS-16 (a)	0.17**	0.34	<.001	0.22 - 0.46
	DERS-16 → PCL-5 (b)	0.36**	0.50	<.001	0.37 - 0.64
	INQ-TB → PCL-5 (c)	0.22**	0.52	<.001	0.38 - 0.67
	INQ-TB → PCL-5 (c')		0.36	<.001	0.22 - 0.49
	INQ-TB → DERS-16 → PCL-5 (a*b)		0.17		0.08 - 0.29
2	INQ-TB → DERS-16 (a)	0.17**	0.34	<.001	0.22 - 0.46
	DERS-16 → PCL-5 B (b)	0.16**	0.09	<.001	0.05 - 0.13
	INQ-TB → PCL-5 B (c)	0.08**	0.07	<.001	0.03 - 0.11
	INQ-TB → PCL-5 B (c')		0.04	.050	0.004 - 0.08
	INQ-TB → DERS-16 → PCL-5 B (a*b)		0.03		0.01 - 0.06
3	INQ-TB → DERS-16 (a)	0.17**	0.34	<.001	0.22 - 0.46
	DERS-16 → PCL-5 C (b)	0.23**	0.05	<.001	0.03 - 0.07
	INQ-TB → PCL-5 C (c)	0.15**	0.06	<.001	0.04 - 0.08
	INQ-TB → PCL-5 C (c')		0.04	<.001	0.02 - 0.06
	INQ-TB → DERS-16 → PCL-5 C (a*b)		0.02		0.01 - 0.03
4	INQ-TB → DERS-16 (a)	0.17**	0.34	<.001	0.22 - 0.46
	DERS-16 → PCL-5 D (b)	0.39**	0.20	<.001	0.15 - 0.25
	INQ-TB → PCL-5 D (c)	0.22**	0.20	<.001	0.15 - 0.25
	INQ-TB → PCL-5 D (c')		0.13	<.001	0.08 - 0.18
	INQ-TB → DERS-16 → PCL-5 D (a*b)		0.07		0.03 - 0.12
5	INQ-TB → DERS-16 (a)	0.17**	0.34	<.001	0.22 - 0.46
	DERS-16 → PCL-5 E (b)	0.36**	0.16	<.001	0.11 - 0.20
	INQ-TB → PCL-5 E (c)	0.24**	0.20	<.001	0.15 - 0.25
	INQ-TB → PCL-5 E (c')		0.14	<.001	0.09 - 0.19
	INQ-TB → DERS-16 → PCL-5 E (a*b)		0.05		0.03 - 0.09

Note. **p < .001. The standard error and 95% CI for a*b is obtained via bootstrapping with 10,000 resamples. INQ-TB = INQ-TB subscale total score (Thwarted Belongingness). DERS-16 = DERS-16 total score (Emotion regulation difficulties). PCL-5 = PCL-5 total score (PTSD symptom severity). PCL-5 B = PCL-5 B subscale score (intrusions). PCL-5 C = PCL-5 C subscale score (avoidance). PCL-5 D = PCL-5 D subscale score (negative alterations in cognitions and mood). PCL-5 E = PCL-5 E subscale score (alterations in arousal and reactivity). CI (lower) is the lower bound of a 95% CI; CI (upper) is the upper bound of a 95% CI. Per Fig. 1, path a indicates effect of X on M; b, effect of M on Y; c, effect of X on Y; c', direct effect of X on Y, controlling for M. All total, direct, and indirect paths are noted after controlling for the variance accounted for by theoretically relevant covariates, including years of fire service, marital status, and trauma load.

Table 4

Standard regression coefficients: reverse indirect effect models

Y	Model	Model R^2	β	p	Bootstrapped 95% CI
1	DERS-16 → INQ-TB (a)	0.15**	0.33	<.001	0.21 - 0.45
	INQ-TB → PCL-5 (b)	0.36**	0.36	<.001	0.22 - 0.49
	DERS-16 → PCL-5 (c)	0.29**	0.62	<.001	0.49 - 0.75
	DERS-16 → PCL-5 (c')		0.50	<.001	0.37 - 0.64
	DERS-16 → INQ-TB → PCL-5 (a*b)		0.12		0.06 - 0.18
2	INQ-TB → PCL-5 (a)	0.22**	0.53	<.001	0.38 - 0.67
	PCL-5 → DERS-16 (b)	0.32**	0.37	<.001	0.27 - 0.47
	INQ-TB → DERS-16 (c)	0.17**	0.34	<.001	0.22 - 0.46
	INQ-TB → DERS-16 (c')		0.15	.020	0.03 - 0.27
	INQ-TB → PCL-5 → DERS-16 (a*b)		0.19		0.10 - 0.32

Note. *p < .001. The standard error and 95% CI for a*b is obtained via bootstrapping with 10,000 resamples. INQ-TB = INQ-TB subscale total score (Thwarted Belongingness). DERS-16 = DERS-16 total score (Emotion regulation difficulties). PCL-5 = PCL-5 total score (PTSD symptom severity) CI (lower) is the lower bound of a 95% CI; CI (upper) is the upper bound of a 95% CI. All total, direct, and indirect paths are noted after controlling for the variance accounted for by theoretically relevant covariates, including years of fire service, marital status, and trauma load.

Figure 1. Indirect effect of Thwarted Belongingness on PTSD Symptom Severity through Emotion Regulation Difficulties. Path "a" shows the direct effect of TB (INQ-15) on ERD (DERS-16). Path "b" shows the direct effect of ERD (DERS-16) on PTSD symptom severity (PCL-5). Path "c" shows the total effect of TB (INQ-15) on PTSD symptom severity (PCL-5). Path "c'" shows the direct effect of TB (INQ-15) on PTSD symptom severity (PCL-5) controlling for ERD (DERS-16).