The following individuals certify that they have read, and recommend to the Faculty of Graduate and Postdoctoral Studies for acceptance, a thesis/dissertation entitled:

Predicting posttraumatic stress symptomology in emergency medical personnel: The role of perceived stress and rumination

submitted by Drake Levere in partial fulfillment of the requirements

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Abstract

Paramedics are frequently exposed to traumatic events on the job, and although they have higher levels of posttraumatic stress symptomology (PTSS) than the general population (Berger et al., 2012), not all paramedics experience high PTSS. Identifying factors that impact PTSS among individuals who are frequently exposed to traumatic stress is important for the development of evidence-based interventions. Using a longitudinal design, we examined relationships among rumination, perceived stress, and PTSS in 87 shift-working paramedics. Perceived stress and rumination were examined daily across a one-week period, while measurements of PTSS were assessed at baseline and at a two-year follow-up. Regression analyses indicated that perceived stress significantly predicted rumination. Rumination significantly predicted PTSS at the two-year follow-up, even after controlling for baseline PTSS, depression, and occupational stressors. Perceived stress did not directly predict PTSS at follow-up. Rather, rumination mediated the relationship between perceived stress and PTSS. Specifically, higher levels of perceived stress were associated with higher rumination, and higher rumination was associated with higher levels of PTSS at follow-up. These findings suggest the importance of targeting both perceived stress and rumination in clinical interventions for individuals who are frequently exposed to traumatic stressors.
Lay Summary

Paramedics are frequently exposed to traumatic events and are at an increased risk of posttraumatic stress symptomology (PTSS). The amount of perceived stress a paramedic reports from stressful or traumatic events may impact the coping strategies they use. Our study examined 87 shift-working paramedics twice daily for a one-week period on how they perceived their most stressful events during the work day and the coping strategies they used. We also assessed the paramedics’ PTSS at the beginning of the study and at a 2-year follow-up. We found that paramedics who reported higher levels of perceived stress during their work days across the week were more likely to use a maladaptive coping strategy (rumination). Paramedics who had higher rumination were more likely to maintain their PTSS across 2 years. These findings suggest that perceived stress and rumination could be addressed in clinical interventions for individuals frequently exposed to traumatic stressors.
Preface

I am the primary contributor and author of the work presented in this thesis. The results have been submitted for publication: Levere, D., Stephenson, E., Pow, J., King, D. B., Dekel, R., & DeLongis, A. (in review). Predicting posttraumatic stress symptomology in individuals frequently exposed to trauma: The role of perceived stress and rumination.

My contributions focused on identifying research questions, conducting data analysis, and composing the manuscript. Ms. Stephenson and Mrs. Pow provided guidance on data analysis and assisted in manuscript revisions. Dr. King contributed to study design and data collection. Dr. Dekel provided guidance on concept formation and theoretical framework. Dr. DeLongis was the supervisory author on this project and contributed to study design and data collection, concept formation, provided guidance on data analysis, and assisted in manuscript revisions.

This project received ethical approval from the University of British Columbia’s Behavioural Research Ethics Board (Research Title: “Stress and Coping across Occupational and Personal Environments (SCOPE) in Paramedics,” BREB #H09-02994).
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I would like to thank all my friends and colleagues that I have met over the last 6 years. Page limitations prohibit me from listing everyone but I couldn’t have survived without their support. My sanity thanks you. Finally, I would like to thank my family for their unconditional love and support. Thank you.

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Chapter 1: Introduction

1.1 Posttraumatic stress symptomology (PTSS)

Research on Posttraumatic Stress Disorder (PTSD) has predominantly focused on isolated traumatic events (e.g., 9/11 terrorist attack, natural disasters, assault), and the risk factors associated with PTSD in those affected by these specific traumatic events. Individuals who are at risk of higher posttraumatic stress symptomology (PTSS) due to chronic and frequent exposure to traumatic stressors (e.g., emergency medical personnel) are an important but understudied group. Studies suggest that individual reactions to trauma are more predictive of PTSS than the trauma itself (Declerq et al., 2011). Specifically, several studies suggest that perceived stress may lead to increases in PTSS (Besser, Neria, & Haynes, 2009, Fincham, Altes, Stein, & Seedat, 2009). However, little is known about the mechanisms linking perceived stress, rumination and PTSS in populations that are frequently exposed to traumatic stress.

1.2 Perceived Stress

Perceived stress can be defined as the degree to which an individual appraises a situation as stressful (Folkman, Lazarus, Gruen, & DeLongis, 1986; Lazarus & Folkman, 1984). Perceived stress provides additional information beyond strict measures of exposure to stressful events by assessing an individual’s interpretation of and perceived control over the stressful event (Cohen, Kamarck, & Mermelstein, 1983). Perceived stress has been identified as a specific risk factor in the development (Fincham, Altes, Stein, & Seedat, 2009) and experience (Besser, Neria, & Haynes, 2009) of PTSD. A positive relationship between perceived stress and PTSD has been found among pregnant earthquake survivors in China (Qu et al., 2011), civilians exposed to terrorist attacks (Besser et al., 2009; Razik, Ehring, & Emmelkamp, 2013), survivors of hurricane Katrina (Leon, Hyre, Ompad, DeSalvo, & Muntner, 2007), and female survivors of
interpersonal violence (Hu, Koucky, Brown, Bruce, & Sheline, 2014). These findings suggest that perceived stress plays a role in PTSS among those who have experienced an isolated traumatic experience. Conversely, research investigating individuals who are frequently exposed to trauma has not adequately addressed the relationship between perceived stress and PTSS. Cognitive appraisals of stress are closely associated with coping responses, which in turn impact both immediate and long-term psychological symptoms and health outcomes (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Pow, King, Stephenson, & DeLongis, 2017). The more events are perceived to be stressful, the more likely they are to elicit maladaptive coping strategies such as rumination (DeLongis, Holtzman, Puterman, & Lam, 2010).

1.3 Rumination

Rumination has been defined as a repetitive, cyclical, self-focused, and uncontrollable negative thinking about past negative experiences and/or negative mood that can be cued by an external event or a prior thought (e.g., Nolen-Hoeksema, 1991; Papageorgiou & Wells, 2001; Teasdale, 1999). Based on Response Style Theory (Nolen-Hoeksema, 1987; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Treynor, Gonzalez, & Nolen-Hoeksema, 2003), rumination is a coping response that involves repetitive and persistent self-reflection and focus on one’s feelings and problems, often with negative psychological consequences (Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema, 1991). It is important in the manifestation and maintenance of PTSD (Elwood, Hahn, Olatunji, & Williams, 2009) and is associated with an increased risk of depressive symptoms and disorders (Nolen-Hoeksema, 2000; Davis & Nolen-Hoeksema, 2000). Numerous studies have found significant and moderately strong associations between trauma-related rumination and PTSS (Bennett & Wells, 2010; Clohessy & Ehlers, 1999; Ehlers, Mayou & Bryant, 1998; Ehring, Frank, & Ehlers, 2008;
Murray, Steil & Ehlers, 2000). These associations have been found in a variety of trauma populations, such as individuals exposed to physical and sexual assault, motor vehicle accidents, and emergency workers (Clohessy & Ehlers, 1999; Ehlers et al., 1998; Hu et al., 2014; Michael, Halligan, Clark, & Ehlers, 2007; Steil & Ehlers, 2000; Wild et al., 2016).

1.4 Perceived stress, rumination, and PTSS in individuals frequently exposed to trauma

No studies, to the author’s knowledge, have investigated the relationship between perceived stress, rumination, and PTSS in samples that are frequently exposed to traumatic events, such as emergency medical personnel (paramedics). A prospective study by Wild and colleagues (2016) examined newly recruited paramedics \( n = 453 \) risk of developing an episode of PTSD across two years. This study indicated that rumination about stressful events prior to starting paramedic training significantly predicted an episode of PTSD across 24 months of assessment. This study examined the predictive value that trait rumination has on PTSD onset in paramedics, however, perceived stress was not assessed. The amount of perceived stress a paramedic experiences during the day may influence their likelihood of ruminating and in turn, increase their PTSS. Although the relationship between perceived stress, rumination, and PTSS has not been examined in this population, two recent studies have assessed this relationship in participants exposed to isolated traumatic events.

A recent longitudinal study (Spinhoven, Penninx, Krempeniou, Van Hemert, & Elzinga, 2015) on participants with a history of anxiety or depression and 652 healthy controls examined the relationship between rumination prior to traumatic exposure and subsequent onset of PTSD. Of the participants that experienced a traumatic event in the previous four years, PTSD onset was more likely for participants who reported high trait rumination. Importantly, the relation between rumination and onset of PTSD was partly mediated by the participant’s cognitive appraisal of the
extent to which the traumatic event had an impact on their life. These results suggest that those high in trait rumination tend to appraise traumatic events as having a greater impact on their lives, which in turn is associated with subsequent PTSD. A second study by Hu, Koucky, Brown, Bruce, and Sheline (2014) used a cross-sectional design to examine 49 females whom experienced interpersonal violence (as a child or adult) and had met diagnostic criteria for PTSD. Similar to Spinhoven et al. (2015), their findings supported a model in which perceived stress mediated the relationship between rumination and PTSD severity; however, the mediating effect did not remain significant after controlling for depression. Although the results differ, these studies suggest that perceived stress and rumination are associated with PTSD within individuals who experience an isolated traumatic event. Whether these findings extend to at-risk populations that face ongoing, chronic exposure to traumatic stressors remains to be seen. One limitation within these studies is that participants’ cognitive appraisals of the traumatic event were assessed concurrently with PTSD. If individuals are exposed to traumatic events frequently, their cognitive appraisals of the event could elicit coping strategies like rumination. Therefore, we propose that individuals who are frequently exposed to traumatic experiences (i.e., paramedics) who appraise situations as more stressful during the work day would be more likely to ruminate and therefore maintain their PTSS across time.

We propose to expand upon previous literature by investigating the relationship between rumination, perceived stress, and PTSS in a sample of paramedics. Paramedics experience frequent exposure to traumatic events and have been found to be one of the highest stress occupations in terms of physical and psychological stress (Johnson et al., 2005). Paramedics are expected to continue to effectively respond to traumatic and high stress situations as part of their daily work lives. Rates of PTSD among paramedics are significantly higher than in the general
population (Berger et al., 2012), with up to 22% of paramedics developing PTSD (Alexander & Klein, 2001; Bennett, Williams, Page, Hood, & Woollard, 2004; Bennett et al., 2005; Berger et al., 2012; Fjeldheim et al., 2014; Michael, Streb, & Häller, 2016; Streb, Häller, & Michael, 2014), compared to 1.3% to 3.5% in the general population (Berger et al., 2012). Over 8% of newly recruited paramedics develop PTSD across the course of their first two years on the job (Wild et al., 2016). In the same study, paramedics that developed PTSD were found to take more days off work, have poorer sleep and quality of life, greater burn-out, and greater weight gain at the two-year follow-up. The high rates of posttraumatic stress symptoms (PTSS) and frequent exposure to potentially traumatic events make paramedics an ideal population in which to examine the relationship between daily perceived stress and rumination on PTSS.

1.5 Study objective

This investigation expands on previous studies by using an intensive longitudinal design paired with a two-year follow-up. Previous research examining the relation of perceived stress and rumination on PTSS have used cross-sectional designs or measured trauma-related cognitions concurrently with PTSD (Hu et al., 2016; Spinhoven et al., 2015). Retrospective assessments have not been found to correspond well with day-to-day reports (Stone et al., 1998). To address this, the current study assessed paramedics’ daily perceived stress and rumination scores through an intensive longitudinal design (Bolger & Laurenceau, 2013) and aggregated these reports across one week. The use of an intensive longitudinal design allows for greater accuracy in daily processes, such as cognitive coping responses. Through this design, retrospective bias can be reduced as participants are prompted to report shortly after an event occurs (Conner, Tennen, Fleeson, & Barrett, 2009; Stone et al., 1998).
We hypothesized that higher levels of perceived stress would be related to significantly higher levels of rumination and in turn, higher rumination would be associated with higher levels of PTSS at a two-year follow-up. Additionally, we hypothesized that rumination would mediate the effect of perceived stress during the workday on future posttraumatic symptomology while controlling for baseline PTSS, depression and occupational stressors. Depression was controlled for as previous studies have suggested a high degree of overlap between depression, rumination, and PTSD (Hu et al., 2016; Kaufman & Charney, 2000; King-Kallimanis, Gum, & Kohn, 2009; Nixon, Resick, & Nishith, 2004). Occupational stressors were also controlled to account for variation in exceptionally high frequency stressor weeks.
Chapter 2: Method

2.1 Participants

Data were drawn from a larger longitudinal study of 87 paramedics and their spouses examining the impact of occupational stress on well-being (King & DeLongis, 2014). Participants were licensed as paramedics by the Canadian Medical Association and had been on the job for an average of 15.24 years ($SD = 7.70$, range $= 3–35$). They had a mean age of 42.09 years ($SD = 8.28$, range $= 27–62$) and the majority identified as male ($n = 71$). Eighty-two self-identified as Caucasian, four as Asian, and one as Hispanic. Mean years of post-secondary education was 2.36 ($SD = 1.86$, range $= 0-6$).

Participants responded to online media as well as flyer and brochure advertisements posted at local Emergency Medical Service stations. The advertisements were directed towards interested paramedics instructing them to visit a website at which they were prompted to complete an eligibility questionnaire. The questionnaire included items on employment status, relationship status, and work schedule information. Paramedics were required to be working full-time or the equivalent to full-time hours (minimum of four shifts per week) to be eligible to participate. Furthermore, all participants were required to work similar shift patterns at the time of participation (i.e., four consecutive shifts) to maintain similar daily diary schedules. Finally, participants were required to have a cohabiting romantic partner willing to participate in the larger study to be eligible to participate. Both paramedics and their spouses received a $40 gift CAD card to a local retail establishment of their choice (e.g., Starbucks) for participation. However, due to the interests of the current study (examining the paramedic’s perceived stress, coping strategies, and posttraumatic symptomology), we only examine paramedic data.
A total of 87 paramedics met eligibility criteria for the current study out of 558 initial inquiries. Reasons for study exclusion were: lack of interest from the paramedic’s spouses (49%), not working four consecutive shifts during the study (46%), and not being in a committed relationship and/or not having a cohabiting spouse (41%). Applicants who did not meet eligibility criteria differed significantly in employment status compared to the current sample with only 53% of total applicants working full-time, while 94% of the current sample reported working full-time ($\chi^2 = 29.4, p < .001$), reflecting our inclusion criteria. The current study collected data at a two-year follow-up from 68 of the original 87 participants (78%) who completed the preliminary questionnaire. Independent samples t-tests showed no significant differences in demographics, baseline PTSS Checklist (PCL) scores, or predictor variables between participants who completed the follow-up portion of the study and those who dropped out.

### 2.2 Procedures and measures

The larger study was separated into four phases of data collection which included a preliminary demographic questionnaire, a baseline questionnaire, a seven-day daily diary phase, and a follow-up questionnaire two years after completion of the daily diary phase. Once participants were determined to have met eligibility criteria, they were directed to an online questionnaire on a secure server located at the University of British Columbia. The preliminary questionnaire included an informed consent agreement as well as a questionnaire on basic demographic information (including age, gender, and ethnicity). Following the online questionnaire, participants were contacted by phone to schedule the diary phase of the study. Once scheduled and coordinated with both parties, a confirmation email was sent to each participant including a link to the online daily diary questions and detailed instructions.
Immediately after completing the phone interview participants completed a series of online questionnaires including items assessing their personality, posttraumatic symptomology, depression, traumatic events experienced in the previous three years, and other items pertaining to overall health and well-being. Participants were asked to complete structured diaries for a one-week period during which days 2-5 were scheduled work days. Considering the frequently changing schedules associated with shift work, we implemented an event-contingent design whereby participants completed diaries within one hour of waking, at the end of the work day, and before going to bed. For the purpose of the current study, we examined diaries that were completed at the end of the workday and before going to bed. Finally, participants were contacted via email two years after the daily diary assessment to complete a follow-up questionnaire. This follow-up questionnaire, like the baseline questionnaire, contained items on posttraumatic symptomology, depression, stress and other items pertaining to health and well-being.

2.2.1 Daily diary measures.

Rumination was measured before bed each day during the one-week daily diary phase of the study. Participants were asked to indicate the extent to which they engaged in rumination in response to “the most bothersome event or problem” (King & DeLongis, 2013). Rumination was measured using three items from the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999). The three items included: 1) *ruminated or dwelled on things that happened*, 2) *often played back in my mind the things I said or did*, and 3) *rehashed in my mind the things I said or did*. The RRQ has been demonstrated to have good internal reliability and high convergent validity with measures of neuroticism and depression (Trapnell & Campbell, 1999).
The three items were rated on a Likert-scale of 1 (*not at all*) to 3 (*a lot*). Cronbach’s alpha for the scale was .79.

Perceived stress was assessed during the after-work portion of the one-week daily diary phase. Perceived stress was measured using a modified four-item version of the Perceived Stress Scale (PSS-4; Cohen et al., 1983). The PSS is a widely used assessment of perceived stress that has been shown to have good reliability and validity (Cohen, Tyrell, & Smith, 1993). The original PSS-4 assesses the degree of perceived stress within the past month. The current study modified the wording of the PSS-4 to reflect perceived stress at work each day. Participants were prompted by being asked “how much have you felt this way while at work?”. The four items included: 1) *That you were unable to control the important things in your life*, 2) *Confident about your ability to handle problems*, 3) *That things were going your way*, and 4) *That difficulties were piling up so high that you could not overcome them*. All items were rated on a scale of 0 (*never*) to 4 (*a lot*). In the current study, daily measurements were aggregated across the amount of work days during the daily diary phase to formulate an average perceived stress score (α = .69).

### 2.2.2 Questionnaire measures.

Posttraumatic symptomology was assessed at two-time points: the first assessment was during the baseline questionnaire (α = .93) and the second assessment at the two-year follow-up questionnaire (α = .93). Posttraumatic symptomology was measured using the 17 item PTSD Checklist (PCL; Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). The PCL is one of the most frequently used self-report measures of PTSS and has been shown to have good reliability and validity across diverse sample populations (Conybeare et al., 2012; McDonald & Calhoun, 2010). The scale asks participants to rate from 1 (*not at all*) to 5 (*extremely*) how frequently they
have been bothered by specific problems in the last month (e.g., avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it, feeling irritable or having angry outbursts, or feeling as if your future will somehow be cut short), with scores ranging from 17 to 85.

### 2.2.3 Control variables.

Occupational stressors were assessed using an 11-item checklist based on cited job responsibilities by major services in Canada. The checklist included items such as high call volume, illegitimate calls, experiencing a threat to crew safety, or responding to a call for a multiple casualty incident (See Pow et al., 2017). The number of stressors was summed for each work-day to create an index of the work day’s occupational stress; creating a possible range from 0 to 11. Depression was assessed using the 10-item self-report Center for Epidemiologic Studies Depression Scale Revised (CESD-R; Radloff, 1977). The CESD-R uses a Likert-scale from 1 (Rarely or none of the time) to 4 (All of the time) to assess depressive mood in the last week (α = .88). Examples of items include: “I felt depressed”, “I felt hopeful about the future” and “I was bothered by things that usually don’t bother me”.

### 2.3 Data analysis

#### 2.3.1 Missing values.

In total, two participants (2%) failed to report before bed rumination scores ($M = 5.53$, $SD = 1.71$), while 57 participants (66%) completed between 6 to 7 before bed daily diary entries. A total of seven participants (8%) failed to complete any perceived stress measures during the after-work diary portion of the daily diary phase. An average of 3.31 after-work diary reports were completed by participants ($SD = 1.31$) with the majority (55%) completing four after-work diaries. A total of 19 participants (22%) did not complete the follow-up questionnaires which
included the follow-up PCL. Mean imputation was used to address missing data for aggregated scores of rumination and perceived stress across the daily diary portion. Full information maximum likelihood (FIML) has been shown to produce unbiased parameter estimates and standard errors for missing data (Graham, 2003), therefore we ran our regression analysis using FIML to account for missing PTSS scores at follow-up.

2.3.2 Analytic strategy.

A series of Linear regression analyses were run in R (version 3.01; RStudio team, 2016) to assess the relationship between perceived stress, rumination, and change in posttraumatic stress symptomology across the two-year follow-up. First, average daily perceived stress was used to predict average daily rumination. Next, we examined the relationship between average daily rumination at baseline and PTSS at follow-up, while controlling for baseline PTSS, depression at baseline, and aggregated occupational stressor scores. Finally, we used the Lavaan package (Rosseel, 2012) to assess the indirect effect of perceived stress on subsequent PTSS that was mediated through rumination. The indirect effect was tested using a bootstrap estimation approach with 10000 samples.
Chapter 3: Results

3.1 Descriptive statistics and bivariate correlations

Means, standard deviations, ranges, and bivariate correlations for all study variables are presented in Table 1. The mean PCL scores were 36.73 at baseline and 36.47 at the two-year follow-up. The means of PCL at baseline and follow-up were not significantly different ($t = -.48$, $p = .63$). Rumination scores were calculated by aggregating the 4-item RRQ (Trapnell & Campbell, 1999) scores reported before bed across the one-week daily diary phase to create a weekly rumination score for each participant. Rumination was rated on a 3-point Likert-scale from 1 (not at all) to 3 (a lot) with a mean of 1.51. Perceived stress scores were calculated by aggregating PSS-4 (Cohen, Kamarck, & Mermelstein, 1983) scores reported after work shifts across all days worked during the daily diary phase. Perceived stress scores were measured on a 5-point Likert Scale from 0 (never) to 4 (very often) with a mean of 0.96.
Table 3.1. Descriptive and Bivariate Correlations for Predictor and Control Variables

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Baseline: PCL score</td>
<td>87</td>
<td>36.73</td>
<td>14.23</td>
<td>17 - 78</td>
<td>-.68**</td>
<td>.60**</td>
<td>.40**</td>
<td>.84**</td>
<td>.25*</td>
<td></td>
</tr>
<tr>
<td>2. Follow-up: PCL score</td>
<td>68</td>
<td>36.47</td>
<td>13.62</td>
<td>17 - 78</td>
<td>-</td>
<td>-</td>
<td>-.42**</td>
<td>.47**</td>
<td>.64**</td>
<td>.20</td>
</tr>
<tr>
<td>3. Rumination</td>
<td>83</td>
<td>1.51</td>
<td>0.37</td>
<td>1 - 2.56</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.44**</td>
<td>.61**</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(aggregated score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Perceived stress</td>
<td>80</td>
<td>0.96</td>
<td>0.62</td>
<td>0 - 2.75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.45**</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(aggregated score)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Depression (baseline)</td>
<td>87</td>
<td>19.01</td>
<td>6.25</td>
<td>10 – 37</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>.28*</td>
</tr>
<tr>
<td>6. Occupational stressors</td>
<td>70</td>
<td>1.16</td>
<td>1.04</td>
<td>0 - 5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. p < .05 = *, p < .001 = **

3.2 Regression Analyses

We used regression analysis to investigate the hypothesis that rumination mediates the effect of perceived stress experienced during the work day on PTSS (See Figure 1 and Table 2). Perceived stress significantly predicted ruminative coping ($\beta = .46$, $SE = 0.06$, $p = .000$). Ruminative coping significantly predicted follow-up PCL scores, even after controlling for baseline PCL scores, depression, and occupational stress ($\beta = .26$, $SE = 3.41$, $p = .009$), while perceived stress did not significantly predict follow-up PCL scores ($\beta = -.01$, $SE = 2.48$, $p = ns$). These findings suggested that rumination may be mediating the effect of perceived stress on change in posttraumatic symptomology. The results indicated that the indirect coefficient was significant ($\beta = .12$, $SE = 1.06$, $p = .023$). Approximately 41.4% of the variance in posttraumatic symptomology was accounted for by the predictors ($R^2 = .414$).
Table 3.2. Regression analyses examining the mediating effect of rumination on perceived stress and PTSS.

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Predictor</th>
<th>β</th>
<th>SE</th>
<th>Z</th>
<th>p</th>
<th>Lower confidence</th>
<th>Upper confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rumination</td>
<td>Perceived stress</td>
<td>0.46</td>
<td>0.06</td>
<td>4.59</td>
<td>.001</td>
<td>0.16</td>
<td>0.39</td>
</tr>
<tr>
<td>PTSS (follow-up)</td>
<td>Rumination</td>
<td>0.26</td>
<td>3.41</td>
<td>2.48</td>
<td>.013</td>
<td>1.76</td>
<td>15.11</td>
</tr>
<tr>
<td></td>
<td>Perceived stress</td>
<td>-0.01</td>
<td>2.48</td>
<td>-0.05</td>
<td>.958</td>
<td>-4.99</td>
<td>4.72</td>
</tr>
<tr>
<td></td>
<td>Depression</td>
<td>0.19</td>
<td>0.33</td>
<td>1.13</td>
<td>.258</td>
<td>-0.28</td>
<td>1.03</td>
</tr>
<tr>
<td></td>
<td>Occupational</td>
<td>-0.01</td>
<td>1.47</td>
<td>-0.14</td>
<td>.891</td>
<td>-3.07</td>
<td>2.67</td>
</tr>
<tr>
<td></td>
<td>PTSS (baseline)</td>
<td>0.49</td>
<td>0.14</td>
<td>2.98</td>
<td>.003</td>
<td>0.15</td>
<td>0.70</td>
</tr>
</tbody>
</table>

**Indirect effect**

<table>
<thead>
<tr>
<th>Outcome variable</th>
<th>Predictor</th>
<th>β</th>
<th>SE</th>
<th>Z</th>
<th>p</th>
<th>Lower confidence</th>
<th>Upper confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived stress*Rumination</td>
<td></td>
<td>0.12</td>
<td>1.06</td>
<td>2.18</td>
<td>.030</td>
<td>0.23</td>
<td>4.38</td>
</tr>
</tbody>
</table>

*Note. n = 87*
Figure 3.1. Mediational test examining perceived stress during the work days mediating the effect of ruminative coping on posttraumatic symptomology change, controlling for baseline posttraumatic symptomology, depression, and work problems. Scores are reported as standardized regression coefficients.

Note. $p < .05 = \ast$. $p < .01 = \ast \ast$. $p < .001 = \ast \ast \ast$
Chapter 4: Conclusion

4.1 General Discussion

The aim of this study was to examine the relationship that perceived stress and rumination have on the maintenance of posttraumatic stress symptomology among those frequently exposed to high stress and traumatic events. As expected, paramedics who reported higher levels of perceived stress during work across the daily diary assessments reported higher levels of rumination compared to those who reported lower levels of perceived stress. In line with previous findings (Michael et al, 2007; Kleim, Ehlers, & Glucksman, 2007), paramedic’s rumination and PTSS at the two-year follow-up were significantly positively related. Perceived stress did not significantly predict PTSS directly. However, as hypothesized, results of the mediational analysis indicated an indirect effect of perceived stress on PTSS. The indirect effect of perceived stress remained significant even after controlling for baseline PTSS scores, depression, and occupational problems. These findings suggest that perceived stress indirectly predicts maintenance of paramedics’ PTSS two-years later.

Paramedics are exposed to traumatic and non-traumatic stressors at work on a regular basis, and our findings here are consistent with cognitive models of stress in suggesting that a) cognitive appraisals of these events, and b) ruminative coping responses, account at least in part, for individual differences in the development and maintenance of PTSS. This was the first longitudinal study to investigate the relationship between perceived stress, rumination, and PTSS in a sample frequently exposed to traumatic stressors. Our results suggest that paramedics who experience higher levels of perceived stress during the work day are more likely to ruminate, which in turn increases the risk for PTSS.
Hu et al. (2014), whose results differed from ours, studied a group of 49 women who had survived interpersonal violence. Their analyses indicated that perceived stress partially mediated the effect of rumination on PTSS, although the mediating effect did not remain when controlling for depression. Consistent with the same model, Spinhoven et al. (2015) found that those high on trait rumination were more likely to appraise traumatic events as highly impactful, which in turn was associated with an increased likelihood of PTSD onset (Spinhoven et al., 2015). A possible explanation for these conflicting findings is that emergency workers may react differently to traumatic experiences due to their psychological preparedness. North and colleagues (2002) found a relatively low PTSD rate (13.6%) among male firefighters after a disaster (the Oklahoma City bombing) compared to a PTSD rate of 22.7% among male victims of the same disaster. This suggests that emergency workers report lower rates of PTSD in response to traumatic events experienced on the job, possibly due to their appraisal of the event. Paramedics and other emergency workers are trained to effectively respond to potentially traumatic experiences daily and this distinction between other populations that are victims of trauma may lead to different appraisals of stressful events. Thus, perceived stress may uniquely predict PTSS and rumination in individuals who experience a traumatic event, while perceived stress only indirectly impacts PTSS through rumination in emergency medical personnel due to their preparedness. Research can build upon the findings of North and colleagues (2002) by assessing the differences in perceived stress and rumination among individuals who are frequently exposed to traumatic events (e.g., first responders) and the individuals exposed to the isolated traumatic event.

4.2 Limitations and future directions

Given that our sample was predominately male (82%), we were limited in our ability to assess gender effects. Obtaining repeated measures of perceived stress and rumination close to
the real-time occurrence increases ecological validity and reduces retrospective bias (Tennen, Affleck, Coyne, Larsen, & DeLongis, 2006). Daily diary sampling for a one-week period allowed for a more accurate depiction of the day-to-day interactions for paramedics while not overwhelming participants, which could lead to increases in participant burden and burnout. Our study investigated perceived stress immediately following the completion of the paramedic’s work shift and rumination before bed. We chose this assessment method to examine emotions and coping strategies as close to the event as possible while ensuring that participant burden was limited. Future research may benefit from using targeted event-contingent ecological momentary assessments in this population. Specifically, future research could use event-contingent assessments that examine perceived stress and rumination immediately following or as close as possible to specific traumatic stressors during work (i.e., suicide calls, multiple casualty incidents). Furthermore, examining the relationship between perceived stress, rumination, and PTSS in other populations that are frequently exposed to traumatic stressors (e.g., firefighters, police officers, social workers) may allow for greater generalizability. Protective factors such as resilience and sense of coherence have been found to be negatively correlated with PTSS (Fincham et al., 2009; Fjeldheim et al., 2014; Streb et al., 2014). Future research should investigate the relationship between protective factors of PTSS and the relationship between rumination and perceived stress in samples that are exposed to frequent trauma.

4.3 Clinical Implications

The findings of this study have clinical implications for paramedics and individuals that are exposed to frequent traumatic stressors. Paramedics who perceived higher levels of stress during the day were significantly more likely to ruminate which increased the likelihood of maintaining PTSS over the two-year study period. Paramedics’ perceptions of stress during work
shifts serve as a predictor for ruminative thinking and indirectly PTSS maintenance. Therefore, paramedics who report higher levels of perceived stress and rumination may be ideal candidates for treatment and prevention efforts. Perceived stress may serve as an appropriate entry point in which mindfulness-based and cognitive-behavioural interventions can reduce the amount of subsequent rumination that would occur in the aftermath of a stressful and/or traumatic experience. Rumination could be reduced by examining and restructuring the cognitive appraisals that an individual makes about specific stressful and traumatic events. Rumination is already considered a core intervention target in cognitive therapy for PTSD (Ehlers et al., 2003), with previous studies suggesting that mindfulness-based and cognitive-behavioural interventions are effective in reducing rumination in clinical, general adult and student populations (Querstret & Cropley, 2013). Individuals who are frequently exposed to traumatic stress or those at-risk of increased PTSS may benefit from programs and therapy that address both the appraisal of stressful events and the maladaptive coping strategies (i.e., rumination) they use to manage the stressful event.
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