

THE RELATIONSHIP BETWEEN DUTY-RELATED TRAUMA EXPOSURE AND  
PTSD SYMPTOM SEVERITY IN URBAN FIREFIGHTERS

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## Abstract

**Background:** Many firefighters are also emergency medical service personnel.

Therefore, they respond not only to fire calls, but also to an array of different incidents, including motor vehicle accidents, accidents involving serious injury or death, suicides, and pediatric death cases. Research suggests that repeated trauma exposure may play a role in the high rates of PTSD reported in firefighter samples. Such studies, however, have failed to account for firefighters' actual experience of repeated trauma on the job, and have not examined the impact of exposure to multiple types of traumatic events or peritraumatic risk factors. Due to the risky nature of their work, as well as their routine exposure to trauma, there is a pressing need for research on the duty-related correlates of PTSD among firefighters. **Purpose:** The present study extended previous research by examining the role that various duty-related trauma characteristics play in firefighters' experience of PTSD symptoms. This study explored the relationships between PTSD symptoms and years of fire service, trauma load, and appraised stressfulness. Further, the study examined whether type of traumatic experiences (i.e., direct experience, indirect experience, or colleague-related) contribute differentially to PTSD risk. **Methods:** This cross-sectional, quantitative study utilized archival data collected from 995 career firefighters in a large, urban fire department. The study used a measure of trauma exposure composed of potentially traumatic, duty-related incidents specific to firefighters. Two multiple regression analyses separately examined the association of trauma type and years of service, trauma load, and appraised stressfulness to PTSD symptoms. Two moderation analyses were also conducted to separately examine whether appraised stressfulness or trauma load moderate the relationship between years of service

and PTSD symptom severity. **Results:** The findings confirmed that firefighters are exposed to a wide array of traumatic events. Participants rated colleague-related traumatic events as more stressful than both direct and indirect events and witnessing the duty-related death of a coworker as the most stressful traumatic event. With regards to traumatic event categories, across indirect, direct, colleague-related, and total traumatic events, both appraised stressfulness and trauma load contributed significant variance to PTSD symptoms. Neither trauma load nor appraised stressfulness moderated the relationship of years of service to PTSD symptoms across all traumatic event categories. **Conclusion:** Future research warrants increased focus on the specific characteristics of traumatic events that may contribute to firefighters' psychological distress. Researchers should also focus on developing and validating measures that accurately and comprehensively capture the types of traumatic events that firefighters experience. The findings highlight the importance of developing adequate screening measures to accurately capture the types of traumas that firefighters face on the job, in order to guide effective treatment for this high-risk group.

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## **Chapter I**

### **Introduction**

Firefighting has long been recognized as one of the most hazardous occupations (IAFF, 2000; U.S. Bureau of Labor Statistics, 2007). Firefighters are routinely exposed to a diverse array of traumatic events. Because many firefighters are also emergency medical service (EMS) personnel, they respond not only to fire calls, but also to other emergencies, including but not limited to motor vehicle accidents, suicides, and pediatric cases that involve serious injury or death (Armstrong, Shakespeare-Finch, & Shochet, 2014; Bryant & Harvey, 1996). As first responders, firefighters are not only responsible for rescuing others, but are also often placed in dangerous situations that threaten their own safety and wellbeing.

Research suggests that repeated trauma exposure may play a role in the high rates of mental health outcomes reported in firefighter samples (Jahnke, Poston, Haddock, & Murphy, 2016). Repeated exposure to trauma has been implicated in increased risk for stress-related disorders such as PTSD (Corneil, Beaton, Murphy, Johnson, & Pike, 1999; Heinrichs, Wagner, Schoch, Soravia, Hellhammer, & Ehlert, 2005; Johnson, Maxwell & Gallea, 2009; Laposa & Alden, 2003); in turn, researchers have identified prevalence rates for PTSD as high as 37% among firefighters (Bryant & Harvey, 1995). However, most often studies have focused on firefighters' mental health following a single disaster or catastrophic event (e.g., Perrin, DiGrande, Wheeler, Thorpe, Farfel, & Brackbill, 2007; Tak, Driscoll, Bernard, & West, 2007). For the most part studies have failed to account for firefighters' repeated, on-the-job exposure to multiple types of traumatic events. Due



to the risky nature of their work, as well as their routine exposure to trauma, there is a pressing need for research on the duty-related correlates of PTSD among firefighters.

Researchers have examined the role of peritraumatic risk factors, such as trauma severity, duration, perceived threat to oneself, and appraised stressfulness, in the development and maintenance of PTSD symptoms. Peritraumatic factors have been positively related to PTSD symptom severity in numerous studies with community samples (e.g., Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003), yet few studies have examined this association in firefighter samples. It has been suggested that one's perception of a traumatic event, or appraisal of the level of suffering or stress while it is occurring, may partially explain PTSD symptom severity (Lee, Lee, Kim, Jeon, & Sim, 2017). However, the nature of the relation of peritraumatic risk factors and PTSD symptom severity remains unclear among firefighters and may be influenced by factors such as years in the fire service and trauma load (e.g., the number of traumatic events experienced). Previous studies that have used years of service as a proxy variable for trauma load have shown mixed results with regards to years of service as a predictor for PTSD (e.g., Corneil, 1995; Chang, Lee, Connor, Davidson, & Lai, 2008; Del Ben, Scotti, Chen, & Fortson, 2006; Meyer, Zimering, Daly, Knight, Kamholz, & Gulliver, 2012; Wagner, Heinrichs, & Ehler, 1998). Therefore, the present study examined trauma load and years of service as separate predictors of PTSD symptoms.

The types of traumatic events firefighters experience may also account for differential development of PTSD symptoms. While trauma type has been conceptualized in a number of ways across the literature, the notion of direct versus indirect traumatic events, as proposed by Lee et al. (2017), may provide additional insight into the role of

trauma type in PTSD risk. In a study with firefighters in Korea, learning about a traumatic event happening to a close loved one or colleague was correlated with higher risk for PTSD than directly experiencing a traumatic event (Lee et al., 2017). Lee et al. (2017) also found that exposure to multiple traumatic events and peritraumatic suffering were both predictive of PTSD symptom severity among firefighters. Thus, PTSD risk for firefighters may vary depending on whether they directly experience a trauma firsthand, learn about or witness it, or learn about it happening to a colleague.

The present study examined various duty-related characteristics and their associations with PTSD symptom severity. No previous studies were located that explicitly examined the associations between trauma type, years of service, trauma load, and PTSD symptom severity. Thus, the purpose of the current study is to extend the findings of Lee et al. (2017) by examining differences in PTSD symptom severity by experience of direct, indirect, and colleague-related trauma among a sample of urban firefighters. Further, the proposed study examined whether trauma load, years of fire service, and appraised stressfulness are predictive of PTSD. Lastly, appraised stressfulness and trauma load were examined separately to determine whether these variables moderate the relationship between years of service and PTSD symptom severity.

## **Chapter II**

### **Literature Review**

Trauma exposure is inherent to the duties of first responders and other emergency service personnel. Firefighters often respond to both fire and emergency medical service (EMS) calls, which routinely expose them to traumatic events including, but not limited to, motor vehicle accidents, burn victims, severely injured victims, and violent deaths (Armstrong et al., 2014; Bryant & Harvey, 1996). Within the United States, the rate of occupational fatalities for firefighters is 4.5 times greater than the national average (U.S. Bureau of Labor Statistics, 2007). Additionally, a report issued in 2000 estimated that one out of five firefighters sustained an occupational injury, with 69.5% of these injuries occurring at the scene of an emergency incident (IAFF, 2000).

Due to the highly stressful and dangerous nature of their work, firefighters and other emergency responders are at an elevated risk for developing stress-related disorders such as PTSD (Corneil, Beaton, Murphy, Johnson, & Pike, 1999; Heinrichs et al., 2005; Johnson, Maxwell & Gallea, 2009; Laposa & Alden, 2003). Compared to prevalence rates of 1% for men and 2.2% for women in community samples (Perkonigg, Kessler, Storz, & Wittchen, 2001), various studies have reported a wide range of prevalence rates for PTSD among firefighters, ranging from as low as 4.2% (Meyer et al., 2012) to as high as 37% (Bryant & Harvey, 1995).

PTSD symptoms commonly co-occur with other psychiatric disorders, such as depression, substance abuse, anxiety, and suicidal ideation (Brady, Killeen, Brewerton, & Lucerini, 2000; Cougle, Resnick, & Kilpatrick, 2009; Sareen, Houlahan, Cox, & Asmundson, 2005). Although there is a growing body of research addressing

psychological risks and outcomes for emergency responders, little is still known about the duty-related variables that contribute to PTSD symptoms and other mental health outcomes specifically in firefighter populations.

### **Etiology and Symptomology of PTSD**

The *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*, American Psychiatric Association, 2013) characterizes PTSD by the presence of four symptom clusters: intrusions, avoidance, negative alterations in cognitions and mood, and hyperarousal and reactivity. These symptoms arise in response to an index trauma, which can include directly experiencing, witnessing, or learning about a traumatic event, or being repeatedly exposed to trauma details as part of one's job. As per the *DSM-5*, the index trauma for a PTSD diagnosis must involve actual or threatened death, actual or threatened serious injury, or actual or threatened sexual violence.

Trauma is a necessary diagnostic criterion for PTSD. In community samples, previous research has found that the nature of the traumatic events experienced may play a role in whether psychopathology will arise, as well as the severity of mental health symptoms (Breslau, Kessler, Chilcoat, Schultz, Davis, & Andreski, 1998; Breslau, Chilcoat, Kessler, & Davis, 1999; Creamer, Burgess, & McFarlane, 2001; Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997). However, the differential risks elicited by exposure to various types of trauma has been understudied in firefighter populations. Due to the unique stressors of the firefighting occupation, there remains a critical need to examine the association of duty-related trauma exposure and characteristics to PTSD symptoms among firefighters.

### **Mental Health of Firefighters**

Despite the higher prevalence of PTSD among firefighter samples compared to the general population, research examining the effects of duty-related trauma exposure on firefighters remains relatively scarce compared to other high-risk groups. Interest in the mental health of firefighters has grown in the past several decades due to recognition of the unique occupational stressors they face and repeated exposure to trauma that is inherent to their line of work. Several studies have examined various aspects of the mental and physical health of firefighters (Barnes, 2000; Corneil et al., 1999; Jahnke et al., 2016; Jahnke, Poston, Jitnarin, & Haddock, 2012; Moran & Colless, 1995; Moran, 2001; Riolli & Savick, 2012; Roy & Steptoe, 1994; Steffen, 2012; Tak et al., 2007; Wagner, McFee, & Martin, 2009). Not surprisingly, due to the consistently dangerous nature of firefighting and repeated exposure to traumatic events, firefighters often report elevated rates of negative psychological outcomes compared to the general population. Pyle (2009) found that 15.6% of a sample of firefighters in the Midwest U.S. screened positive for depression, while Tak et al. (2007) found that 27% of firefighters in their sample reported clinically significant depressive symptoms three months after responding to Hurricane Katrina. Marmar et al. (2006) found that greater routine work stress and lower levels of social support were both significant predictors of PTSD symptoms in a large sample of police officers. Although growing interest in firefighters' mental health has sparked several studies examining various correlates of psychological variables, few studies have explicitly examined the unique aspects of firefighters' occupation that may contribute to psychopathology.

### **Repeated Trauma Exposure and PTSD**

Although firefighters respond to traumatic incidents on a regular basis, previous studies examining PTSD risk among firefighters have largely focused on the effects of a specific disaster or trauma (e.g., Perrin et al., 2007; Tak et al., 2007). This limits the generalizability of the results to firefighters who experience traumatic events that are routine to their work and does not account for the impact of cumulative stress through repeated trauma exposure. Research focusing on the effects of repeated trauma exposure may be more in line with most firefighters' actual experience. There is evidence that repeated exposure to traumatic events has a negative impact on the mental and physical health of firefighters. Using focus groups and interviews, Jahnke et al. (2016) showed that firefighters largely cited repeated exposure to trauma as more distressing than any single event. Although a number of firefighters in the study discussed the effects resulting from a specific distressing event or call, the majority of participants pointed out the negative impact and toll of cumulative stress and trauma.

Other studies have confirmed that trauma load, or the number of traumatic event types experienced, may contribute to elevated PTSD risk. Korean firefighters who reported experiencing more than six types of traumatic events had higher levels of PTSD than did firefighters who reported experiencing fewer than four types of traumatic events (Lee et al., 2017). Among a community sample of trauma survivors, Ehring and Quack (2010) found evidence for a positive relationship between multiple incidences of trauma exposure (regardless of type of traumatic event) and increased PTSD symptoms and emotion regulation difficulties. Therefore, trauma load may provide additional insight into the development and maintenance of PTSD among firefighters. Within the context of

the proposed study, the total number of traumatic event types experienced will be referred to as *trauma load*.

### **Measurement of Trauma Exposure and Associated Variables**

Trauma exposure has been operationalized in various ways. Universal measures of traumatic event exposure, such as the Life Events Checklist Version-5 (LEC-5; Weathers et al. 2013) or the Trauma History Questionnaire (THQ; Hooper, Stockton, Krupnick, & Green, 2011) provide information on general exposure to potentially traumatic events throughout the lifespan. Various measures have also been developed to assess for trauma exposure in specific groups, such as the Combat Exposure Scale (CES; Keane, Fairbank, Caddell, Zimering, Taylor, & Mora, 1989) for veterans. However, few measures have been developed that specifically examine exposure to occupational traumas unique to firefighters.

Beaton, Murphy, Johnson, Pike, and Corneil (1998) developed a measure of incident stressors unique to firefighters and paramedics in order to operationalize duty-related trauma exposure and to more accurately examine the role of routine occupational trauma exposure in PTSD symptomatology (see Table 3 for item descriptions). Prior to their work, no incident exposure measures had been developed to specifically capture the types of traumatic events that firefighters encounter on a routine basis. Furthermore, many prior studies examining the effects of trauma exposure on PTSD symptoms included only unusual, highly specific events (e.g., terrorist attacks, natural disasters) rather than more common events that firefighters encounter in their work (e.g., motor vehicle accidents, cardiac arrests). Beaton et al.'s (1998) 25-item Duty-Related Incident Stressor scale assesses the incidence and the appraised stressfulness of 25 distinct events

that include rare, catastrophic events as well as commonly experienced, on-the-job traumatic events specific to the firefighting and paramedic profession. Therefore, the scale provides a measure of not only the appraised stressfulness of each individual event, but also information regarding the number of different types of specific events experienced (i.e., trauma load).

### **Categorization of Trauma Type**

Although several studies have examined the various risk factors for PTSD among firefighters, few studies have focused on trauma type as a distinct contributor to PTSD symptom severity. Ditlevsen and Elkit (2012) define trauma type as an “overarching category for a series of different individual trauma events that are related or familiar to each other through some defining similar characteristics” (p. 1). As no two traumatic events are exactly alike, it is likely that the multifarious nature of traumatic events may contribute unique variance to the experience of posttraumatic outcomes. Though research on trauma type among firefighters is relatively scarce, several studies have examined the differential effects of trauma type in various other samples and occupational groups.

Researchers have attempted to categorize traumatic experience in a number of ways. Most commonly, traumatic events have been categorized in the literature by grouping together conceptually related events, or by distinguishing between interpersonal and non-interpersonal trauma. For instance, Ditlevsen and Elkit (2012) analyzed several PTSD studies conducted in Denmark and Iceland and categorized related traumatic events into five types: exposure to a disaster or accident, loss of a family member or friend, experience of a chronic disease (self or family member), experience of a non-malignant disease (self or family member), and exposure to violence. The researchers



found that individuals who reported exposure to a disaster or accident had the highest prevalence of PTSD. Within community samples, several studies have found that survivors of interpersonal traumas, such as physical abuse, sexual abuse, and rape, report higher rates of PTSD, general distress, and other negative psychological consequences compared to survivors of non-interpersonal trauma (Breslau et al., 1999; Creamer et al., 2001; Kilpatrick et al., 1997).

Various trauma types, studied in non-firefighter samples, appear to contribute differential risk for PTSD symptoms. In a large population-based study conducted in Sweden, the trauma type most strongly correlated with PTSD was sexual and physical assault, while the trauma type least associated with PTSD was motor vehicle accidents (Frans, Rimmö, Åberg, & Fredrikson, 2005). Among veterans, higher levels of combat exposure have been significantly correlated with PTSD symptom severity (Hoge et al., 2004; Jakob, Lamp, Rauch, Smith, & Buchholz, 2017; Ramchand et al., 2010; Rona et al., 2009). Jakob et al. (2017) further found that veterans who reported experiencing combat trauma or sexual trauma were more likely to be diagnosed with PTSD than veterans who reported experiencing other types of traumas. Thus, there is evidence that various trauma types may be differentially associated with severity of PTSD symptoms.

Although firefighters experience a multitude of traumatic events in their line of work, few studies have examined duty-related trauma types specifically in firefighter samples. In a related study on police officers, Robinson, Sigman, and Wilson (1997) found that exposure to death or a life-threatening event on the job was highly predictive of PTSD symptomatology. Beaton et al. (1998) categorized firefighter-specific traumatic events into five occupational categories: catastrophic injury to self or co-worker,

gruesome victim incidents, rendering aid to seriously injured vulnerable victims, minor injury to self, and exposure to death and dying. A major limitation with this method of categorization is that the trauma types may not be mutually exclusive; for instance, a firefighter may respond to a gruesome victim incident and also experience a minor injury to self within the same event. As such, measurement of trauma load using Beaton et al.'s (1998) categories may be inaccurate. The present study attempted to account for this limitation by recategorizing the critical incidents in Beaton et al.'s (1998) Duty-Related Incident Stressor scale into mutually exclusive traumatic event types. Additionally, studies examining the role of interpersonal traumas compared to non-interpersonal traumas are limited in scope, in that both of these categories can refer to the direct experience of trauma (i.e., experiencing the event firsthand). Examining dimensions of both *direct* and *indirect* traumatic events may provide additional insight into the differential effects of trauma type on PTSD symptom severity.

### **Direct, Indirect, and Colleague-Related Traumatic Events and PTSD**

As outlined in the *DSM-5* (American Psychiatric Association, 2013), a PTSD diagnosis can arise whether an individual directly experiences, witnesses, or learns about a traumatic event. These distinctions in how individuals experience a trauma have been understudied in both firefighter and civilian samples. However, the difference between direct and indirect traumatic event types may provide insight into the etiology of PTSD among firefighters. Breslau et al. (1998) assessed trauma exposure in a large community sample of adults and categorized each specific type of event into four categories: direct personal traumas involving intentional violence, other directly experienced traumas, learning about traumatic events experienced by others, and learning about the sudden

unexpected death of a family member or close friend. The researchers found that a greater proportion of PTSD cases was associated with learning about the sudden unexpected death of a loved one than with the other three categories.

Experiencing a traumatic event directly versus witnessing or learning about it may differentially affect the development of PTSD symptoms among firefighters. For instance, direct experience of a traumatic event may place firefighters at higher risk for personal injury or death. Perrin et al. (2007) assessed PTSD symptoms among rescue workers who responded to 9/11 and found that sustaining an injury during the rescue effort increased their risk of PTSD. Similarly, the level of firefighters' perceived threat during a traumatic experience was predictive of PTSD symptom severity above and beyond total number of traumatic events experienced, frequency of trauma exposure, and recency of traumatic events (Pinto, Henriques, Jongenelen, Carvalho, & Maia, 2015). Thus, it is plausible that direct experience of traumatic events may place firefighters at higher risk of harm or danger, and thus increase perceived threat to their safety or wellbeing, as compared to indirect experience of traumatic events in which firefighters may not be directly or personally threatened.

Only one study to date was located that explicitly examined the differences in PTSD risk among firefighters utilizing the categorization of direct versus indirect traumatic events. In a sample of Korean firefighters, Lee et al. (2017) suggested that firefighters' experience of trauma may be distinct from the general population, in that they routinely encounter direct, life-threatening situations and also witness the deaths and severe injuries of others during the rescue process. The researchers thus distinguished between three categories of traumatic events: direct, indirect, and colleague-related

trauma. Direct traumatic events included firefighters or their family members being threatened or injured, whereas indirect traumatic events were defined as “experiences related to rescuing or witnessing seriously injured persons or dead bodies” (Lee et al., 2017, p. 134). In addition to examining the conditional risk for PTSD by trauma type, the researchers calculated a composite index to explore the combined role of total number of traumatic events experienced and average perceived suffering of all events endorsed. This composite index reflecting multiple traumatic events and peritraumatic suffering was more associated with PTSD symptom severity than either factor alone (Lee et al., 2017). Furthermore, the researchers found that firefighters who experienced a greater number of traumatic event types (i.e., > 6) also reported higher PTSD symptoms than firefighters who experienced fewer traumatic event types (i.e., > 4). When considered simultaneously, number of colleague-related and indirect traumatic events experienced were positively associated with a probable PTSD diagnosis. Surprisingly, direct traumatic events were not significantly associated with probable PTSD (Lee et al, 2017).

The results presented by Lee et al. (2017) suggest that the distinction between direct, indirect, and colleague-related trauma types may provide differential information regarding PTSD risk for firefighters. It appears that both differences in peritraumatic suffering for specific traumatic events as well as trauma load are related to PTSD symptom severity among firefighters. The findings of the study are consistent with Breslau et al. (1998) in that the experience of indirect traumatic events appears to confer greater risk for PTSD among firefighters than the experience of direct traumatic events. However, while the study provides crucial insight into the relationships between PTSD, trauma type, trauma load, and peritraumatic suffering, Lee et al. (2017) did not address

other potential mechanisms that may influence their results. For instance, years of fire service may affect firefighters' appraisals of suffering during traumatic events. It is possible that firefighters who have been in the service for longer periods of time may experience a habituation effect to routine trauma exposure (Doroga & Băban, 2013), and thus report lower perceived peritraumatic suffering. Firefighters who have fewer years of service may appraise traumatic incidents as more distressing due to the "novelty" or uniqueness of each event. On the other hand, it is also possible that firefighters with a greater number of years in the service may be negatively affected by higher trauma loads due to cumulative stress. Thus, appraised stressfulness of traumatic event types experienced may moderate the relationship between years of service and PTSD symptom severity. The present study seeks to extend the findings of Lee et al. (2017) by including years of service as a predictor for PTSD, and by examining appraised stressfulness and trauma load as separate moderators of the relation of years of service to PTSD symptoms.

### **Years of Service, Trauma Load, and PTSD**

Previous research has produced mixed results with regards to the relationship between years of service and PTSD symptom severity. Years in the fire service has been used as a proxy variable for determining trauma load, or total number of traumas experienced. Several studies have found a positive relationship between years of service and PTSD symptoms (Corneil, 1995; Chang et al., 2008; Nydegger, Nydegger, & Basile, 2011; Wagner et al., 1998). However, Del Ben et al. (2006) examined various demographic characteristics, job-related factors, and trauma-related factors in a sample of firefighters and found no relationship between years of service and PTSD symptoms. Similarly, Meyer et al. (2012) did not find any association between years of service and

PTSD in firefighters. The researchers further found a small correlation between years of service and number of traumatic events experienced, indicating that these two constructs may be empirically distinct. Years in the fire service may not fully or accurately capture firefighters' trauma loads. As such, the present study sought to overcome limitations and mixed results of previous research by examining years of fire service and trauma load as separate predictive variables.

### **Appraised Stressfulness and PTSD**

Several studies have distinguished between pre-, peri-, and posttraumatic risk factors for PTSD. Peritraumatic factors are variables that occur during and immediately after a traumatic event, such as trauma severity, the duration of the trauma, dissociation while the event is happening, and perceived or appraised stressfulness of the trauma. Studies examining first responder samples have found that peritraumatic risk factors, particularly peritraumatic association, perceived distress, and trauma severity, contribute unique variance to PTSD risk (Brewin et al., 2000; Marmar et al., 2006; Ozer et al., 2003).

Peritraumatic stress, or appraised stressfulness of a traumatic event, has been assessed in different ways in the literature. The Peritraumatic Distress Inventory (PDI; Brunet et al., 2001) is often used as a measure of the level of distress experienced during and immediately after a traumatic event. Scores on the PDI were significantly related to PTSD symptom severity among police officers (Brunet et al., 2001) and rescue workers present during the 2001 Great East Japan Earthquake (Nishi et al., 2012). However, a major limitation with the PDI (Brunet et al., 2001) is that it only measures peritraumatic distress for a single index event and is time-consuming to administer to individuals who

report exposure to multiple traumatic events. As such, the current study addresses this limitation by utilizing the Duty-Related Incident Stressors scale (Beaton et al., 1999) as a measure of appraised stressfulness of the various potentially traumatic event types within the instrument.

### **Limitations in Current Research**

Given the dangerous and risky nature of their work, more research needs to examine duty-related correlates of PTSD risk among firefighters. Several limitations are apparent in the existing literature on repeated trauma exposure and PTSD risk for firefighters. Most notably, only a handful of studies have examined the relationship between PTSD and repeated exposure to trauma within firefighter samples (Berninger et al., 2010; Jahnke et al., 2016). Even fewer studies were located that explored the associations between trauma type and PTSD symptom severity in firefighter samples, and only one that examined the distinction between direct and indirect experience of traumatic events (Lee et al., 2017). Further, no study was located that examined simultaneously the associations of trauma type, trauma load, appraised stressfulness, and years of service with PTSD symptom severity. The studies that have examined PTSD risk among firefighters have typically focused on the effects of a specific disaster or trauma, which limits the generalizability of the results to firefighters who experience traumatic events that may be more routine to their work. In addition, prior studies have also diverged considerably in their categorization of trauma type. Due to the diversified, multifaceted nature of traumatic events, it has proven challenging for researchers to develop consensus on categorization of trauma types, which may vary along several dimensions, including level of life threat, controllability, and duration (Hetzel-Riggin &

Roby, 2013). The lack of agreement among researchers regarding the relationship between trauma type and PTSD is likely due in part to the diverse nature of traumas and the associated challenges of categorizing traumas according to a universal standard. Lastly, the conceptualization of years of service as a proxy variable for trauma load has produced mixed results in the literature with regards to PTSD risk (e.g., Corneil, 1995; Chang et al., 2008; Del Ben et al., 2006; Meyer et al., 2012; Wagner et al., 1998). This is likely because the two constructs are empirically distinct, and as such the present study examined these two facets of trauma exposure separately. The relationship between years of service and PTSD symptom severity may be moderated by trauma load or appraised stressfulness of traumatic events. Specifically, the association between years of service and PTSD symptomatology may be stronger for firefighters who have experienced a greater number of traumatic events or appraise traumatic events to be more stressful overall, compared to firefighters who have experienced fewer traumatic events or appraise events as less stressful.

### **The Present Study**

The present study sought to overcome some of the limitations of previous studies by (a) examining the relative contribution of direct, indirect, and colleague-related traumatic events using an existing duty-related incident stressor measure specific to firefighters' experiences, and (b) examining aspects of trauma load, years of service, and appraised stressfulness in predicting PTSD risk. The purpose of the current study is to examine the association of aspects of duty-related trauma exposure to demographic, work-related characteristics, and PTSD symptom severity. The study investigated the following research questions:



- (1) To what extent do firefighters experience different types of duty-related traumatic events?
- (2) What is the relationship between trauma type (i.e., direct, indirect, colleague-related) and PTSD symptom severity?
- (3) Are years of service, trauma load (e.g., number of types of traumatic events experienced), and appraised stressfulness predictive of PTSD symptom severity?
- (4) Is the relationship between years of service and PTSD symptom severity moderated by appraised stressfulness?
- (5) Is the relationship between years of service and PTSD symptom severity moderated by trauma load?

The research questions explored in the present study have important clinical and research implications. A greater understanding of risk factors that contribute to PTSD symptoms among firefighters will allow for more targeted prevention and intervention efforts. The findings may also provide a basis for future research examining trauma load, appraised stressfulness, years of service, and the association of direct, indirect, and colleague-related traumatic events to firefighter mental health.

### **Statistical Analyses**

The present study utilized a correlational field design, in which no experimental methods were employed. The goal of the study was to use a between-subjects comparison to examine the outlined research questions. Preliminary analyses were conducted to examine correlations between predictor variables and the outcome variable.

In order to test research question 1, descriptive statistics were calculated to indicate the frequency, percentage, mean, and standard deviation for each duty-related traumatic event. To test research question 2, direct, indirect, and colleague-related trauma were entered into a multiple regression equation with PTSD symptom severity as the outcome variable. To test research question 3, years of service, trauma load, and appraised stressfulness were entered into a regression equation with PTSD symptom severity as the outcome variable. For research question 4, years of service, appraised stressfulness, and the interaction term composed of these two variables were entered into a regression equation with PTSD symptom severity as the outcome variable. Similarly, for research question 5, years of service, trauma load, and the interaction term composed of these two variables were entered into a regression equation with PTSD symptom severity as the outcome variable.

## Chapter III

### Method

#### Participants

Participants in the study included 995 career firefighters employed by a large fire department in a major metropolitan city in the Southwest U.S. In this department, all firefighters also perform EMS duties, which differs from some departments in which these roles are separated. Of the 995 participants who completed the study measures, a subset of 755 male firefighters was retained for analyses in the current paper. Due to the small number of female firefighters who participated in the study ( $N = 50$ ), women were excluded from analyses. In addition, participants were excluded from analyses if they did not complete the PCL-5 or had over 10% of items missing in any of the other self-report measures. See Table 1 for complete participant characteristics. The majority of participants identified as White (63.4%), married (73.5%), and had completed some college (50.3%). The average age of participants was 39.49 years ( $SD = 9.07$ ) and the average years of service was 13.5 ( $SD = 9.1$ ). The most commonly endorsed rank was firefighter (37.4%) and the majority of participants were involved in suppression/basic EMT (73.8%). Over half (63.6%) of the sample reported working at a second job in addition to their role in the fire department. About one fifth of the firefighters (22.1%) reported having served in active duty in the U.S. military.

Table 1  
*Participant Demographic Characteristics*

Variable	<i>n</i>	%
<b>Race/Ethnicity</b>		
White	479	63.4
Black or African American	66	8.7
Hispanic or Latino/a	167	22.1
Indian (American)	3	0.4
Asian	11	1.5
<b>Education</b>		
GED or equivalent	4	0.5
High school	27	3.6
Some college, no degree	380	50.3
Associate's degree	154	20.4
Bachelor's degree	174	23
Master's degree or higher	15	2
<b>Relationship Status</b>		
Married/living with spouse	555	73.5
Living with partner/not married	56	7.4
In a relationship/not living with partner	56	7.4
Not in a relationship	88	11.7
<b>Veteran Status</b>		
Yes	167	22.1
No	588	77.9
<b>Second Job</b>		
Yes	480	63.6
No	274	36.3
<b>Rank</b>		
Rookie (on probationary status)	46	6.1
Rookie (not probationary)	15	2
Firefighter	282	37.4
Engineer Operator	200	26.5
Captain or equivalent	138	18.3
Senior Captain or equivalent	44	5.8
District Chief or equivalent or higher	30	4
<b>Departmental Function</b>		
Suppression/Basic EMT	557	73.8
Suppression/Paramedic	128	17
Rescue	9	1.2
Arson	3	0.4
AARF (Airport)	32	4.2
Inspection/Prevention	5	0.7
Communications	3	0.4
HAZMAT	10	1.3
Public Information	2	0.3
Administration/Support/Management	1	0.1
Training	3	0.4

## Procedures

The data were collected in 2015 as part of a department-wide mental health survey organized by the department's psychologist. Firefighters were sent an email containing a link to a voluntary, anonymous survey that asked questions regarding health, stress, depression, suicidal thoughts/behaviors, substance use, social support and the use of mental health services. There was no penalty for choosing not to participate in the study. At the end of the survey, firefighters were given the chance to provide their email address to be entered into a raffle for various prizes. A total of 995 participants completed the survey, which represented approximately 25% of the department's firefighters. This study has been approved by the University of Houston institutional review board.

## Instruments

**Demographic questionnaire.** This questionnaire inquired about a range of demographic information, including participants' gender, age, race/ethnicity, marital status, years in service, service rank, highest degree completed, veteran status, second job status, mental health outcomes, and several other characteristics.

**Duty-Related Incident Stressors.** The Duty-Related Incident Stressors scale (Beaton et al., 1998) is a self-report instrument used to assess the perceived stressfulness of 25 duty-related incidents. The measure includes incidents commonly encountered by firefighters and paramedics. Participants were asked to rate how stressful each event was on a Likert-style scale from 1 (*not at all stressful*) to 5 (*extremely stressful*). In the case that participants had not experienced an incident described by an item, they were asked to select a value of 0. Preliminary factor analyses provided evidence for a 5-factor structure for the scale: catastrophic injury to self or co-worker, gruesome victim incidents, render

aid to seriously injured vulnerable victims, minor injury to self, and exposure to death and dying. Due to the potentially overlapping nature of some of these factors, for the purposes of the present study, the items were divided into three categories based on the structure proposed by Lee et al. (2017). “*Direct*” traumatic event refers to the participant or a family member being directly threatened or injured. “*Indirect*” traumatic event includes the experience of witnessing or rescuing seriously injured people or exposure to dead bodies. Lastly, “*colleague-related*” traumatic event includes the death, injury, or suicide of a co-worker. Table 2 includes descriptions of the 25 traumatic events organized by type: direct, indirect and colleague-related.

**Posttraumatic Stress Disorder Checklist (PCL-5).** The PCL-5 (Weathers, Litz, Keane, Palmieri, Marx, & Schnurr, 2013) is a self-report instrument used to assess severity of PTSD symptoms, consisting of 20 items which correspond to *DSM-5* PTSD criteria. Participants are asked to indicate how much they were bothered by each item within the past month (e.g., “Avoiding memories, thoughts, or feelings related to the stressful experience”). Each item is rated on a 5-point Likert-style scale from 0 (*not at all*) to 4 (*extremely*); scores are summed and range from 0 to 80. In the current sample, internal consistency for the PCL-5 was excellent ( $\alpha = 0.95$ ).

## Chapter IV

### Results

#### Preliminary Analysis

Statistical analysis was performed using SPSS version 25. A preliminary analysis was conducted to examine the bivariate correlations of the variables within the study (see Table 2). Total appraised stressfulness was positively correlated with years of service,  $r(694) = .19, p < .01$ , and PTSD symptom severity,  $r(755) = .36, p < .01$ . Trauma load was positively correlated with years of service,  $r(694) = .23, p < .01$ , PTSD symptom severity,  $r(755) = .25, p < .01$ , and appraised stressfulness,  $r(755) = .21, p < .01$ .

Table 2  
*Means, Standard Deviations, and Intercorrelations for Predictor and Criterion Variables*

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1. Years of service	13.5	9.10	--									
2. PTSD	7.58	11.9	.002	--								
3. AS – total	1.89	.72	.19**	.36**	--							
4. AS – indirect	1.81	.71	.19**	.32**	.95**	--						
5. AS – direct	2.00	1.00	.33**	.33**	.67**	.54*	--					
6. AS – colleague-related	2.78	1.19	.10*	.35**	.70**	.56*	.51**	--				
7. TL - total	15.00	6.02	.23**	.25**	.21**	.16*	.09	.01	--			
8. TL – indirect	12.12	4.11	.24**	.21**	.21**	.17*	.08	.04	.94**	--		
9. TL – direct	1.60	1.79	.11**	.21**	.10**	.05	.04	-.09**	.74**	.48**	--	
10. TL – colleague-related	1.28	1.11	.20**	.25**	.24**	.14*	.11**	.15**	.77**	.60**	.61**	--

\*\*  $p < .01$ .

Note: AS = appraised stressfulness; TL = trauma load.

Range of variables: 1. Years of service: 0-40; 2. PTSD: 0-80; 3. AS - total: 1-5; 4. AS – indirect: 1-5; 5. AS – direct: 1-5; 6. AS – colleague-related: 1-5; 7. TL – total: 1-25; 8. TL – indirect: 0-16; 9. TL – direct: 0-6; 10. TL – colleague-related: 0-3

## Primary Analysis

To address research question 1, descriptive statistics were calculated for each traumatic event included in the Duty-Related Incident Stressor Scale (Beaton et al., 1998; see Table 3) including frequencies and percentage of traumatic event exposure and mean and standard deviation for level of stressfulness regarding each traumatic event experienced. The number of participants who reported experiencing at least one direct event ( $N = 499$ ) was approximately the same as the number who reported experiencing at least one colleague-related event ( $N = 503$ ). The most frequently endorsed indirect traumatic event was performing CPR on a patient in cardiac arrest ( $N = 731$ ). Over two-thirds (67.2%) of participants reported experiencing a sudden infant death incident ( $N = 507$ ), which was rated as the most stressful indirect event. Within the direct traumatic event category, the most frequently endorsed event was duty-related muscle strain to self, with over half (54.6%) of participants indicating they had experienced it on the job ( $N = 412$ ). Experiencing a career-ending injury to self was rated as the most stressful direct event, though it was a relatively rare event among participants ( $N = 89$ ). Finally, the most commonly endorsed colleague-related traumatic event was the death of a co-worker (not witnessed) ( $N = 431$ ). Roughly one-fourth (24.6%) of participants reported witnessing the duty-related death of a co-worker ( $N = 186$ ), which was rated as the most stressful colleague-related event. Stressfulness scores were calculated by taking the mean score of each item and excluding those participants who selected “0”, indicating that they had not experienced the event. Overall, colleague-related traumatic events were appraised as most stressful ( $M = 2.78$ ) compared to indirect ( $M = 1.81$ ) and direct events ( $M = 2.00$ ).



Table 3  
*Results of Duty-Related Potentially Traumatic Events*

Traumatic Event Type	PTE Exposure		Stressfulness scores	
	<i>N</i>	%	<i>M</i>	<i>SD</i>
<b><i>Indirect</i></b>				
CPR-patient in cardiac arrest	731	96.8	1.77	.88
Adult DOA—natural causes	711	94.2	1.25	.53
Death of patient after long resuscitation	681	90.2	1.76	.88
Render aid to seriously injured adolescent	645	85.4	2.27	1.08
Adult DOA—multiple wounds/injuries	637	84.4	1.64	.83
Multiple-causality motor vehicle accident	637	84.4	1.88	1.01
Render aid to adult stabbing victim	628	83.2	1.60	.79
Render aid to attempted suicide/drug overdose	604	80.0	1.53	.78
Completed gunshot suicide	575	76.2	1.83	.97
Gunshot victim of gang violence	546	72.3	1.60	.84
Sudden infant death incident	507	67.2	2.77	1.27
Attempted domestic homicide victim	505	66.9	1.78	.93
Completed suicide—hanging	496	65.7	1.85	.97
Fire incident with multiple burn victims	464	61.5	2.25	1.15
Render aid to adult victim mutilated in attempted homicide	441	58.4	1.91	1.01
Render aid to seriously injured friend/relative	347	45.9	2.44	1.21
<b>Total</b>	755	100	1.81	.71
<b><i>Direct</i></b>				
Duty-related muscle strain (self)	412	54.6	1.91	1.03
Exposure to hazardous chemicals (self)	270	35.8	2.20	1.21
Duty-related fracture of extremity (self)	177	23.4	1.80	1.14
Duty-related concussion (self)	140	18.5	1.76	1.16
Third-degree burn (self)	120	15.9	2.31	1.45
Career-ending injury to self	89	11.8	2.49	1.55
<b>Total</b>	499	66.1	2.00	1.00
<b><i>Colleague-related</i></b>				
Co-worker fatality (not witnessed)	431	57.1	2.86	1.28
Serious injury to co-worker	346	45.8	2.63	1.29
Witness duty-related death of co-worker	186	24.6	3.24	1.57
<b>Total</b>	503	66.6	2.78	1.19

To examine the relationship between trauma type (i.e., direct, indirect, colleague-related) and PTSD symptom severity (research question 2), appraised stressfulness of indirect, direct, and colleague-related traumatic events was entered into a multiple regression equation with PTSD symptom severity as the outcome variable. Trauma load

was included in the regression equation in order to account for variability in the number of types of trauma that participants endorsed (i.e., to control for the number of different trauma types participants experienced). Table 4 contains results of the multiple regression analysis. The overall model was significant,  $R^2 = .21$ ,  $F(4,385) = 25.67$ ,  $p < .001$ , indicating that the combination of stressfulness of indirect, direct, and colleague-related trauma types shared 21% of the variance in the criterion. All four predictor variables contributed unique variance to PTSD symptom severity (indirect,  $\beta = .19$ ; direct,  $\beta = .15$ ; colleague-related,  $\beta = .19$ ; trauma load,  $\beta = .13$ ).

Table 4  
*Multiple Regression Analysis of Trauma Event Type Stressfulness Predicting PTSD Symptom Severity*

Predictor Variable	<i>B</i>	<i>SE</i>	$\beta$
Indirect	3.18	1.03	.19**
Direct	1.96	.77	.15*
Colleague-Related	2.08	.65	.19***
Trauma Load	.45	1.6	.13**
$R^2$	.21***		
$F$	25.67		

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

A second regression analysis was planned to examine to what extent years of service, trauma load, and mean appraised stressfulness were associated with PTSD symptom severity (research question 3). However, results indicated that years of service was not associated to PTSD symptoms; therefore, only trauma load and mean appraised stressfulness were included in the model. The overall model was significant,  $R^2 = .16$ ,  $F(2,752) = 73.35$ ,  $p < .001$ , indicating that the combination of trauma load and mean stressfulness share 16% of the variance with the criterion. Both predictor variables contributed unique variance to PTSD symptom severity (trauma load,  $\beta = .18$ ; stressfulness,  $\beta = .32$ ) (see Table 5).

Table 5  
*Multiple Regression Analysis Summary of Duty-Related Trauma Exposure Indicators  
Predicting PTSD Symptom Severity*

Predictor Variable	<i>B</i>	<i>SE</i>	$\beta$
Trauma load	.36	.067	.18***
Mean stressfulness score	5.37	.57	.32***
$R^2$	.16***		
$F$	73.35		

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

For research question 4, four separate interaction terms were created using years of service and appraised stressfulness of indirect, direct, and colleague-related events, as well as the average stressfulness of all event types endorsed. Four additional hierarchical regression analyses were conducted to examine whether the relationship between years of service and PTSD symptoms is moderated by appraised stressfulness of indirect, direct, colleague-related, and total traumatic events. Table 6 contains results of each separate hierarchical regression analysis by trauma type.

For indirect traumatic events, years of service and appraised stressfulness were entered into Step 1, and the interaction term (i.e., years of service  $\times$  appraised stressfulness) was entered into Step 2. In Step 1, the variables accounted for 9.8% of the variance in PTSD symptoms ( $R^2 = 0.098$ ,  $p < .001$ ),  $F(2,691) = 37.71$ . Appraised stressfulness contributed significant variance to the outcome variable ( $B = 5.41$ ,  $\beta = .32$ ,  $p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 9.9% of the variance in PTSD symptoms ( $R^2 = 0.099$ ,  $\Delta R^2 = .001$ ,  $p < .001$ ),  $F(3,690) = 25.34$ . While the change in  $R^2$  from the first to second step was statistically significant, the  $\beta$  for the interaction term was not statistically significant, indicating that there was no interaction effect.

For direct traumatic events, the variables in Step 1 accounted for 11.1% of the variance in PTSD symptoms ( $R^2 = .111, p < .001$ ),  $F(2,456) = 28.50$ . Appraised stressfulness contributed significant variance to the outcome variable ( $B = 4.44, \beta = .33, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 11.4% of the variance in PTSD symptoms ( $R^2 = 0.114, \Delta R^2 = .003, p < .001$ ),  $F(3,455) = 19.56$ . The  $\beta$  for years of service and the interaction effect were not statistically significant, indicating that these variables did not contribute unique variance to the criterion. While the change in  $R^2$  from the first to second step was statistically significant, the  $\beta$  for the interaction term was not statistically significant, indicating that there was no interaction effect.

For colleague-related traumatic events, the variables in Step 1 accounted for 12.5% of the variance in PTSD symptoms ( $R^2 = .125, p < .001$ ),  $F(2,468) = 33.44$ . Appraised stressfulness contributed significant variance to the outcome variable ( $B = 3.81, \beta = .35, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 12.5% of the variance in PTSD symptoms ( $R^2 = 0.125, \Delta R^2 = .000, p < .001$ ),  $F(3,467) = 22.25$ . The  $\beta$  for years of service and the interaction term were not statistically significant, indicating that these variables did not contribute unique variance to the criterion.

For all traumatic events, the variables in Step 1 accounted for 12.8% of the variance in PTSD symptoms ( $R^2 = .128, p < .001$ ),  $F(2,691) = 50.90$ . Appraised stressfulness contributed significant variance to the outcome variable ( $B = 6.11, \beta = .37, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 12.9% of the variance in PTSD symptoms ( $R^2 =$

0.129,  $\Delta R^2 = .000$ ,  $p < .001$ ),  $F(3,690) = 34.01$ . While the change in  $R^2$  from the first to second step was statistically significant, the  $\beta$  for the interaction term was not statistically significant, indicating that there was no interaction effect.

Table 6

*Summary of Moderation Analyses: Years of Service x Appraised Stressfulness for PTSD Symptom Severity by Traumatic Event Type*

<b>Indirect</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.098***	
Years of service	-.079	.049	-.059		
Appraised stressfulness	5.41	.62	.32***		
Step 2:				.099***	.001***
Years of service	-.18	.14	-.14		
Appraised stressfulness	4.59	1.20	.27***		
<b>Years of service × appraised stressfulness</b>	.054	.069	.10		
<b>Direct</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.111***	
Years of service	-.09	.07	-.06		
Appraised stressfulness	4.44	.60	.33***		
Step 2:				.114***	.003***
Years of service	-.27	.16	-.18		
Appraised stressfulness	3.24	1.12	.24**		
<b>Years of service × appraised stressfulness</b>	.094	.074	.16		
<b>Colleague-related</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.125***	
Years of service	-.10	.065	-.069		
Appraised stressfulness	3.81	.47	.354***		
Step 2:				.125***	.000***
Years of service	-.11	.18	-.071		
Appraised stressfulness	3.80	.93	.353***		
<b>Years of service × appraised stressfulness</b>	.001	.056	.003		
<b>Total</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.128***	
Years of service	-.089	.048	-.067		
Appraised stressfulness	6.11	.61	.37***		
Step 2:				.129***	.000***
Years of service	-.16	.14	-.12		
Appraised stressfulness	5.55	1.16	.33***		
<b>Years of service × appraised stressfulness</b>	.039	.068	.074		

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

To examine research question 5, four separate interaction terms were created using years of service and trauma load of indirect, direct, and colleague-related events, as well as the total trauma load across all event types. Four separate hierarchical regression analyses were conducted to examine whether the relationship between years of service and PTSD symptoms is moderated by trauma load of indirect, direct, colleague-related, and total traumatic events. Table 7 contains results of each separate hierarchical regression analysis, separated by trauma type.

For indirect traumatic events, years of service and trauma load were entered into Step 1, and the interaction term (i.e., years of service  $\times$  trauma load) was entered into Step 2. In Step 1, the variables accounted for 4.4% of the variance in PTSD symptoms ( $R^2 = .044, p < .001$ ),  $F(2,691) = 15.97$ . Trauma load contributed significant variance to the outcome variable ( $B = .65, \beta = .22, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 4.4% of the variance in PTSD symptoms ( $R^2 = .044, \Delta R^2 = .000, p < .001$ ),  $F(3,690) = 10.65$ . While the change in  $R^2$  from the first to second step was statistically significant, the  $\beta$  for the interaction term was not statistically significant, indicating that there was no interaction effect.

For direct traumatic events, the variables in Step 1 accounted for 4.5% of the variance in PTSD symptoms ( $R^2 = .045, p < .001$ ),  $F(2,691) = 16.25$ . Trauma load contributed significant variance to the outcome variable ( $B = 1.44, \beta = .21, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 4.5% of the variance in PTSD symptoms ( $R^2 = .045, \Delta R^2 = .001, p < .001$ ),  $F(3,690) = 10.94$ . While the change in  $R^2$  from the first to second step

was statistically significant, the  $\beta$  for the interaction term was not statistically significant, indicating that there was no interaction effect.

For colleague-related traumatic events, the variables in Step 1 accounted for 6.8% of the variance in PTSD symptoms ( $R^2 = .068, p < .001, F(2,691) = 25.38$ ). Trauma load contributed significant variance to the outcome variable ( $B = 2.91, \beta = .27, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 6.9% of the variance in PTSD symptoms ( $R^2 = .069, \Delta R^2 = .000, p < .001, F(3,690) = 16.93$ ). The  $\beta$  for years of service and the interaction term were not statistically significant, indicating that these variables did not contribute unique variance to the criterion.

For all traumatic events, the variables in Step 1 accounted for 6.6% of the variance in PTSD symptoms ( $R^2 = .066, p < .001, F(2,691) = 24.40$ ). Trauma load contributed significant variance to the outcome variable ( $B = .54, \beta = .26, p < .001$ ). Years of service did not contribute unique variance to the criterion in Step 1. In Step 2, the variables accounted for 6.6% of the variance in PTSD symptoms ( $R^2 = .066, \Delta R^2 = .000, p < .001, F(3,690) = 16.29$ ). While the change in  $R^2$  from the first to second step was statistically significant, the  $\beta$  for the interaction term was not statistically significant, indicating that there was no interaction effect.

Table 7

*Summary of Moderation Analyses: Years of Service x Trauma Load for PTSD Symptom Severity by Traumatic Event Type*

<b>Indirect</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.044***	
Years of service	-.065	.051	-.049		
Trauma load	.65	.12	.22***		
Step 2:				.044***	.000***
Years of service	-.093	.14	-.07		
Trauma load	.62	.19	.21**		
<b>Years of service × Trauma load</b>	.002	.011	.026		
<b>Direct</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.045***	
Years of service	-.028	.05	-.021		
Trauma load	1.44	.25	.21***		
Step 2:				.045***	.001***
Years of service	-.055	.067	-.042		
Trauma load	1.19	.48	.18*		
<b>Years of service × Trauma load</b>	.019	.031	.049		
<b>Colleague-related</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.068***	
Years of service	-.07	.050	-.052		
Trauma load	2.91	.41	.27***		
Step 2:				.069***	.000***
Years of service	-.054	.072	-.041		
Trauma load	3.09	.73	.28***		
<b>Years of service × Trauma load</b>	-.013	.045	-.025		
<b>Total</b>					
Step and predictor variable	<i>B</i>	<i>SE</i>	$\beta$	$R^2$	$\Delta R^2$
Step 1:				.066***	
Years of service	-.078	.05	-.059		
Trauma load	.54	.077	.26***		
Step 2:				.066***	.000***
Years of service	-.12	.13	-.090		
Trauma load	.50	.13	.25***		
<b>Years of service × Trauma load</b>	.003	.008	.042		

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .



## **Chapter V**

### **Discussion**

The purpose of the present study was to examine factors relevant to occupational trauma exposure among urban firefighters. Specifically, the study addressed limitations in previous research by examining the relative contribution of direct, indirect, and colleague-related traumatic events to PTSD symptom severity. In addition, the study explored the relationships between PTSD, years of service, and trauma load and appraised stressfulness of each traumatic event category.

Consistent with extant literature on firefighters and trauma exposure, the findings for research question 1 confirm that firefighters are exposed to a wide array of traumatic events. While appraised stressfulness ratings appeared largely moderate, one hundred percent of the participants in the sample endorsed exposure to at least one indirect event, indicating the ubiquity of this category of potentially traumatic events. Participants were most likely to endorse experiencing indirect traumatic events, followed by direct and then colleague-related events. Within the indirect category, exposure to a sudden infant death incident was rated as the most stressful traumatic event. This is consistent with previous research that indicates events involving children are associated with greater distress among emergency workers (Declercq et al., 2011). Furthermore, firefighters rated experiencing a career-ending injury to self as the most stressful direct event. Importantly, this was also the least frequently endorsed event by participants overall, which suggests that the rare, catastrophic nature of the event may contribute to firefighters' perception of stressfulness. The potentially long-term, far-reaching consequences of a career-ending injury may also compound the inherent psychological distress of such an event.

Colleague-related traumatic events were rated as more stressful than both direct and indirect events. Further, participants appraised witnessing the duty-related death of a coworker as the most stressful traumatic event overall. One possible explanation for these findings is the interpersonal cohesion and collective identity shared among most firefighters. Witnessing the death of a coworker can translate to losses in both personal and professional domains, which may compound the traumatic effect of such an event. This finding has important clinical implications, as fire departments with crisis intervention teams and clinicians treating firefighters should be mindful of screening for exposure to this particular traumatic event.

After accounting for trauma load, appraised stressfulness of all trauma types accounted for 21% of the variance in PTSD symptom severity. Further, when considered together, trauma load and appraised stressfulness accounted for 16% of the variance in PTSD symptom severity, and both variables were uniquely associated with PTSD. These findings confirm previous research demonstrating a positive relationship between trauma load and increased PTSD symptoms (e.g., Ehring & Quack, 2010; Lee et al., 2017). Results of research questions 2 and 3 are also consistent with previous studies showing that peritraumatic stress is positively related to PTSD symptoms (e.g., Lee et al., 2017; Marmar et al., 2006; Ozer et al., 2003; Pinto, Henriques, Jongenelen, Carvalho, & Maia, 2015).

Results revealed that years of service was not associated to either trauma load or appraised stressfulness. Similarly, neither trauma load nor appraised stressfulness moderate the relation of years of service to PTSD symptoms across all traumatic event categories (direct, indirect and colleague related). These finding are consistent with other

studies that have found no relationship between years of service and PTSD symptom severity (e.g., Del Ben et al., 2006; Meyer et al., 2012; Wagner, McFee, & Martin, 2009). However, it contradicts results from studies that have indicated a positive relationship between years of service and PTSD symptoms (e.g., Nydegger et al., 2011). Within the present study, it is possible that coping strategies and resources may shed light on the null findings. For instance, Nydegger et al. (2001) found a negative relationship between years of service and the use of emotional support as a coping mechanism for occupational stress. It may be that within our sample, younger firefighters utilize greater emotional support to cope with exposure to novel traumatic events. For firefighters with higher years of service, habituation effects to traumatic events may play a role in reducing self-reported PTSD symptoms. Years of service should continue to be studied in future research as a potential variable impacting firefighters' mental health.

With regards to traumatic event categories, across indirect, direct, colleague-related, and total traumatic events, appraised stressfulness contributed significant variance to PTSD symptoms. The same phenomenon was observed for trauma load across all four traumatic event categories. Therefore, the relative contributions of appraised stressfulness and trauma load to PTSD symptom severity should continue to be examined and assessed, both clinically and in future research, in order to improve our understanding of duty-related factors that contribute to PTSD symptomatology.

### **Limitations and Future Research**

Limitations of this study include the use of self-report measures to assess PTSD symptoms, traumatic event exposure, and other variables included in the study. Future research should ideally utilize clinical interviews, such as the Clinician-Administered

PTSD Scale for DSM-5 (CAPS-5; Weathers et al., 2018) for PTSD symptoms, to gather the most accurate information regarding firefighters' experiences and symptomatology. In addition, future researchers who wish to replicate the present study should incorporate multiple methods of collecting data, including clinician interview and observational reports. Because social desirability likely affects firefighters' responses to sensitive mental health issues, it is critical to ensure anonymity of results and include measures beyond self-report to ensure that assessment is thorough and accurate (Wagner et al., 1998).

With regards to trauma history, the Duty-Related Incident Stressors scale (Beaton et al., 1998) was developed to capture traumatic events most commonly encountered by firefighters. However, it is likely that the list of potentially traumatic events listed on the scale does not capture the full extent of the situations that firefighters face, particularly within a large, urban setting that can present unpredictable and varied circumstances. Thus, the total trauma load for each participant captured in the study may be an underestimate. Further, appraised stressfulness was measured using a limited scale (from 1 to 5), which may have limited the variability in participants' responses.

In addition, the present study did not account for traumatic events experienced outside of work, as well as trauma history prior to joining the fire department, which may have affected the reported scores on the PCL-5 (Weathers et al., 2013). Future studies can expand on the findings of the present study by examining the relative contributions of traumatic events faced on the job versus traumatic events experienced outside of firefighting. The sample demographics may also limit the generalizability of the findings. Because the participant group solely included male career firefighters, findings of the

present study may not extend to female firefighters or hybrid/volunteer fire departments. Finally, the current study was cross-sectional, and as such causal relationships cannot be inferred from the results. Longitudinal methods for examining indicators of firefighters' mental health should be considered in future studies.

Despite these limitations, the current study offers preliminary insights into the role of various duty-related characteristics of trauma exposure for an occupational group that has been historically understudied. Future research may further examine the relationship between various potentially traumatic event types and PTSD symptom severity. The results of the present study highlight the importance of firefighters' interpretation and associated appraisal of the stressfulness of each traumatic event. Future research warrants increased focus on the specific characteristics of traumatic events that contribute to firefighters' psychological distress. Clinicians and administrators working with emergency response personnel in general may benefit from greater understanding of the factors that contribute to appraisal of level of stressfulness in each individual worker.

Researchers may also explore different ways of categorizing and capturing potentially traumatic events that firefighters experience. While trauma exposure checklists such as the LEC-5 (Weathers et al. 2013) and the THQ (Hooper et al., 2011) capture a wide range of traumatic events across the lifespan, these checklists likely fail to capture the specific incidents firefighters routinely encounter on the job. Similar to military service members, firefighters are at higher risk for experiencing rare, potentially catastrophic events that are uncommonly faced in the general civilian population. As such, future research should focus on developing and validating measures that accurately and comprehensively capture the types of traumatic events that firefighters experience.

Clinically, the use of specific screening measures for firefighters can facilitate effective treatment and guide the use of crisis interventions, such as Critical Incident Stress Management.

## **Conclusions**

Overall, the present study addressed limitations in previous studies on firefighters by examining the relationships between PTSD symptom severity and various duty-related contributing factors, including trauma type, appraised stressfulness, trauma load, and years of service. The study expanded upon the findings and methodology presented in Lee et al. (2017) by utilizing the categories of direct, indirect, and colleague-related traumatic events. Appraised stressfulness and trauma load were positively and significantly related to PTSD symptoms, whereas years of service was found to have no effect across all trauma types. Colleague-related traumatic events had the strongest association with PTSD symptom severity. Taken together, these findings highlight the importance of developing adequate screening measures to accurately capture the types of traumas that firefighters face on the job, in order to guide effective treatment for this high-risk group.

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