Cortisol as Mediator of Mindfulness Training for Aggression and Burnout Among Law Enforcement Officers

Josh Kaplan
Pacific University

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Cortisol as Mediator of Mindfulness Training for Aggression and Burnout Among Law Enforcement Officers

Abstract
Law enforcement officers (LEOs) face significant occupational stress as a regular aspect of their job and as a result are at increased risk for negative health outcomes, such as aggression and burnout. Salivary cortisol has been identified as a link between environmental stressors and aggression and burnout, and is often abnormally elevated among LEOs. Despite a clear need, studies of interventions for aggression, burnout, and cortisol among LEOs are lacking. Mindfulness training (MT) interventions have shown efficacy in reducing abnormally elevated salivary cortisol, aggression, and burnout in non-LEO populations. Mindfulness-Based Resilience Training (MBRT) is a preventive intervention developed for LEOs to reduce negative outcomes, and has demonstrated preliminary efficacy in reducing aggression and burnout in this population. The purpose of this study was to assess the role of reduced cortisol awakening response (CAR) in mediating the relationship between MBRT and improved aggression and burnout in a sample of LEOs. Results failed to provide evidence of CAR as a mediator in the proposed model, and baseline correlations revealed no significant relationship between CAR and either burnout or aggression. Limitations and directions for future research are discussed.

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CORTISOL AS MEDIATOR IN MBRT

CORTISOL AS MEDIATOR OF MINDFULNESS TRAINING FOR AGGRESSION AND BURNOUT AMONG LAW ENFORCEMENT OFFICERS

A DISSERTATION
SUBMITTED TO THE FACULTY
OF
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JOSH KAPLAN, MS

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ABSTRACT

Law enforcement officers (LEOs) face significant occupational stress as a regular aspect of their job and as a result are at increased risk for negative health outcomes, such as aggression and burnout. Salivary cortisol has been identified as a link between environmental stressors and aggression and burnout, and is often abnormally elevated among LEOs. Despite a clear need, studies of interventions for aggression, burnout, and cortisol among LEOs are lacking. Mindfulness training (MT) interventions have shown efficacy in reducing abnormally elevated salivary cortisol, aggression, and burnout in non-LEO populations. Mindfulness-Based Resilience Training (MBRT) is a preventive intervention developed for LEOs to reduce negative outcomes, and has demonstrated preliminary efficacy in reducing aggression and burnout in this population. The purpose of this study was to assess the role of reduced cortisol awakening response (CAR) in mediating the relationship between MBRT and improved aggression and burnout in a sample of LEOs. Results failed to provide evidence of CAR as a mediator in the proposed model, and baseline correlations revealed no significant relationship between CAR and either burnout or aggression. Limitations and directions for future research are discussed.

Keywords: law enforcement officers, mindfulness, cortisol, burnout, aggression
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Chapter One:

Manuscript prepared for journal submission
Introduction

Police Stress

Policing is a highly stressful occupation (Gershon, Barocas, Canton, Xianbin Li, & Vlahov, 2009; Violanti et al., 2011). Law enforcement officers (LEOs) are frequently and unpredictably exposed to stressors in all aspects of their job (Acquadro Maran, Varetto, Zedda, & Ieraci, 2015; Griffin & Bernard, 2003; Neely, 2012) at a higher rate than other professions (Acquadro Maran et al., 2015). These stressors are often categorized as acute or chronic. Acute stressors include critical incidents such as high speed pursuits (Berg, Hem, Lau, Haseth, & Ekeberg, 2005) that place the lives of LEOs at risk (Hickman, Fricas, Strom, & Pope, 2011). Chronic stressors include ongoing aspects of the job such as departmental politics and shiftwork (Bergman, Christopher, & Bowen, 2016; Shane, 2010). Acute and chronic stressors contribute to negative health outcomes among LEOs (Kaplan, Bergman, Hunsinger, Bowen, & Christopher, 2016). Compounding the negative effects of occupational stressors, LEOs endorse high rates of maladaptive and avoidant coping (Ballenger et al., 2011; Ménard & Arter, 2013), such as alcohol misuse (Pasillas, Follette, & Perumean-Chaney, 2006) and distraction (Arble, Daugherty, & Arnetz, 2018). The combination of stressors, maladaptive coping, and a toxic work environment result in significant negative mental health, occupational, and behavioral outcomes among LEOs (Avdija, 2014; McCrathy & Atkinson, 2012; O'Hara, Violanti, Levenson, & Clark, 2013).

Outcomes of LEO Stress

LEOs experience negative health outcomes at rates higher than the general population (Violanti et al., 2017), including anxiety (Gershon et al., 2009; Violanti et al., 2014), fatigue and sleep disorders (Bond et al., 2013; Neylan, 2013; Tyagi & Dhar, 2014), depression (Garbarino,
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Cuomo, Chiorri, & Magnavita, 2013; Wang et al., 2010), and suicidal ideation (Clark, White, & Violanti, 2012; Wang et al., 2010). LEOs also experience higher rates of physical health issues than the general population (Hartley, Burchfiel, Fekedulegn, Andrew, & Violanti, 2011; Morash, Haarr, & Kwak, 2006), including chronic back pain (Benyamina Douma, Cote, & Lacasse, 2018), as well as higher rates of disease such as diabetes and obesity (Yoo & Franke, 2011), cardiovascular disease (Hartley et al., 2011), and ulcers (Patterson, Chung, & Swan, 2014). These negative health outcomes have a harmful impact on officer wellbeing and the communities they serve (Hickman et al., 2011; Morash et al., 2006).

Aggression

A particularly deleterious effect of LEO occupational stress is aggression toward civilians (Kop, Euwema, & Schaufeli, 1999; Kop & Euwema, 2001; Queirós, Kaiseler, & Leitão da Silva, 2013; Sack, 2009). LEO aggression toward members of the community is a global concern (Prenzler, Porter, & Alpert, 2013) and it has been documented in research, legal investigations, and governmental audits around the world (Alpert & Dunham, 2004; Porter, 2012). Aggression among LEOs is related to environmental factors such as professional (Koepfler, Brewster, Stoloff, & Saville, 2012) and neighborhood culture (Brunson & Miller, 2006; Holmes & Smith, 2012), as well as individual factors such as preexisting psychological impairment (Kurtz, Zavala, & Melander, 2015; Nieuwenhuys, Cañal-Bruland, & Oudejans, 2012) and abnormal stress reactivity (Groer et al., 2010; Hao, Hong, Xu, Zhou, & Xie, 2015; Strahler & Ziegert, 2015).

LEO aggression toward civilians includes unjustified shootings, beatings, fatal chokings, and overly rough treatment of suspects (Collins, 1998; Griffin & Bernard, 2003; Ramey et al., 2012). LEO aggression toward civilians also includes incidents such as torture and violent public
suppression (Prenzler et al., 2013), all of which may result in serious injury or death of civilians (Alpert & Dunham, 2010). LEO aggression toward civilians may result in community unrest and negative attitudes toward police (Alpert & Dunham, 2010; Prenzler et al., 2013), and taxpayers incur the cost of investigations and successful lawsuits against LEOs (Porter, 2012).

**Burnout**

Occupational stress has also been linked to burnout at higher rates among LEOs than other professions (Backteman-Erlanson, Padyab, & Brulin, 2013; De la Fuente Solana, Aguayo Extremera, Vargas Pecino, & Canadas de la Fuente, 2013; Schaible & Six, 2016). Professional factors such as demanding workload, role ambiguity, and poor social interactions at work (Maslach & Leiter, 2005; Maslach, Schaufeli, & Leiter, 2001; Pines & Keinan, 2005), and individual factors such as maladaptive coping strategies (Grandey, 2000) and values incongruence (Grandey, 2003; Johnson & Spector, 2007; Schaible & Six, 2016), are predictive of burnout among LEOs.

Burnout is linked to decreased general physical well-being among LEOs (Kop et al., 1999; Stearns, 2018), including hypertension, cold and flu symptoms, and sleep issues (Hawkins, 2001; Leiter & Maslach, 2000). Burnout is also associated with general mental and emotional distress among LEOs (Pines & Keinan, 2005), and specific conditions such as depression (Aguayo, Vargas, Canadas, & De la Fuente, 2017; Maslach & Leiter, 2008), anxiety (Aguayo et al., 2017), and suicidal thoughts (Berg, Hem, Lau, Loeb, & Ekeberg, 2003), as well as disruptions in relationships and domestic violence (Johnson, Todd, & Subramanian, 2005). Burnout has also been linked to increased maladaptive coping strategies among LEOs, including higher utilization of alcohol, prescription medications, and recreational drugs (Mikkelsen &
Burke, 2004). LEOs experiencing burnout are also less motivated to excel professionally and are more likely to perceive themselves as failing in their professional roles (Maslach & Leiter, 2008; Pines & Keinan, 2005), which may impact overall job performance (Kop et al., 1999; Maslach & Leiter, 2008). Cortisol has been identified as a link between environmental stressors and negative outcomes (Chrousos, 2009) such as burnout and aggression.

Cortisol

Cortisol is a product of the hypothalamic-pituitary-adrenocortical (HPA) axis, which when activated is instrumental in preparing the body’s fight-or-flight stress response (Andersen, Dorai, Papazoglou, & Arnetz, 2016; Chrousos, 2009). Cortisol acts to prevent the physiological system from returning to allostasis (McEwen, 2007, 2008), allowing the body to remain ready to act in the presence of stress or danger (Violanti et al., 2017). A hyperactive HPA axis may sustain harmful “wear and tear” and lead to a chronic state of deregulation wherein its response to stressors is often expressed as exaggerated cortisol secretion (Violanti et al., 2017). Changes to the circadian regulation of cortisol are another important aspect of physiological stress reactivity (Menet & Rosbash, 2011; Nader, Chrousos, & Kino, 2010). The cortisol awakening response (CAR) is a combination of stress response and circadian rhythm (Stalder et al., 2016), and is a commonly used proxy for HPA activity. Previous research has found a positive relationship between cortisol and occupational stress (Austin-Ketch et al., 2012; Groer et al., 2010; Walvekar, Ambekar, & Devaranavadagi, 2015), and that CAR predicts increased acute stress disorder (Inslicht et al., 2011).

Cortisol among LEOs

Amongst LEOs, dysregulated CAR is common (Andersen et al., 2016), but findings on the relationship between cortisol and occupational stress are mixed. Some studies have found a
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positive relationship between cortisol levels and high stress scenarios (Groer et al., 2010), and perceived stress (Walvekar et al., 2015), while other studies have found that abnormally decreased, or blunted CAR is related to increased traumatic experiences of police work (Violanti et al., 2017) and PTSD (Wessa, Rohleder, Kirschbaum, & Flor, 2006).

Unlike many other high-stress occupations that exhibit dysregulated cortisol, LEOs are at risk for associated negative outcomes associated with dysregulated cortisol (Violanti et al., 2007), likely due to LEO-specific stress such as threats to their lives and other chronic sources of stress (Andersen et al., 2016; Binder & Holsboer, 2012; Lovallo, 2015). Among LEOs, dysregulated cortisol has been positively associated with occupational stress (Austin-Ketch et al., 2012; Groer et al., 2010; Walvekar et al., 2015), and increased CAR has been found to positively predict increased acute stress disorder (Inslicht et al., 2011). Increased cortisol levels have also associated with risk factors for cardiovascular disease in female LEOs (Violanti et al., 2009), and may leave LEOs more generally vulnerable to disease (Violanti et al., 2017). Dysregulated cortisol has also been associated with problematic aspects of LEO performance, including increased threat perception, negative emotion, and a lack of control, all of which have detrimental impacts on LEO performance (Lovallo, 2015).

Cortisol and burnout

A significant amount of research has examined the relationship between cortisol and burnout (Langelaan, Bakker, Schaufeli, Van Rhenen, & Van Doornen, 2006; Marchand, Juster, Durand, & Lupien, 2014; Nislin et al., 2016). Several studies found a positive relationship between cortisol and burnout in samples endorsing clinical burnout relative to healthy control groups (De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Grossi et al., 2005) and a sample of women with stress-related exhaustion disorder (Olsson, Roth, & Melin, 2010). A
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longitudinal intervention study of clinically burned-out patients found reductions in both burnout and diurnal cortisol levels eight months pre- and post-psychotherapy (Mommersteeg, Heijnen, Verbraak, & van Doornen, 2006).

Despite these findings, multiple systematic reviews of biomarkers of burnout determined that results are inconclusive, suggesting that there is currently no definitive biomarker for burnout (Danhof-Pont, van Veen, & Zitman, 2011; Grossi, Perski, Osika, & Savic, 2015). Other research has supported this, reiterating that more work is needed to develop an understanding of physiological stress responses in the presence of burnout (Nislin et al., 2016).

Cortisol and aggression

Multiple meta-analyses and systematic reviews have described a positive relationship between cortisol and aggression (Montoya, Terburg, Bos, & van Honk, 2012; Rosell & Siever, 2015). Other studies have found that cortisol positively predicts aggression among women (Denson, Mehta, & Ho Tan, 2013), and correlates positively with aggression among healthy adults (Almeida, Lee, & Coccaro, 2010) and children with ADHD (Yang, Won Shin, Sun Noh, & Stein, 2007). Intervention studies of cortisol and aggression are lacking. One study found that behavioral problems were significantly lowered among children with high cortisol stress responsivity post psychotherapy treatment (van de Wiel, van Goozen, Matthys, Snoek, & van Engeland, 2004), and another found that relative to a control group, a meditation intervention significantly decreased aggression and cortisol levels among elementary school students in South Korea (Yoo et al., 2016).

However, some studies refute these findings. Other research has found a negative relationship between cortisol and aggression among Palestinian boys living in Gaza (Carré & Mehta, 2011), and a nonsignificant relationship between cortisol and aggression in a large
sample of undergraduate students (Vaillancourt & Sunderani, 2011) and among elementary-aged children (Ryan, Schechter, & Brennan, 2012). Continued research is needed to understand the relationship between cortisol and aggression, and the potential role of cortisol as a mediator in interventions.

**Interventions for LEO Stress, Aggression, and Burnout**

Despite the prevalence and impact of aggression and burnout among LEOs, and the link between cortisol dysregulation and negative health outcomes, few studies have explored the impact of intervention among LEOs (Schaible & Six, 2016) or the role of cortisol in the relationship between intervention and improved health outcomes. Some studies of interventions such as cognitive-behavioral therapy (Gersons, Carlier, Lamberts, & van der Kolk, 2000), relaxation, visualization, progressive muscle relaxation, stress inoculation (Arnetz, Nevedal, Lumley, Backman, & Lublin, 2009; Ranta, 2009; Shipley & Baranski, 2002), and cognitive decision-making training (Alpert, 2011) have shown promising results. However, a meta-analysis determined that there is insufficient evidence to support the general efficacy of current stress management interventions among LEOs (Patterson et al., 2014). The significant impact of LEO stress and associated outcomes, coupled with a lack of efficacious interventions, suggests novel approaches are needed. A recent study of mindfulness training (MT) found reductions in both aggression and burnout among LEOs (Christopher et al., 2018). This study of is part of a growing body of literature, suggesting that mindfulness training may be an effective option for improving cortisol, aggression, and burnout among LEOs.

**Mindfulness Training (MT)**
MT has acquired significant empirical support in laboratory, clinical, and community-based research contexts. Systematic reviews and meta-analyses of MT have shown reduced aggression (Fix & Fix, 2013; Zoogman, Goldberg, Hoyt, & Miller, 2014) and burnout (Luken & Sammons, 2016; Regehr, Glancy, Pitts, & LeBlanc, 2014). Among LEOs, MT has demonstrated positive impacts on aggression (Christopher et al., 2018) and burnout (Christopher et al., 2015; Christopher et al., 2018; Kaplan et al., 2016). MT has also demonstrated pre- to post-intervention reductions in cortisol levels (Brand, Holsboer-Trachsler, Naranjo, & Schmidt, 2012; Christopher et al., 2018; Lengacher et al., 2012; Marcus et al., 2003). While we are unaware of studies of the mediating role of cortisol in MT, it has been suggested that MT may exert its positive impact on stress-related negative health outcomes by regulating cortisol, increasing it in samples with blunted cortisol, and reducing it in samples with exaggerated cortisol (Christopher et al., 2018).

MT has also been shown to reduce diurnal salivary cortisol (Carlson, Speca, Faris, & Patel, 2007; Carlson, Speca, Patel, & Goodey, 2004), diurnal plasma cortisol (Witek-Janusek et al., 2008), and CAR (Marcus et al., 2003; Matousek, Pruessner, & Dobkin, 2011). In a recent meta-analysis, authors concluded that randomized controlled trials of MT significantly reduced salivary cortisol among healthy adults (Sanada et al., 2016), and a systematic review determined that cortisol may be a viable biomarker for improvement following MT (Matousek, Dobkin, & Pruessner, 2010).

Therefore, the primary aim of this study was to assess the impact of improved CAR on reducing aggression and burnout among LEOs in an 8-week MT. It was hypothesized that among MT participants (versus no intervention control [NIC]), reduced CAR will mediate reductions in aggression and burnout. The proposed mediation model may be found in Figure 2. A secondary aim was to explore the baseline correlations between CAR, aggression, and burnout among a
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sample of LEOs. It was hypothesized that CAR would be positively correlated with aggression and burnout at baseline.

Method

The present study is a secondary data analysis of a larger parent study evaluating the feasibility and preliminary efficacy of Mindfulness-Based Resilience Training (MBRT; see Christopher et al., 2018 for a description of MBRT).

Participants

Participants were LEOs recruited from law enforcement agencies throughout the greater metropolitan area of a major city in the Pacific Northwestern United States. Recruitment methods included emails to superior officers and departmental contacts (e.g., mental health staff), general canvassing, and in-person presentations conducted by members of the research team in the presence of administrative staff and potential participants. A complete list of demographic variables can be found in Table 1.

Procedure

To be eligible for the intervention, LEOs had to be full-time sworn officers with no prior exposure to MBRT or similar mindfulness training. Participants meeting these criteria completed a battery of computer-administered measures pre- and post-training, and at three-month follow-up. During baseline assessment, participants provided written informed consent, and were subsequently randomly assigned using a permuted-block procedure (1:1) with stratification (gender and age) to MBRT or a no intervention control (NIC) group. Assessment points were consistent between NIC and MBRT conditions. Participants were given materials at pre- and post-training to supply saliva samples for cortisol analyses. Only pre- and post-intervention data were used in the current study.
Mindfulness training. MBRT was specifically designed to enhance resilience for LEOs in the context of acute and chronic occupational stressors. Based on Mindfulness-Based Stress Reduction (Kabat-Zinn, 1990), MBRT was delivered in this study through eight weekly 2-hour sessions with a 6-hour session in the seventh week. Sessions contained didactic and experiential exercises, including body scan, sitting and walking meditations, mindful movement, and group discussion. Specific content, including language and exercises were adapted for a LEO population; the primary focus of the curriculum was to learn strategies to manage stressors inherent to police work, such as critical incidents, job dissatisfaction, and public scrutiny, as well as interpersonal, affective and behavioral challenges common to LEOs.

Measures

Oldenburg Burnout Inventory (OLBI). The Oldenburg Burnout Inventory (OLBI; Demerouti, Bakker, Vardakou, & Kantas, 2003; Halbesleben & Demerouti, 2005) is a 16-item measure of burnout with subscales of exhaustion and disengagement from work, two factors that contribute to burnout amongst LEOs (Adebayo et al., 2008). Scores on the OLBI range from 1-4, with higher scores indicating higher burnout. The OLBI has demonstrated adequate internal consistency, factorial validity, and discriminant and convergent validity (Demerouti, Bakker, Vardakou, & Kantas, 2003; Demerouti, Mostert, & Bakker, 2010; Halbesleben & Demerouti, 2005). The OLBI has been used in previous studies of MBRT amongst LEOs (Christopher et al., 2015), as well as mediation analyses amongst first responders (Kaplan et al., 2016). In the present sample, the OLBI demonstrated adequate internal consistency ($\alpha_{pre} = .73; \alpha_{post} = .76$).

Buss-Perry Aggression Questionnaire-Short Form (BPAQ-SF). The BPAQ-SF (Bryant & Smith, 2001) is a 12-item scale of aggression, comprised of four sub-domains of aggression: physical aggression, verbal aggression, anger, and hostility. Scores on the BPAQ-SF
range from 1-5, with higher scores indicating increased aggression. The BPAQ-SF has shown good internal consistency, and strong convergent and discriminant validity (Diamond & Magaletta, 2006). The BPAQ-SF demonstrated good internal consistency in the present sample ($\alpha_{\text{Pre}} = .83; \alpha_{\text{Post}} = .83$).

**Cortisol awakening response (CAR).** Salivary cortisol is a common measure of physiological response to occupational stressors (Nislin et al., 2016). In accordance with consensus guidelines (Stalder et al., 2016), participants provided saliva samples (2-3 ml) in their homes at timepoints of 0, 30, and 45 minutes after waking on three consecutive days both pre- and post-MBRT, and were asked to complete logs on collections days verifying the precise times of collection. This collection procedure avoids pitfalls of single timepoint collection, including intra-individual variability and poor ecological validity (Rapcencu, Gorter, Kennis, van Rooij, & Geuze, 2017; Schulz & Knabe, 1994; Stalder et al., 2016), and has been used in previous studies of CAR amongst LEOs (Christopher et al., 2018; Violanti et al., 2017). Participants were also asked to refrain from eating, drinking any liquid except water, smoking, brushing their teeth, taking medications, and exercising before collecting samples. Participants returned completed samples to the research team by mail using prepaid insulated boxes provided to them at the time of assessment. Samples were stored in a -80°C freezer until being processed and assayed for cortisol with an FDA-approved direct (non-extracted) salivary EIA cortisol kit (Pantex; Santa Monica, CA) at ZRT Laboratory (Beaverton, OR). Cortisol was measured in 25 microliter saliva samples with minor modifications of a previously described method (Du et al., 2013). Inter-assay coefficient of variation for cortisol is 8% at 1 ng/ml, 7.1% at 4 ng/ml, and 7.6% at 12.9 ng/ml. The detectable limit is 0.1 to 30ng/ml. All cortisol values were converted from ng/ml to nmol/L.

**Data Analyses**
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Multiple timepoint collection allows for the calculation of area under the curve (AUC) (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003; Stalder et al., 2016). Computing AUC increases the measurement power via multiple data points, and simplifies statistical analyses (Pruessner et al., 2003). When calculating AUC, there are two specific formulas for computing different characteristics of the data: \( \text{AUC}_G \): area under the curve with respect to ground, and \( \text{AUC}_I \): area under the curve with respect to increase. The former formula, \( \text{AUC}_G \), assesses overall intensity of the cortisol response, whereas \( \text{AUC}_I \) is intended to assess changes in cortisol response over time (Pruessner et al., 2003). The CAR refers specifically to an individual’s change in cortisol levels (\( \text{AUC}_I \)) over a particular time, rather than one’s total cortisol secretion over that same period of time (\( \text{AUC}_G \); Stalder et al., 2016). Previous research has indicated that \( \text{AUC}_I \) is the standard by which CAR should be measured (Stalder et al., 2016). One rationale provided is that CAR is a dynamic process and that \( \text{AUC}_I \) treats it as such (Clow et al., 2010; Khoury et al., 2015). Additionally, \( \text{AUC}_I \) has been found to respond to treatment, whereas \( \text{AUC}_G \) appears more resistant to intervention (Rapcencu et al., 2017). For these reasons, \( \text{AUC}_I \) will be used as the measure of physiological resilience, and a reduction in \( \text{AUC}_I \) is considered to be indicative of positive change from pre- to post-MBRT.

Several covariates were included in the mediation analyses to further illuminate the relationship between MBRT, cortisol, and burnout and aggression, including age, gender, and depression. These covariates were included in the parent study, and previous research has shown that cortisol is related to gender (Greenspan, Rowe, Maitland, McAloon-Dyke, & Elahi, 1993; Roelfsema et al., 2017), age (Purnell, Brandon, Isabelle, Loriaux, & Samuels, 2004; Roelfsema et al., 2017), and depression (Dienes, Hazel, & Hammen, 2013; Vammen et al., 2014). In a review paper of best practices for the analysis of CAR, the authors reiterated that depression is
related to cortisol, and that age and sex should be included as covariates in analyses of CAR (Stalder et al., 2016).

Reductions in CAR, burnout, and aggression from pre- to post-MBRT were evaluated using residualized change scores. All mediation analyses were conducted using the PROCESS plug-in (Hayes, 2012) for SPSS, which uses a bias-corrected bootstrapping method with 10,000 resamples. This method evaluates the statistical change made to a regression model with the addition of a mediator, and whether this indirect pathway is stronger than the original relationship between the predictor and outcome. This method has been used in previous mediation research among LEOs (Kaplan et al., 2016). An ad hoc power analysis was conducted, revealing a required sample size of $n = 50$ for a power level of 0.80.

**Results**

**Preliminary Analyses**

Participant demographic information may be found in Table 1, and a consort diagram from the parent study may be found in Figure 1. Missing values analyses were performed in order to determine the pattern of data missingness. These analyses revealed the data to be missing at random (MAR). In order to preserve statistical power and in accordance with the parent study procedure, missing data were imputed using maximum likelihood estimation (MLE). MLE is a method of missing data imputation that uses existing observations to estimate values for missing data points (Myung, 2003). In accordance with past MLE research (e.g. Myung, 2003; Excoffier & Slatkin, 1995), the MLE function in SPSS was conducted using observed data from each variable to estimate missing values in separate analyses. MLE yielded a dataset with complete imputed data for all 61 participants who were assessed at baseline.
CORTISOL AS MEDIATOR IN MBRT

Original data was also analyzed using complete case analysis (CCA), which yielded a dataset with complete data for 47 participants. Previous research has suggested CCA always be used in studies when data imputation is also used, and that under MAR and MCAR circumstances of missingness, imputation often offers no advantage (Mukaka et al., 2016).

Prior to data analysis, all variables were examined using SPSS-23 (v. 23; IBM 2015) to examine univariate and multivariate outliers. Three participants were identified as univariate outliers in the imputed and non-imputed datasets, one of which was also identified as a multivariate outlier using Mahalanobis Distance and excluded from subsequent analyses. All variables were screened for normality. Two variables were found to be leptokurtotic using a kurtosis absolute cutoff value of 2 (George & Mallery, 2010): burnout post (2.23) and aggression pre (3.55). These variables were transformed prior to analyses using a log10 transformation. Descriptive statistics may be found in Table 2 and correlations between study variables may be found in Table 3.

Consistent with expectations and findings from the parent study, there was a main effect for group for both outcomes variables using CCA analysis. However, this finding for aggression differed between the imputed and non-imputed datasets in the present study, and was non-significant in MLE analysis. Main effects for group and time predicting changes aggression, burnout, and AUCi may be found in Table 4.

Mediation Analyses

Mediation analyses were conducted to investigate the role of reductions in cortisol in mediating the relationship between group (MBRT v. NIC) and changes in burnout and aggression among LEOs. In the CCA dataset, the bootstrapped confidence interval analyzing changes in CAR mediating the relationship between group and reductions in aggression
CORTISOL AS MEDIATOR IN MBRT

contained zero [95% CI: -.02, .21], and changes in CAR mediating the relationship between group and reductions in burnout contained zero [95% CI: -.14, .09]. In the MLE dataset, the bootstrapped confidence interval analyzing changes in CAR mediating group and reductions in aggression contained zero [95% CI: -.08, .16], and changes in CAR mediating group and reductions in burnout contained zero [95% CI: -.09, .09]. The inclusion of gender, age, and baseline depression did not alter the results of the mediation analyses. Results from mediation analyses with covariates may be found in Table 5.

Contrary to expectations, baseline CAR was not correlated with baseline aggression ($r = -.16$, $p = .24$) or baseline burnout ($r = .08$, $p = .54$). Baseline correlations may be found in Table 5. Bivariate correlations between residualized change score variables and potential baseline covariates may be found in Table 3.

**Discussion**

The primary aim of this study was to assess the mediating role of salivary cortisol in the relationship between MBRT and improvements in burnout and aggression. The lack of significant relationships between CAR, aggression, and burnout was surprising, given that previous research has described a positive relationship between burnout and CAR among clinically burned-out samples (De Vente et al., 2003; Grossi et al., 2005) and women experiencing stress-related exhaustion disorder (Olsson et al., 2010), and cortisol and burnout are improved by intervention (Mommersteeg et al., 2006). Some studies have found contradictory results, and review studies have concluded there is no definitive biomarker for burnout (Danhof-Pont et al., 2011; Grossi et al., 2015).

Similarly, past systematic reviews and meta-analyses have described a positive relationship between aggression and cortisol (Montoya et al., 2012; Rosell & Siever, 2015).
CORTISOL AS MEDIATOR IN MBRT

Other studies have found that aggression is predicted by basal cortisol among women (Denson et al., 2013), and correlates positively with aggression among healthy adults (Almeida et al., 2010) and children with ADHD (Yang et al., 2007). Diurnal cortisol and aggression among school children were also improved by meditation (Yoo et al., 2016), and behavioral problems were significantly lowered among children with high cortisol stress responsivity post-psychotherapy (van de Wiel et al., 2004). However, some studies have found nonsignificant relationships between aggression and salivary cortisol across four days (Vaillancourt & Sunderani, 2011) and between aggression and acute cortisol reactivity (Ryan et al., 2012), and a negative relationship between aggression and basal cortisol (Carré & Mehta, 2011).

The present study failed to find significant reductions in CAR in the MBRT condition relative to NIC, which is contradictory to other research. Past studies have found that MT reduces diurnal salivary cortisol (Carlson et al., 2007; Carlson et al., 2004), diurnal plasma cortisol (Witek-Janusek et al., 2008), and CAR (Marcus et al., 2003; Matousek et al., 2011), and a recent meta-analysis suggested that MT reduces salivary cortisol among healthy adults (Sanada et al., 2016).

The lack of significant findings in the present study and contradictory findings in previous research may be a product of our limited understanding of the directionality of dysregulated cortisol response. Neurobiological responses may differ significantly in the presence of identical stressors (Cohen et al., 2006), and chronic HPA reactivity has been shown to be related to both exaggerated and blunted cortisol response (Rapcencu et al., 2017). For example, blunted CAR has been documented in PTSD samples (Wessa, Rohleder, Kirschbaum, & Flor, 2006), and chronic activation of the HPA system among cancer patients has been associated with a blunted acute cortisol stress response (Black et al., 2017) and blunted diurnal
CORTISOL AS MEDIATOR IN MBRT

cortisol (Miller, Ancoli-Israel, Bower, Capuron, & Irwin, 2008). Similarly, a blunted acute cortisol stress response has been found among tinnitus patients (Hebert & Lupien, 2007), bullied children (Ouellet-Morin et al., 2011), and healthy adults with a history of adverse childhood experiences (Elzinga et al., 2008). Alternatively, other studies have found elevated CAR among healthy adult males with a history of early life stress (Butler, Klaus, Edwards, & Pennington, 2017) and children at risk for bipolar disorder experiencing severe interpersonal stress (Ellenhagen, Ostiguy, Linnen, & Hodgins, 2010).

Studies of cortisol response and stress in LEOs have been similarly contradictory. Some research has found a positive relationship between CAR and posttraumatic symptomology (Austin-Ketch et al., 2012; Violanti, Miller, et al., 2007) and a positive relationship between serum cortisol and perceived occupational stress (Walvekar et al., 2015), while others have found an inverse relationship between CAR and cumulative occupational stress (Violanti et al., 2017) and time spent working overnight shift (Fekedulegn et al., 2012). Given these contradictory findings across studies, it is likely that participants in the present study may have increased or decrease CAR profiles in response to identical occupational stressors. Based on factors not measured in this study, such as adverse childhood experiences or PTSD symptomology, some LEOs may have exhibited a blunted CAR, while others may have exhibited an exaggerated CAR as hypothesized. For this reason, while MBRT may have served to improve CAR in the present study (i.e., decreased it for some and raised it for others), the heterogeneous nature of cortisol dysregulation likely precluded our ability to detect significant change. While the current study included covariates that have been shown to influence cortisol in past studies in accordance with best practices (Stalder et al., 2016), including gender (Greenspan et al., 1993; Roelfsema et al., 2017), age (Purnell et al., 2004; Roelfsema et al., 2017), and depression (Dienes et al., 2013;
CORTISOL AS MEDIATOR IN MBRT

Vammen et al., 2014), future research should include other covariates that have been shown to blunt salivary cortisol such as traumatic experiences (Violanti et al., 2017) and PTSD (Wessa et al., 2006).

There are several limitations to this study. First, the small sample size reduced statistical power and may have contributed to the lack of detected significant mediation in the CCA analysis ($n = 47$). Second, despite the inclusion of three relevant covariates in the mediation analyses, the present study did not collect data for other variables that may have blunted the CAR in the current sample, such as traumatic experiences or PTSD symptomology. Third, the sample was gathered from a single metropolitan area, which limits the generalizability of the findings. Future larger studies of cortisol among LEOs are needed to improve methodology and statistical power to detect meaningful change.

Despite these limitations, the present study provides direction for future research. A move toward standardizing cortisol methodology (cf. Stadler et al., 2016) can help improve consistency across studies. While the present study employed best practices for CAR collection and analysis, previous studies have used many different measures of cortisol, such as CAR, plasma cortisol, basal cortisol, and diurnal cortisol. Continued clarification regarding the study of cortisol in various populations is needed to focus research moving forward. The present study also included several covariates, such as gender, age, and depression, which have been shown to influence cortisol secretion in past research. Despite the inclusion of these variables, other covariates should be considered in future studies of cortisol and LEOs, such as traumatic experiences and PTSD, which may have influenced the directionality of cortisol dysregulation in the present sample. With these methodological improvements, continued study of the
CORTISOL AS MEDIATOR IN MBRT

relationship between cortisol, burnout, and aggression, and the role of cortisol as a mediator in MT may better benefit the development of future interventions for high stress populations.

References


Andersen, J., Dorai, M., Papazoglou, K., & Arnetz, B. (2016). Diurnal and reactivity measures of cortisol in response to intensive resilience and tactical training among special forces
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De Vente, W., Olff, M., Van Amsterdam, J. G. C., Kamphuis, J. H., & Emmelkamp, P. M. G. (2003). Physiological differences between burnout patients and healthy controls: blood
pressure, heart rate, and cortisol responses. *Occupational and Environmental Medicine, 60*(Suppl. 1), i54-61. doi:10.1136/oem.60.suppl_1.i54


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CORTISOL AS MEDIATOR IN MBRT


CORTISOL AS MEDIATOR IN MBRT


CORTISOL AS MEDIATOR IN MBRT


CORTISOL AS MEDIATOR IN MBRT


CORTISOL AS MEDIATOR IN MBRT


CORTISOL AS MEDIATOR IN MBRT


Table 1

*Participant Demographics Pre-MBRT*

<table>
<thead>
<tr>
<th></th>
<th>MBRT</th>
<th>NIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N or</td>
<td>%</td>
</tr>
<tr>
<td>Mean</td>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>31</td>
<td>--</td>
</tr>
<tr>
<td>Age (SD)</td>
<td>44.73</td>
<td>--</td>
</tr>
<tr>
<td>(6.63)</td>
<td>(5.43)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Male</td>
<td>28</td>
<td>90%</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>27</td>
<td>88%</td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Native</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Hawaiian/Pacific</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Islander Native</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>American/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaskan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Multi-racial</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Not</td>
<td>30</td>
<td>97%</td>
</tr>
<tr>
<td>Hispanic/Latino Years of education (SD)</td>
<td>15.89 (2.37)</td>
<td>--</td>
</tr>
<tr>
<td>Years on the job (SD)</td>
<td>18.50 (6.98)</td>
<td>--</td>
</tr>
<tr>
<td>Relationship status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>23</td>
<td>74%</td>
</tr>
<tr>
<td>Divorced</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Cohabitating</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Single</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Officer</td>
<td>9</td>
<td>29%</td>
</tr>
<tr>
<td>Deputy</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Criminalist</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Detective</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Sergeant</td>
<td>6</td>
<td>19%</td>
</tr>
</tbody>
</table>
CORTISOL AS MEDIATOR IN MBRT

<table>
<thead>
<tr>
<th>Rank</th>
<th>NIC</th>
<th>MBRT</th>
<th>NIC</th>
<th>MBRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lieutenant</td>
<td>3</td>
<td>10%</td>
<td>5</td>
<td>17%</td>
</tr>
<tr>
<td>Commander</td>
<td>1</td>
<td>3%</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Captain</td>
<td>4</td>
<td>13%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>6%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Note. MBRT = Mindfulness-Based Resilience Training; NIC = no intervention control.*
### Table 2. Means and Standard Deviations for Study Variables at Pre- and Post-MBRT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-Training</th>
<th>Post-Training</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortisol AUC_i</td>
<td>NIC (n = 30) M (SD) MBRT (n = 31) M (SD)</td>
<td>NIC (n = 26) M (SD) MBRT (n = 24) M (SD)</td>
<td>MBRT = Mindfulness-Based Resilience Training; NIC = no intervention control; AUC_i = area under the curve (increase)</td>
</tr>
<tr>
<td></td>
<td>26.38 (59.16)</td>
<td>45.42 (64.26)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.25 (51.48)</td>
<td>24.77 (44.78)</td>
<td></td>
</tr>
<tr>
<td>Burnout</td>
<td>2.43 (.31)</td>
<td>2.44 (.36)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.36 (.35)</td>
<td>2.20 (.29)</td>
<td></td>
</tr>
<tr>
<td>Aggression</td>
<td>1.86 (.61)</td>
<td>1.74 (.57)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.87 (.63)</td>
<td>1.47 (.43)</td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Correlations Between Residualized Change Score Variables and Potential Baseline Covariates

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. AUCi Δ</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Aggression Δ</td>
<td>.06</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Burnout Δ</td>
<td>-.06</td>
<td>.06</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Depression</td>
<td>-.17</td>
<td>.06</td>
<td>.42**</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>5. Gender</td>
<td>.03</td>
<td>.03</td>
<td>.000</td>
<td>.12</td>
<td>---</td>
</tr>
<tr>
<td>6. Age</td>
<td>-.08</td>
<td>.20</td>
<td>.001</td>
<td>-.05</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note. Δ = residualized change score, AUCi = Area under the curve increase, Aggression = Buss-Perry Aggression Questionnaire-Short Form, Burnout = Oldenburg Burnout Inventory, Depression = PROMIS Depression at baseline, **p < .01
Table 4. Time by Group Interactions and Effect Sizes for Study Variables

<table>
<thead>
<tr>
<th></th>
<th>Pre- to post-training x group</th>
<th>Pre- to post-training x group (CCA dataset)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$-value, $p$-value</td>
<td>$F$-value, $p$-value</td>
</tr>
<tr>
<td>Aggression</td>
<td>4.68, .04</td>
<td>3.96, .05</td>
</tr>
<tr>
<td>Burnout</td>
<td>8.19, .01</td>
<td>.42, .52</td>
</tr>
<tr>
<td>AUC$_i$</td>
<td>1.95, .17</td>
<td>1.35, .25</td>
</tr>
</tbody>
</table>

Note. AUC$_i$ = area under the curve (increase)
Table 5. Indirect effect of AUC mediating relationship between group and outcomes

<table>
<thead>
<tr>
<th>Outcome (dataset)</th>
<th>Effect</th>
<th>Boot SE</th>
<th>Bias-corrected CI Lower</th>
<th>Bias-corrected CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burnout (CCA)</td>
<td>.02</td>
<td>.07</td>
<td>-.02</td>
<td>.21</td>
</tr>
<tr>
<td>Aggression (CCA)</td>
<td>-.02</td>
<td>.05</td>
<td>-.14</td>
<td>.09</td>
</tr>
<tr>
<td>Burnout (MLE)</td>
<td>-.003</td>
<td>.04</td>
<td>-.09</td>
<td>.09</td>
</tr>
<tr>
<td>Aggression (MLE)</td>
<td>.03</td>
<td>.06</td>
<td>-.08</td>
<td>.16</td>
</tr>
</tbody>
</table>

Note. AUC\textsubscript{i} = area under the curve\textsubscript{(increase)}, 95% CI
Table 6. Baseline correlations for AUCi, aggression, and burnout

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. AUCi</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>2. Burnout</td>
<td>.08</td>
<td>---</td>
</tr>
<tr>
<td>3. Aggression</td>
<td>-.16</td>
<td>.38**</td>
</tr>
</tbody>
</table>

Note. AUCi = Area under the curve increase, 
Aggression = Buss-Perry Aggression Questionnaire-Short Form, Burnout = Oldenburg Burnout Inventory, ** = $p < .01$
Figure 1. Consort diagram
Figure 2. Proposed mediation model

Δ CAR

MBRT v. NIC  Δ Burnout  Δ Aggression

CORTISOL AS MEDIATOR IN MBRT
Figure 3. Mediation figures with beta coefficients (MLE dataset)

Note. No significant pathways.
Figure 4. Mediation figures with beta coefficients (CCA dataset)

Note. * = p ≤ .05
Chapter Two

Literature Review
Police Stressors

Policing is considered one of the most stressful occupations (Gershon, Barocas, Canton, Xianbin Li, & Vlahov, 2009; Kop, Euwema, & Schaufeli, 1999). Law enforcement officers (LEOs) are routinely exposed to stressors that span all aspects of their job (Acquadro Maran, Varetto, Zedda, & Ieraci, 2015; Griffin & Bernard, 2003; Neely P, 2012), and experience stressful events more frequently than other professions (Acquadro Maran et al., 2015).

Police stressors have commonly been categorized as either operational or organizational stressors. Operational stressors largely include stressors unique to LEOs (e.g., death of another LEO or civilian in the line of duty, high-speed pursuits, use of force), and organizational include those not unique to LEOs (e.g., rigid bureaucracy, demanding workload, limited opportunity for promotion, shift work; see (Territo & Vetter, 1981; Hickman, Fricas, Strom, & Pope, 2011). Operational versus occupational stressors in police work are also often distinguished by the frequency and the intensity of their impact (Berg, Hem, Lau, Haseth, & Ekeberg, 2005; Brown, Fielding, & Grover, 1999). Operational stressors typically include infrequent and highly impactful acute incidents (e.g., involvement in a shooting or working a major accident), while organizational stressors are more often chronic (e.g., paperwork, making a routine arrest).

Operational, or acute, stressors are less frequent and highly impactful experiences (Berg et al., 2005; Brown et al., 1999), and often present as critical incidents in which the lives of LEOs are civilians are at risk (Hickman et al., 2011). LEOs often rank the most stressful occupational experiences as acute incidents, such as killing someone in the line of duty, death of a fellow LEO, physical harm, violent crimes against children, high-speed pursuits, involvement in an accident in their patrol car, and being injured in the line of duty (Berg et al., 2005; Violanti & Aron, 1994). LEOs whose job duties include patrol and the potential for violence are more
vulnerable to stress (Abdollahi, 2002). Lethal violence committed by and against LEOs is frequently identified as the most extreme form of acute police stress (Hickman et al., 2011), and several studies have emphasized that LEOs face the threat of death daily in the line of duty (Crank, 1998; Crank & Caldero, 1991; Violanti & Aron, 1994). Over the course of an average law enforcement career, most LEOs are threatened or assaulted, frequently with a weapon (Kelley & Lambert, 2012), and approximately one third of LEOs will experience being shot at (29.8%), a colleague being intentionally injured (31.3%), a badly beaten child (36.5%), a sexually assaulted child (42.4%), and being trapped in a life-threatening situation (29.7%; Chopko, Palmieri, & Adams, 2015). Further, when LEOs witness or are directly involved in lethal violence, it serves as a reminder that they face the potential for violence, injury, and death on a daily basis (Crank, 1998; Crank & Caldero, 1991; Territo & Vetter, 1981; Violanti & Aron, 1994). Studies of police work have clearly distinguished these acute stressors from chronic stressors (Morash, Haarr, & Kwak, 2006).

While acute incidents stand out amongst LEO stressors, the majority of LEO time on the job consists of more routine aspects of the work, many of which have the potential to accumulate and contribute to chronic stress (Crank, 1998; Cheryl Regehr, LeBlanc, Jelley, & Barath, 2008). Chronic stressors include departmental politics, impending litigation, irregular shifts, changing policies, perceived miscarriages of justice, and lack of promotional opportunities (Bergman, Christopher, & Bowen, 2016; Shane, 2010; Tuckey, Winwood, & Dollard, 2012; van Gelderen, Heuven, van Veldhoven, Zeelenberg, & Croon, 2007). Some research has indicated that chronic LEO stressors are at least as stressful as acute stressors (Liberman et al., 2002), and may in fact be more distressing than critical incidents (Acquadro Maran et al., 2015; Buker & Wiecko, 2007; Collins & Gibbs, 2003; Crank & Caldero, 1991; Kirkcaldy, Cooper, & Ruffalo, 1995; Shane,
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2010; Violanti & Aron, 1994). Chronic stressors often rank among the top ten most stressful experiences as reported by LEOs (Violanti & Aron, 1994), and are mentioned more frequently on surveys of LEO stress (Storch & Panzarella, 1996). Chronic stressors also uniquely predict LEO depression (Spielberger, Westberry, Grier, & Greenfield, 1981), psychological distress and PTSD symptomology (Liberman et al., 2002), sleep problems (Neylan et al., 2002), and perceived job stress (Morash & Haarr, 1995), relative to acute stressors. Alongside these stressors, police culture is often cited as a major cause of negative health outcomes among LEOs.

LEO Culture

LEOs have been described as possessing a distinct “police personality” (Terrill, Paoline, & Manning, 2003) and a problematic crime-fighter mentality (Marenin, 2016). Many cultural factors contribute to occupational stressors, and LEOs are subjected to demanding public expectations as a result of their image as professional crime-fighters (Cosgrove, 2015; Marenin, 2016). LEO culture has been described as an environment that supports “highly questionable and singular codes of deviance, secrecy, silence, and cynicism, as well as such ‘pathological’ personality dispositions as suspiciousness, insularity, brutality, authoritarianism, ultraconservatism, bigotry and racism” (Sayles & Albritton, 1999, p. 163). These attitudes are typically shared by LEOs who experience them and cope collectively (i.e., comiserating; Paoline, Myers, & Worden, 2000). Other contributing factors include lack of supervisory oversight (Marenin, 2016), defensive patterns (e.g., victim-blaming) when responding to external criticism (Brown, 2016; Marenin, 2016), operational constraints imposed by legal, organizational, community, and political demands (Marenin, 2016), and role ambiguity (Terrill et al., 2003). Further, research indicates that LEO culture leads to social isolation (Brown, 1981; Westley, 1972) and an increasing divide between LEOs and citizens (Terrill et al., 2003) as a result of
negative attitudes held by LEOs toward civilians (Skolnick, 1994; Westley, 1972). However, some research has questioned the idea of toxic police culture, suggesting that LEO culture is more intricate, and that most studies provide a skewed description by focusing on elements such as corruption, deception, and cynicism (Crank, 1998).

**LEO Coping**

In an effort to reduce perceived stress, LEOs employ individual and often maladaptive coping strategies, such as dissociation, suppression (Ballenger et al., 2011; Ménard & Arter, 2014), alcohol use, and other avoidance behaviors (Gershon et al., 2009; Ménard & Arter, 2013; Pasillas, Follette, & Perumean-Chaney, 2006; Smith, Devine, Leggat, & Ishitake, 2005; Willman, 2012). While interacting with the public, LEOs engage in defensive behavior such as suspicion (Skolnick, 1994; Terrill et al., 2003; Westley, 1972) and dominance or control over citizens (Rubinstein, 1973) developed by overtly displaying authority (Manning, 1995).

Avoidant coping strategies, which include any attempt to escape, suppress, change, or forget about a stressful experience (Williams, Ciarrochi, & Deane, 2010) are particularly unhelpful (Ben-Zur, 2009), but are the coping strategies most congruent with LEO culture (Blau, 1994). Further, avoidant coping strategies often lead to other maladaptive forms of coping, such as alcohol use (Violanti et al., 2011). Indeed, alcohol use has been identified as the primary method of coping for LEOs dealing with occupational stressors (Violanti et al., 2011). Drinking is encouraged by LEO culture, and is often expected by colleagues (Lindsay & Shelley, 2009). There is significant pressure on LEOs to conform (Swanson, Territo, & Taylor, 1998), and drinking to fit in is reported by LEOs as a primary reason for alcohol use (Lindsay & Shelley, 2009). As a result of the combination of chronic and acute stressors, as well as a potentially toxic
work environment and maladaptive coping strategies, LEOs experience a wide variety of negative health outcomes.

**Negative Consequences of LEO Stressors**

Occupational stress and related negative health outcomes constitute a significant concern for the departments, LEOs, and their communities (Hickman et al., 2011; Morash et al., 2006). A large body of research describes that police-specific stressors result in negative consequences for individual LEOs (Collins & Gibbs, 2003; Hickman et al., 2011; Patterson, Chung, & Swan, 2014; Wang et al., 2010), indirectly impact law enforcement organizations as a result of litigation against LEOs (Finn & Tomz, 1997), and negatively impact the communities they serve (Hickman et al., 2011).

Occupational stressors among LEOs are related to fatigue and sleep disorders (Tyagi & Dhar, 2014), depression and suicide (Berg, Hem, Lau, & Ekeberg, 2006; Wang et al., 2010), anxiety (Gershon, Lin, & Li, 2002), domestic violence and strained personal relationships (Chopko, Palmieri, & Adams, 2013; Waters & Ussery, 2007), somatization (Gershon et al., 2002), posttraumatic stress symptoms (Gershon et al., 2002; Ma et al., 2014; Maia et al., 2007), and problematic alcohol use (Chopko et al., 2013; Waters & Ussery, 2007). LEOs also exhibit physical health issues at a higher rate than the general population (Morash et al., 2006). These issues include chronic back pain (Gershon et al., 2002), diabetes and obesity (Yoo & Franke, 2011), as well as heart attacks and ulcers (Patterson et al., 2014). LEOs also experience disease rates higher than the general public (Franke, Collins, & Hinz, 1998; Violanti, Vena, & Marshall, 1986), possibly due to hormonal products (e.g., cortisol) of a habitually activated fight-or-flight system (Hickman et al., 2011).
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Other outcomes of LEO stress include anger, hostility, and aggression (Gershon et al., 2002; Kelley & Lambert, 2012; Leonard & Alison, 1999; Robinson & Mitchell, 1993) and several studies suggest LEOs who experience higher stress are likely to be more aggressive (Kop et al., 1999; Kop & Euwema, 2001; Queirós, Kaiseler, & Leitão da Silva, 2013; Sack, 2009).

Aggression

Aggression is often defined as a behavior intended to cause harm to another person who is motivated to avoid that harm (Bushman & Huesmann, 2010; DeWall, Anderson, & Bushman, 2012). Although aggressive cognitions, such as hostile attributions, and aggressive affect, such as feelings of anger and rage, are frequent precursors to aggressive behavior, they are not typically considered to contribute to the construct of aggression (Allen, Anderson, & Sturmey, 2017). Amongst LEOs, aggressive behaviors (commonly referred to as extra-legal aggressive behaviors) range from verbal commands and threats to infliction of severe physical harm (Terrill & Mastrofski, 2002).

Predictors of LEO aggression. Many factors predict LEO aggression, including occupational, individual (e.g., personality), and contextual (Aniței, Birău, Chraif, Burtăverde, & Mihăilă, 2014). Factors may also interact to predict increased likelihood of aggressive behavior from LEOs (Anderson & Bushman, 2002).

Occupational factors. Occupational stressors increase risk for LEO aggression in close relationships (Can, Helen, & Meaghan, 2013; Gershon, 2000) and toward their professional partners (Can et al., 2013). Chronic organizational stressors often associated with increased aggression include work demands, low perceived control, conflict or social rejection among coworkers (Baumeister, Smart, & Boden, 1996), organizational change, and lacking social
support within a department (Can et al., 2013). Acute stressors such as physical threats and assault also trigger aggression among LEOs (Kelley & Lambert, 2012).

Further, because of the cultural structure of police organizations (i.e., fraternal order or family; Gershon, 2000), LEOs are encouraged to use aggression as a style of conflict resolution (Can et al., 2013; Kane, 2002). Similarly, the provocative and frustrating nature of the police environment is likely to increase the risk of aggressive behavior among LEOs (Koepfler, Brewster, Stoloff, & Saville, 2012). However, these stressors do not appear to affect all LEOs equally. Complaints about excessively aggressive behavior tend to center on “problem officers,” who are typically younger and less experienced (Prenzler, Porter, & Alpert, 2013). LEOs more vulnerable to stress-induced psychological impairment are more likely to use excessive force (Kop et al., 1999; Kurtz, Zavala, & Melander, 2015; Nieuwenhuys, Savaesbergh, & Oudejans, 2012) and aggression toward suspects (Can & Helen, 2014; Gershon et al., 2009; Griffin & Bernard, 2003; Kurtz et al., 2015; Rajaratnam, Barger, & Lockley, 2011).

**Individual factors.** Some studies have cited individual differences between LEOs as a primary causal factors in predicting aggression (Smith & Holmes, 2003; Worden, 1995), though the specific degree of influence has been debated (Holmes & Smith, 2012). Such individual factors include both conscious and unconscious processes (Holmes & Smith, 2012), such as anger, impulsivity, hostile attribution bias, low behavioral control, cognitive inhibition (Chambers, Lo, & Allen, 2008; Koepfler et al., 2012), and abnormal stress reactivity (Groer et al., 2010; Hao, Hong, Xu, Zhou, & Xie, 2015; Strahler & Ziegert, 2015), as well as personality traits such as narcissism, sadism, and envious tendencies (Can et al., 2013). Years of education is inversely correlated with aggressive behavior (Acquadro Maran et al., 2015; Prenzler et al.,
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2013), and maladaptive individual coping strategies may exacerbate the likelihood of aggressive behavior (Feldner, Zvolensky, Eifert, & Spira, 2003).

One of the most frequent personality factors involved in LEO aggression is authoritarianism (Crank, 1998), which is associated with cynicism, bigotry, violence, and suspicion (Balch, 1972), which are qualities that have been identified in the broader LEO culture. However, several studies have demonstrated that LEO personalities may not differ substantially from the general population (Balch, 1972; Trojanowicz, 1971; Walker, 1999), and that personality and attitudes may not influence job performance (Griffin & Bernard, 2003), including propensity for use of force (Friedrich, 1980). Similarly, it has been suggested that no particular personality type is attracted to law enforcement in the first place (Walker, 1999).

Another individual factor that may predict aggression among LEOs is anger. Anger is the primary cause of aggression with the intent to cause suffering (Anitei et al., 2014). Throughout their career, most LEOs will struggle with anger, hostility, and aggression as a result of ubiquitous occupational stressors (Kelley & Lambert, 2012; Leonard & Alison, 1999; Robinson & Mitchell, 1993), and LEOs endorse higher levels of state and trait anger relative to the general population (Leonard & Alison, 1999). LEOs often use suppression as a primary coping strategy in response to anger, typically with unsuccessful results (Brown & Daus, 2012; Leonard & Alison, 1999). Failure to effectively cope with anger among LEOs can lead to hostility, stress, prejudice, stereotyping, increased conflict, brutality, and the use of excessive force (Fein & Spencer, 1997; Stinchcomb, 2004). For example, among LEOs, the ability to control anger is significantly related to the likelihood of engaging in aggressive behavior such as issuing a ticket or shooting a suspect (Brown & Daus, 2015).
**Contextual factors.** Contextual factors, such as departmental policy and neighborhood culture can also impact aggression (Anitei, Birau, Chraif, Burtaverde, & Mihaila, 2014; Riksheim & Chermak, 1993; Skogan & Frydl, 2004). Contextual factors may also include negativity of environment, recent negative life events, the presence of aggression cues, triggers experienced by participants of an interaction, the nature of the relationship between participants, and departmental support and attention (Leonard & Alison, 1999; Miller, Pedersen, Earleywine, & Pollock, 2003; Reilly, Clark, Shopshire, Lewis, & Sorensen, 1994). It has been suggested that among LEOs there is no difference in aggressive expression between office and field assigned LEOs (Anitei et al., 2014). Characteristics of civilians also influence the aggressive behavior of LEOs. For example, younger males are more likely to experience aggressive LEO behavior (Prenzler et al., 2013), as are racial and ethnic minorities (Holmes & Smith, 2012). Discrimination and higher crime rates are thought to factor into this discrepancy (Prenzler et al., 2013). Beyond the individual and department, contextual factors such as the neighborhood culture are also predictive of aggression (Brunson & Miller, 2006; Holmes & Smith, 2012). These factors may exist at multiple levels of society, rooted in segregation and discrimination (Meehan & Ponder, 2002).

**Multiple factors.** Other studies have indicated that aggression is likely predicted by the interaction of two or more factors. For example, aggression is typically precipitated by a combination of personality and situational factors (Anderson & Bushman, 2002). In policing studies, research indicates that LEOs primed for a negative affect are more likely to express anger via aggression when given the opportunity, such as by exercising their discretion to arrest a perpetrator for a minor offense, or by exhibiting racial profiling (Holmes & Smith, 2012; Johnson, 2013), and strong associations between anger, hostility, use of a weapon, and
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involvement in violence have been demonstrated in high-stress populations such as combat veterans (Reilly et al., 1994; Riggs, Dancu, Gershuny, Greenberg, & Foa, 1992).

**Aggression consequences.** Although interventions have been attempted at various levels of administration, excessively aggressive behavior by LEOs remains a major problem for the community, department, and individual LEOs (Collins, 1998; Prenzler et al., 2013).

**Civilian / community consequences.** In the context of police work, overt expression of anger often includes behaviors that uniquely impact judgment and decision-making (Sinclair & Ashkanasy, 2005). This is particularly worrisome because threatening situations often elicit anger and demand split-second decision-making (Bodenhausen, Sheppard, & Kramer, 1994; Kelley & Lambert, 2012), and because uncontrolled anger can override cognitive processes crucial to effective police work (Brown & Daus, 2012; Goleman, 2004; Howells, 2004; Kelley & Lambert, 2012).

LEOs impacted by occupational stress and impaired decision-making pose a greater risk for exhibiting aggressive behavior toward civilians. This behavior includes unjustified shootings, beatings, fatal chokings, and overly rough treatment (Collins, 1998; Griffin & Bernard, 2003; Ramey et al., 2012), as well as less frequent but more severe incidents, including torture, dangerous vehicle pursuits, and violent public suppression (Prenzler et al., 2013). When LEOs engage in aggressive behavior toward a civilian, whether extra-legal or legal, serious injury or death may occur to civilians (Alpert & Dunham, 2010; Prenzler et al., 2013). LEO aggression toward the community is a global concern (Prenzler et al., 2013), as these aggressive behaviors are commonly found in research, legal investigations, and governmental audits around the world (Alpert & Dunham, 2004; Porter, 2012).
Excessively aggressive behavior by LEOs toward civilians also leads to community unrest and negative attitudes toward LEOs (Alpert & Dunham, 2010; Prenzler et al., 2013). Certain communities may be more vulnerable to LEO aggression. Verbal abuse and harassment, common forms of LEO aggression, have been described as standard operating procedure for LEOs in certain communities (Holmes & Smith, 2012). In addition to direct consequences of LEO aggression, taxpayers also experience the costs of investigations and successful lawsuits against LEOs (Porter, 2012).

**LEO consequences.** LEOs also experience individual consequences of aggression. In the general population, aggressive tendencies are associated with suicide more than depression alone (Painuly, Sharan, & Mattoo, 2007), and the frequency of confrontations with aggression is related to psychological distress (Collins & Gibbs, 2003) such as anxiety, hostility, burnout, and sleep problems (Evers, Tomic, & Brouwers, 2002; Jansen, Dassen, & Moorer, 2013; Miller-Burke, Attridge, & Fass, 1999). Among LEOs, greater risk of personal threat during a critical incident is predictive of LEO distress following the incident (McCaslin et al., 2006), and situational threat has been significantly linked to somatization among LEOs (Robinson, Sigman, & Wilson, 1997).

Aggressive behavior may result in serious injury or death to LEOs (Alpert & Dunham, 2010; Prenzler et al., 2013; van der Velden, Kleber, Grieving, & Yzermans, 2010), possibly as a result of inadequate training (Prenzler et al., 2013). LEOs who exhibit aggression may also be subsequently assigned to more dangerous shifts (Prenzler et al., 2013), and actual or potential occupational aggression is a major source of stress for LEOs (Lennings, 1997; Santos, Leather, Dunn, & Zarola, 2009).
**Departmental consequences.** In addition to harming civilians, LEOs who engage in extra-legal aggressive behavior may be disciplined departmentally (Prenzler et al., 2013), prosecuted under state or federal laws (Koepfler et al., 2012; Prenzler et al., 2013), or subjected to a civil claim (McCoy, 2010). In 2008, thirty thousand civil actions related to excessive force were filed against LEOs (Gaines & Kappeler, 2008). In successful civil suits, taxpayers bear legal costs (Porter, 2012).

**Burnout**

Burnout, another problematic consequence of LEO stress (Ackerley, 1986; Patterson et al., 2014), has been defined as physical or mental collapse caused by overwork or stress (Schaible & Six, 2016). A large body of literature has compartmentalized burnout into key components, including emotional exhaustion (EE), depersonalization (DP), and a decreased sense of personal accomplishment (PA; Aguayo, Vargas, Canadas, & De la Fuente, 2017; Maslach, 1982; Schaible & Six, 2016).

EE occurs in the presence of disingenuous and/or powerful emotions (Maslach, 1982), which in turn consume emotional resources. DP may include a sense of distance from others, often produced by repeated unpleasant social interactions in an occupational context (Maslach, 1982). These two aspects of burnout are strongly associated with stressors and work attitudes of LEOs (Kop et al., 1999). Workers may experience a diminished sense of self-efficacy and PA as a result of negative or punitive interactions with those with whom they work, or from whom they require approval (Maslach, 1982). Policing, like other public service work, can be both fulfilling and taxing, and the development of burnout is predicted by a variety of contextual, occupational, and individual factors (Jin, Park, & Bak, 2015; Schaible & Six, 2016).

**Predictors of LEO Burnout.** LEOs are considered at higher risk for developing burnout than the general population (Aguayo et al., 2017), a syndrome that is predicted by a variety of
contextual, occupational, and individual factors (Leiter, Bakker, & Maslach, 2014; Maslach & Leiter, 2008; Schaible & Six, 2016).

**Contextual predictors.** LEOs are at increased risk relative to other high-stress professions for developing burnout (Aguayo et al., 2017; Backteman-Erlanson, Padyab, & Brulin, 2013; De la Fuente Solana, Aguayo Extremera, Vargas Pecino, & Canadas de la Fuente, 2013; Schaible & Six, 2016). A possible theoretical explanation is the Emotional Labor Theory, which refers to the degree to which a LEO engages in authentic expression of emotions and values on the job (Schaible & Six, 2016), and the extent to which they perceive their values to be congruent with the demands of the job (Maslach & Leiter, 2008). For example, a single LEO serving in a district may receive complaints targeted at the entire department, and be forced to apologize on behalf of an entire organization. This conflict between the LEO’s authentic internal experience and the display rules imposed by their department increases a LEO’s chance of burnout (Bakker & Heuven, 2006; Glomb & Tews, 2004; Maslach & Leiter, 2008; Schaible & Six, 2016; Zapf & Holz, 2006).

**Occupational factors.** Burnout has also been linked to chronic organizational stressors (Aguayo et al., 2017), including those specifically experienced by LEOs (Burke, 1994; Burke, 1997; Kohan & Mazmanian, 2003; M. Leiter et al., 2014; Maslach & Leiter, 2008). Occupational factors such as workload, control (e.g., clarity of role), reward (e.g., appropriate compensation), community (i.e., quality of social interactions at work), fairness (e.g., equitable decision-making), and values (i.e., the cognitive-emotional impact of goals and expectations) all contribute to LEO burnout (Maslach & Leiter, 2005, 2008; Maslach, Schaufeli, & Leiter, 2001; Pines & Keinan, 2005).
LEOs are placed in the unique position of fulfilling both law enforcement and civilian service responsibilities, and must either express or suppress a variety of emotions on the job (Bakker & Heuven, 2006; Frewin, Stephens, & Tuffin, 2006; van Gelderen et al., 2007), a requirement which can lead to role confusion, and conflict of values and emotions (Bakker & Heuven, 2006; Schaible & Gecas, 2010; van Gelderen et al., 2007). Repetitive negative interactions with civilians, such as writing traffic tickets, increase the risk of burnout in LEOs as well (Maslach, 1982; Schaible & Six, 2016).

**Individual factors.** Research indicates that factors in LEO personal context may also impact the development of burnout (Maslach & Leiter, 2008; Maslach et al., 2001), although there has been minimal research investigating the role of dispositional (e.g. socio-demographic) variables that predict or influence the development of burnout among LEOs, and many findings have been inconclusive (Aguayo et al., 2017; Schaufeli & Enzmann, 1998). It is uncertain whether younger or older LEOs are at more risk for developing burnout (Aranda Beltrán & Pando Moreno, 2010), or whether being partnered or a parent buffers the development and impact of burnout (Durán, Montalbán, & Stangeland, 2006). Some studies have identified gender differences in the experience of burnout: female LEOs may be more susceptible to EE (Adebayo, Sunmola, & Udegbe, 2008), whereas male LEOs may be prone to depersonalization (Burke & Mikkelsen, 2005). However, other studies have refuted these findings (Chrisopoulos, Dollard, Winefield, & Dormann, 2010; McCarty, Jihong, & Garland, 2007).

Some research has also explored the relationship between personality factors as burnout, although these studies are relatively scarce (Maslach & Leiter, 2008). Burnout has been linked to neuroticism (Deary et al., 1996; Zellars, Perrewé, & Hochwarter, 2000). Further, it has been noted that the impact of burnout across LEOs varies, and the effectiveness of LEOs’ coping
strategies likely plays a role (Schaible & Six, 2016). For example, avoidant coping strategies such as the suppression of emotion lead to various negative outcomes, including burnout (Grandey, 2000).

**Multiple factors.** Multiple domains of predictors likely interact to uniquely predict burnout. For example, while the frequency and intensity of emotional demands do not seem to have a standalone impact on burnout (Schaible & Six, 2016), in the presence of certain occupational contexts they may increase the risk of burnout among LEOs (Zapf & Holz, 2006). Similarly, when LEOs attempt to conform to the display rules of their job (e.g., speaking in front of stakeholders) in an inauthentic way, the dissonance may interact with physiological processes to increase the likelihood of burnout (Grandey, 2003; Johnson & Spector, 2007; Schaible & Six, 2016).

**Burnout consequences.** Burnout represents a major threat to LEOs (Aguayo et al., 2017), their departments, and their communities (Maslach & Leiter, 2008; Pines & Keinan, 2005; Schaufeli & Enzmann, 1998). LEOs are particularly vulnerable to burnout (Kop et al., 1999), and among correctional officers, higher rates of stress and burnout lead to more pronounced negative effects of burnout (Bourbonnais, Jauvin, Dussault, & Vezina, 2007).

**Civilian / community consequences.** Burnout negatively impacts the quality of service provided by LEOs to the community (Hawkins, 2001; Jackson & Maslach, 1982). Burned out LEOs adopt a negative, callous, and cynical approach toward the public (Kop et al., 1999) which may influence interactions with civilians (Kop et al., 1999; Martinussen, Richardsen, & Burke, 2007), particularly in the context of conflict (Euwema, Kop, & Bakker, 2004), and LEOs may use their authority to exercise their frustration on civilians (Schaible & Six, 2016). Burned out LEOs may also experience a lowered threshold and more favorable attitude toward the use of
violence against civilians (Stearns, 2018) when prone to viewing them as impersonal objects, an effect of certain dimensions of burnout (Kop et al., 1999). In addition to perspectives on violence, LEOs suffering from burnout endorse increased self-reported violent behavior (Kop et al., 1999). Burned out LEOs may also resort to violence as a result of impaired critical thinking, problem solving capacities (Kop et al., 1999), and decision-making skills (Kligyte, Connelly, Thiel, & Devenport, 2013). Other research has indicated that burned out LEOs may engage in withdrawal behaviors, including actively avoiding interactions with the community (Lee & Brotheridge, 2006).

**LEO consequences.** Burnout negatively impacts LEOs (Lee & Brotheridge, 2006), and is linked to decreased physical well-being (Kop et al., 1999; Stearns, 2018), including physiological symptomology (Pines & Keinan, 2005) such as headaches, gastrointestinal disorders, muscle tension, hypertension, cold and flu symptoms, sleep issues (Hawkins, 2001; Leiter & Maslach, 2000), and physical malaise (Kahill, 1988; Kohan & Mazmanian, 2003). Burnout causes mental and emotional distress among LEOs as well (Pines & Keinan, 2005), including dysphoria and fatigue, (Schaufeli, Maslach, & Marek, 1993), and is predictive of psychopathology (Maslach & Leiter, 2008) such as depression (Aguayo et al., 2017; Greenglass & Burke, 1990; Maslach & Leiter, 2008; Schonfeld, 1990), anxiety (Aguayo et al., 2017), thoughts of suicide (Berg, Hem, Lau, Loeb, & Ekeberg, 2003), and dissociation (Aaron, 2000). Other negative effects of burnout among LEOs include increased alcohol, drug, medication (Mikkelsen & Burke, 2004) and tobacco use (Cordes & Dougherty, 1993; Johnson, Todd, & Subramanian, 2005; Kohan & Mazmanian, 2003), as well as the *spillover effect*, whereby burnout at work leads to disruptions in interpersonal relationships (Burke & Deszca, 1986; Burke, Shearer, & Deszca, 1984; Johnson et al., 2005).
Research has found that workers experiencing by burnout were evaluated more negatively by their spouses (Jackson & Maslach, 1982; Zedeck, Maslach, Mosier, & Skitka, 1988), while burnout workers endorse negative impact on their family and an unsatisfactory marriage (Burke & Greenglass, 1989; Burke & Greenglass, 2001). LEOs impacted by burnout also tend to withdraw from friends and family, and spouses reported that these LEOs interacted with their children as though they were still on the job (Jackson & Maslach, 1982). Burned out LEOs also demonstrate an increased frequency of domestic violence (Johnson et al., 2005). Longitudinal studies of LEOs have found aspects of burnout at follow-up assessments as well. After two years, a sample of LEOs endorsed more negative attitudes toward work demands and vulnerabilities to addiction. After four years, the same sample exhibited higher rates of neurotic psychopathology, and increased risk for physiological stress-related illness and problematic substance use (Beutler, Nussbaum, & Meredith, 1988). Other research has found that LEOs with 16-25 years of experience on the job scored highest on dimensions of burnout (Cannizzo & Liu, 1995).

**Departmental consequences.** Research has specifically indicated that while burnout poses a major risk for individuals, it represents a threat to organizations as well (Martinussen et al., 2007; Schaufeli & Enzmann, 1998). Among LEOs burnout is linked to cynicism toward the government (Stearns, 2018), which in turn may impact LEO job performance (Kop et al., 1999; Maslach & Leiter, 2008). LEOs suffering from burnout also exhibit higher rates of perceived failure and performance level, loss of motivation (Maslach & Leiter, 2008; Pines & Keinan, 2005; Schaufeli & Enzmann, 1998), as well as workplace problems, such as officer absenteeism, increased turnover, job dissatisfaction, low organizational commitment, intention to quit, impaired productivity (Aguayo et al., 2017; Pines & Keinan, 2005), and increased usage of sick
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days (Mikkelsen & Burke, 2004). Among correctional officers, burnout leads to decreased job involvement (Lambert & Paoline, 2010) and negative safety outcomes (Finn, 1998)

**Interventions for LEO Stress, Aggression, and Burnout**

Despite the clear need for interventions for LEOs, the literature exploring such options is inconsistent. Some studies have demonstrated improvements stress (Arnetz, Arble, Backman, Lynch, & Lublin, 2013; Arnetz, Nevedal, Lumley, Backman, & Lublin, 2009; McCrathy & Atkinson, 2012), aggression (Christopher et al., 2018; Prenzler et al., 2013), and burnout (Ackerley, 1986; Christopher et al., 2015; Christopher et al., 2018), while other studies have failed to show improvement.

Stress management protocols for LEOs typically take one of two approaches: clinical interventions including psychotherapy, or more commonly techniques to recognize stress and bolster coping strategies (Patterson et al., 2014; Stinchcomb, 2004). A meta-analysis described small effect sizes produced by specific examples of these stress management interventions in studies of LEOs, including general wellness and stress prevention planning (Tanigoshi, Kontos, & Remley, 2008), a writing intervention (Ireland, Malouff, & Byrne, 2007), emotion management and biofeedback (McCraty, Tomasino, Atkinson, & Sundram, 1999), health assessment and self-help materials (Richmond, Kehoe, Hailstone, Wodak, & Uebel-Yan, 1999), and progressive relaxation and imagery (Shipley & Baranski, 2002). This meta-analysis also described several studies of stress management describing negative effect sizes, indicating an increase in stress outcomes following interventions. These interventions included exercise and physical conditioning (Norvell & Belles, 1993; Short, DiCarlo, Steffee, & Pavlou, 1984), relaxation training and cognitive restructuring (Ackerley, 1986), stress inoculation and control (Coulson, 1987), skills training and rehearsal (Digliani, 1994), psychoeducation and guided
imagery (Gersons, Carlier, Lamberts, & van der Kolk, 2000). Overall, this meta-analysis concluded that there is insufficient evidence to support stress management interventions among LEOs (Patterson et al., 2014). Further, despite the implementation of various internal stress-reduction programs, levels of stress-related mental health issues amongst LEOs have doubled in the past decade (Collins & Gibbs, 2003).

Some research has speculated that barriers limit intervention effectiveness among LEOs. For example, LEOs often do not participate in interventions because their culture emphasizes independence and stoicism (Waters & Ussery, 2007). It may also be more difficult to provide effective intervention for critical incidents with personal salience for LEOs (McCaslin et al., 2006). Lastly, and perhaps most problematically, most interventions are not equipped to address chronic stressors that play a major role in negative LEO consequences (Hurrell, 1995; Stinchcomb, 2004). Although support for status quo interventions is lacking, preliminary studies of mindfulness training (MT) amongst LEOs and high-stress populations are promising.

**Mindfulness**

Mindfulness has been defined as “moment-to-moment awareness, cultivated by paying attention in a specific way… in the present moment… as nonjudgmentally and as openheartedly as possible” (Kabat-Zinn, 2015). Historically, mindfulness has been a central aspect of Buddhism – called by some the heart of Buddhist meditation (Thera & Fromm, 2005) – across Asia for thousands of years. However, mindfulness has only relatively recently arrived in the West, where it is currently flourishing (Baer, 2006; Kabat-Zinn, 2003; Kabat-Zinn, 2015). Western studies of mindfulness emerged in the 1970s, and were primarily concerned with fundamental characteristics of mindfulness such as differences between mindful and mindless behavior (e.g., Chanowitz & Langer, 1981; Langer, Blank, & Chanowitz, 1978), as opposed to
mechanisms or amenability to enhancement. However, it has been noted more recently that mindfulness is not an ever-present quality that one is able to tap into at will to gain health benefits, but rather a process that develops dynamically, deepens over time, and is enhanced through practice on a regular basis (Kabat-Zinn, 2003). As such, subsequent research has focused on MT, which many healthcare disciplines have tailored into fully-developed and efficacious interventions (see Baer, 2006; Kabat-Zinn, 2003 for reviews).

**Mindfulness training.** Within the fields of psychology and mental health, MT typically emphasizes development of specific mindfulness skills (Baer, 2006; Hanh, 2016; Kabat-Zinn, 1990, 1994; Linehan, 1993). For example, most MT programs encourage participants to engage in exercises designed to promote present moment awareness and nonjudgmental acceptance, including attending to internal experiences such as bodily sensations, thoughts, and emotions, or external stimuli such as sights and sounds (Baer, 2006; Kabat-Zinn, 1994; Linehan, 1993). MT has been empirically supported in many contexts, including laboratory, clinical, and community settings, and meta-analyses have found MT to be more effective than other interventions in the treatment of anxiety and depression (Hofmann, Sawyer, Witt, & Oh, 2010; Khoury et al., 2013), as well as pain, psychological well-being among cancer patients, and other physical and medical conditions (see Khoury et al., 2013 for a review). MT has also demonstrated benefits in non-clinical samples, and a meta-analysis found reduced stress and enhanced spiritual values across such studies (Chiesa & Serretti, 2009).

Review-level research has demonstrated the benefit of MT for aggression as well (Fix & Fix, 2013). Specifically, MT has demonstrated efficacy in managing aggression in the general population (Fix & Fix, 2013), college students (Peters et al., 2015), adults with mental illness (Singh, Lancioni, Winton, et al., 2007), intellectual disabilities (Singh et al., 2013), and
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borderline personality disorder (Keng & Tan, 2018), among at-risk youth (Franco, Amutio, López-González, Oriol, & Martínez-Taboada, 2016; Singh, Lancioni, Singh Joy, et al., 2007; Zoogman, Goldberg, Hoyt, & Miller, 2014), and among criminal justice professionals (Kelley & Lambert, 2012) and LEOs (Christopher et al., 2015; Christopher et al., 2018). There is evidence that mindfulness may impact specific aspects of aggression pertinent to LEOs, such as aggression toward intimate partners (Gallagher, Hudepohl, & Parrott, 2010) and among populations with high substance use (Epstein-Ngo, Roche, Walton, Zimmerman, & Cunningham, 2013; Shorey, Anderson, & Stuart, 2015; Wupperman et al., 2012). MT has also shown efficacy in reducing outcomes related to aggression, including anger (Peters et al., 2015; Singh et al., 2014), and anger expression (Fix & Fix, 2013; Robins, Keng, Ekblad, & Brantley, 2012).

Research of MT for burnout is limited, but a review-level investigation of several studies demonstrated promising evidence for MT as a buffer against job burnout among workers in emotionally-charged and social occupations (Luken & Sammons, 2016b). Other studies have shown that MT is associated with decreased risk of burnout among surgeons (Lebares et al., 2017), primary care physicians (Fortney, Luchterhand, Zaklet skaia, Zgierska, & Rakel, 2013; Krasner et al., 2009), other health professionals (Goodman & Schorling, 2012), and in randomized-controlled trials of teachers (Roeser et al., 2013) and pediatric oncologists (Moody et al., 2012). Some studies have also demonstrated the positive impact of mindfulness on specific elements of burnout, including emotional exhaustion (Cohen-Katz, Wiley, Capuano, Baker, & Shapiro, 2004; Flook, Goldberg, Pinger, Bonus, & Davidson, 2013; Hulsheger, Alberts, Feinholdt, & Lang, 2013), personal achievement or accomplishment (Cohen-Katz et al., 2004; Flook et al., 2013; Jennings, Snowberg, Coccia, & Greenberg, 2011), and depersonalization (Mackenzie, Poulin, & Seidman-Carlson, 2006). Several studies have also demonstrate the
effectiveness of MT in reducing burnout among LEOs (M. Christopher et al., 2015; Kaplan, Bergman, Hunsinger, Bowen, & Christopher, 2016; Luken & Sammons, 2016a; Regehr, Glancy, Pitts, & LeBlanc, 2014).

**Mediators of outcomes in MT.** Many studies have identified mindfulness as a potential primary mediator of change in MT, although the evidence is mixed (Creswell, 2017). A recent meta-analysis presented a moderate effect size when examining the impact of MT on self-reported mindfulness, and positive significant results from 10 studies demonstrating self-reported mindfulness mediating improvements in outcomes such as perceived stress and anxiety (Visted, Vøllestad, Nielsen, & Nielsen, 2015). Other research has demonstrated that changes in mindfulness mediate the relationship between MT and burnout among oncology nurses (Duarte & Pinto-Gouveia, 2017) and that mindfulness attenuates the relationship between hostility and workplace aggression in the general population (Liang et al., 2018). Despite these promising findings, and despite the positive impact of MT on outcomes, a recent review noted that approximately half of all MT studies do not demonstrate significant improvement in mindfulness pre-post intervention (Creswell, 2017). Similarly, other research has pointed to insufficient evidence that MT increases self-reported mindfulness relative to treatment comparison groups, such as relaxation interventions (Visted et al., 2015). Because of these inconsistencies, alternative mediators of the benefit of MT have been suggested.

One potential mediator is self-compassion (Chiesa, Anselmi, & Serretti, 2014). Many studies have detailed the positive relationship between MT and self-compassion (Rimes & Wingrove, 2013; Robins, Keng, Ekblad, & Brantley, 2012; Thompson et al., 2010), and between increased self-compassion post-MT and improved outcomes such as stress and mood among cancer patients (Birnie, Garland, & Carlson, 2010), fatigue levels among patients with chronic
fatigue syndrome (Rimes & Wingrove, 2013), and depression among a clinical sample (Kuyken et al., 2010). It has also been found that self-compassion is predictive of depression and anxiety outcomes beyond levels of mindfulness (Van Dam, Sheppard, Forsyth, & Earleywine, 2011).

Self-compassion has also shown to ameliorate the impact of burnout among medical trainees (Richardson et al., 2016), the relationship between narcissism and burnout among college students (Barnett & Flores, 2016), and between MT and reductions in burnout among oncology nurses (Duarte & Pinto-Gouveia, 2017). Self-compassion also negatively correlates with aggression among adolescents in a residential treatment program (Barry, Loflin, & Doucette, 2015), and changes in self-compassion are associated with neurological structures associated with violence, and a self-compassion intervention reduced aggression among violent men (Morley, 2015).

Mechanistic studies of MT for burnout and aggression are lacking, though some research has suggested that focus on achieving work-related goals mediates the relationship between mindfulness and burnout (Zivnuska, Kacmar, & Valle, 2017) and changes in psychological inflexibility mediate the relationship between MT and burnout among oncology nurses (Duarte & Pinto-Gouveia, 2017). Other research has suggested that the awareness aspect of mindfulness, versus the acceptance aspect, influences the relationship between hostility and workplace aggression (Liang et al., 2018) and anger management mediated the relationship between mindfulness and dating violence perpetration among undergraduate college students (Shorey, Seavey, Quinn, & Cornelius, 2014).

Other less studied mediators of MT include decentering, which involves objectively observing experiences from a third-person perspective (Bernstein et al., 2015). In a small group of studies, decentering has been shown to mediate outcomes such as anxiety (Hoge et al., 2015).
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and depression (Bieling et al., 2012) in MT. Another multiphase study found that mindful awareness tempered workplace aggression in the general population (Liang et al., 2018). However, decentering, mindful awareness, and other alternative mediators, also including acceptance and emotion regulation (Holzel et al., 2011; Lindsay, & Creswell, 2015), exposure (Baer, 2006), reduced rumination (Jain et al., 2007), and altered self-concept (Carlson, 2013; Golubickis, Tan, Falben, & Macrae, 2016) lack the empirical base or methodological rigor to stand out as likely mechanisms of action (Creswell, 2017). Despite the abundance of proposed mediators, there is not consensus in the research (see Chiesa et al., 2014 for a review). For this reason, further investigation of potential mediators is crucial. Resilience is one promising candidate.

Resilience

Definitions of resilience. Definitions of resilience and descriptions of its theoretical base vary substantially across the research (Chmitorz et al., 2018; Davydov, Stewart, Ritchie, & Chaudieu, 2010; Kalisch et al., 2017), particularly in the context occupational stress (Rees, Breen, Cusack, & Hegney, 2015), and the field has garnered criticism as a result (Earvolino-Ramirez, 2007; Vanderbilt-Adriance & Shaw, 2008). It has also been noted that the heterogeneity of definitions influences our ability to measure it, and a recent review of studies of resilience-enhancing interventions suggested that there is no ‘gold standard’ for resilience assessment and no established outcome measure (Chmitorz et al., 2018). Despite this inconsistency, many definitions of resilience refer to positive stress reactivity, or the ability of a system to return to baseline or homeostasis following a stressful experience (Chmitorz et al., 2018; Kalisch, Muller, & Tuscher, 2015; Layne et al., 2009; Oken, Chamine, & Wakeland, 2015).
Resilience as stress reactivity. Resilience has often been conceptualized resilience as an index of stress reactivity (Black, Balanos, & Whittaker, 2017; Clays et al., 2007; Haglund, Nestadt, Cooper, Southwick, & Charney, 2007; Steptoe, Fieldman, Evans, & Perry, 1993). These studies operationalize stress reactivity by arguing that stressful experiences either increase vulnerability to subsequent negative outcomes or foster resistance to them (Rutter, 2002; Stiller, Drugan, Hazi, & Kent, 2011). For example, medical adversity or disabilities have been related to negative outcomes such as depression, utilization of psychotherapy, and self-reported stress (Bugental, Beaulieu, Fowler, O'Brien, & Cayan, 2010; Huebner, Thomas, & Berven, 1999; Turner & Kelly, 2000; Turner & Noh, 1988). However, other studies have shown medical adversity to predict positive outcomes, such as functional adaptation and coping (Barnum, Snyder, Rapoff, Mani, & Thompson, 1998; Bugental et al., 2010). Several studies have related stress reactivity and resilience, to the extent that they are both important determinants and may often influence the valence (e.g., positive or negative) of long-term outcomes of stressful experiences (Bugental et al., 2010; Carver, 1998; O'Leary & Ickovics, 1995).

Stress reactivity has also been related to outcomes relevant to LEOs, such as aggression and burnout. Stress reactivity is related to aggression among children (Murray-Close et al., 2014; Suurland, van Der Heijden, Huijbregts, van Goozen, & Swaab, 2017), veterans with PTSD (Taft et al., 2007), and patients with ADHD (Yang, Won Shin, Sun Noh, & Stein, 2007). Stress reactivity is related to burnout among otherwise healthy workers (Juster et al., 2011) and childcare professionals (Nislin et al., 2016), and is predictive of consequences of burnout, such as job-stress-related sick days taken by a sample of depressed women (Wahlberg et al., 2009).

Influencing factors of resilience. Resilience is mediated by a variety of factors, broadly including genetics, individual factors, and environmental support (Binder & Holsboer, 2012;
Haglund et al., 2007). Individual factors influencing the impact of resilience include neurobiological and psychological characteristics, as well as personal trauma history (Haglund et al., 2007). Psychological characteristics can include positive emotions, active coping style, cognitive flexibility, moral compass attunement, and optimism can determine either positive or negative reactivity to stress (Carver, 1998; Epel, McEwen, & Ickovics, 2010; Southwick, Vythilingam, & Charney, 2005). Resilient individuals may exhibit more efficient extinction and dismissal of fearful memories (Haglund et al., 2007). Further, certain individuals are genetically predisposed to hypersensitivity to stress and increased reactivity (DeRijk et al., 2006).

**Mono-causal resilience.** Resilience has traditionally been characterized via mono-causal models, i.e., distinctly in biomedical/physiological, psychological, or sociocultural arenas without a general theoretical perspective integrating these perspectives. These unidimensional perspectives on resilience are particularly popular in clinical practice because of their ease of application, largely because they ignore other influencing factors (Davydov et al., 2010). More recent research, including a review of resilience and mental health, have suggested adopting a multi-modal perspective of resilience (e.g., mental resilience and somatic immunity to stress; Davydov et al., 2010).

In this review, the authors relate somatic health protection (e.g., immune and hygiene systems) and mental resilience to one another, suggesting that they both protect against adversity via multi-level (e.g., sociocultural and individual) protective barriers that differ with various stressors and contexts (Davydov et al., 2010). Additionally, the authors suggest that a comparison of the somatic immune and psychological resilience systems will benefit theoretical perspectives on resilience in mental health research in two specific ways: first, the consolidation of a conceptualization of resilience that includes the interaction between mental health
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protection, maintenance, and recovery; and second, merging the conceptualization and operationalization (e.g., measurement) of resilience within a singular theoretical model (Davydov et al., 2010).

Sociocultural/group (non-specific) levels of resilience. As per the authors of this review (Davydov et al., 2010), non-specific levels of resilience include geographical, political, economic, social, medical, and cultural factors that influence the development of risk factors (e.g., unemployment and poverty) for negative outcomes. Failure (e.g., adversity penetrates regardless) of these protective factors may activate individual-level resilience characteristics or maladaptive coping strategies (e.g., withdrawal/avoidance; Davydov, Shapiro, Goldstein, & Chicz-DeMet, 2007). The authors relate these levels of resilience to social hygiene or herd immunity in somatic health (Davydov et al., 2010), and many studies have stressed the need to incorporate such factors into any academic discussion of resilience (Diener, Oishi, & Lucas, 2003; Haeffel & Grigorenko, 2007).

Individual (specific) levels of resilience. Individual resilience includes both general (e.g., fundamental stress reactivity systems) and specific (e.g., coping strategies) resilience characteristics (Davydov et al., 2010). Studies of psychological resilience investigating individual resilience have explored the variability in individuals’ responses to the same traumatic experiences as a result of individual resilience characteristics. These studies have yielded results in the same way that studies of somatic immunity have explored varying individual pathology despite consistent exposure to pathogens (e.g., sex workers who have not contracted sexually-transmitted diseases; Davydov et al., 2010; Kaul et al., 2000). These studies have also included cardiac surgery patients who demonstrate resilience against hypertension as a result of anxiety (Bokereia, Golukhova, Polunina, Davydov, & Kruglova, 2008) and survivors of a recent loss...
demonstrating resilience to chronic grief (Bokeriia et al., 2008). Depending on the effectiveness of these individual resilience characteristics, they will be retained as an element of the individual level of resilience (e.g., successful coping strategies; Seligman & Maier, 1967). In addition to these varying levels of specific resilience, studies have also demonstrated that interventions may improve individual levels of resilience (Steinhardt & Dolbier, 2008). Because of the complexity of resilience as well as related interventions, multi-modal methods of conceptualization and measurement are needed.

**Psychological Resilience**

Historically, psychological resilience has been conceptualized as a trait (Meredith, Sherbourne, & Gaillot, 2011), predominantly determined by a particular personality type that enhances adaptability to stress (Chmitorz et al., 2018; Hu, Zhang, & Wang, 2015; Ong, Bergeman, Bisconti, & Wallace, 2006). However, recent research has shed light on a lack of evidence to support this theory (Bonanno & Diminich, 2013; Raffael Kalisch et al., 2017), and has instead suggested that personality is rather a risk or promoting factor for resilience and positive stress adaptation (Bonanno & Diminich, 2013; Luthar, Cicchetti, & Becker, 2000). A more contemporary conceptualization of resilience suggests it is instead a dynamic process of positive adaptation and coping in the presence of stressors (Bonanno & Diminich, 2013; Chmitorz et al., 2018; Connor & Davidson, 2003; Jenson & Fraser, 2006; Luthar et al., 2000; Meredith et al., 2011). A commonly used self-report measure of psychological resilience has described it as a multi-faceted construct, and identified constituent factors of psychological resilience such as personal competence and tenacity, trust in one’s instincts and tolerance of negative affect, acceptance of change and secure relationships, control, and spiritual influences (see Connor & Davidson, 2003 for a full review of these factors). Various specific processes by
which resilience buffers stress-related outcomes have also been suggested: (i) resilience protects against stressful experiences themselves, (ii) against the development of stress-related psychopathology, (iii) it protects against negative outcomes by promoting adaptive stress reactivity (see Davydov et al., 2010 for a review). A growing body of research supports the notion of psychological resilience as adaptive stress reactivity.

External and internal sources of stress are ever-present, and one’s reactivity to this stress (i.e., positive coping) is a suggested mechanism of resilience (Meredith et al., 2011; Rees et al., 2015). Positive and adaptive coping strategies implemented during stress reactivity are reinforced by a less impaired level of homeostasis and thereby more likely to be utilized in the future, whereas other coping strategies are ineffective and lead to disruption of biopsychospiritual homeostasis (Connor & Davidson, 2003). Homeostatic disruption may subsequently lead to a variety of outcomes: an opportunity for growth and increased long-term resilience, a return to a pre-disruption level of homeostasis, a return to a lower, less-functional level of homeostasis, or a dysfunctional state in which maladaptive strategies are regularly utilized during instances of stress reactivity (Connor & Davidson, 2003). Such reactivity to stress has been referred to as a common central aspect of resilience across studies (Garcia-Dia, DiNapoli, Garcia-Ona, Jakubowski, & O'Flaherty, 2013; Gillespie, Chaboyer, & Wallis, 2007).

Psychological resilience has shown a positive impact on a variety of outcomes in diverse populations, including improvements in mood, anxiety, and post-traumatic stress among mothers whose children were recently diagnosed with cancer (Sahler et al., 2013), improvements in stress, anxiety, and quality of life among breast cancer survivors (Loprinzi, Prasad, Schroeder, & Sood, 2011), and improvements in goal attainment and workplace well-being among executives and senior managers (Grant, Curtayne, & Burton, 2009). Psychological resilience is also related
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to burnout among first responders (Kaplan et al., 2016), buffered the impact of traumatic experiences on PTSD in firefighters (Lee, Ahn, Jeong, Chae, & Choi, 2014), led to improved psychophysiological stress and work performance among LEOs (Arnetz et al., 2009), demonstrated improvements in depression symptomology and emotional health among veterans with PTSD (Kent, Davis, Stark, & Stewart, 2011), and led to better recovery after physiological stress in Marines (Johnson et al., 2014).

Physiological resilience

In a novel conceptualization from a systems science perspective, physiological resilience has been recently referred as an index of systemic stress reactivity (Black et al., 2017). Specifically, many studies have referred to physiological resilience as the ability of a system to react adaptively to stress, and to return to baseline following a stressful experience (Holling, 1973; Oken et al., 2015). The bipolarity of resilience and stress reactivity (i.e., stress reactivity predicting positive versus negative outcomes) is represented physiologically as either allostatic load (i.e., stress reactivity leading to maladaptive behavior), repeated and consistent stress decreasing one’s ability to adapt to subsequent stress, or allostasis (i.e., adaptive stress reactivity or resilience), referring to stressful experience followed by recovery, which may increase one’s ability to adapt to subsequent stress (McEwen & Lasley, 2002).

Several studies have conceptualized salivary cortisol as a specific indicator for physiological resilience and stress reactivity (Binder & Holsboer, 2012; Oken et al., 2015), including among LEOs (Galatzer-Levy et al., 2014). Further, a handful of studies have framed physiological stress reactivity using cortisol in research of occupational stress and burnout (Nislin et al., 2016), and aggression (Yang et al., 2007).
Cortisol is a product of the hypothalamic-pituitary-adrenocortical (HPA), which when deregulated is a link between environmental stressors and negative outcomes of stress reactivity (Chrousos, 2009), including the fight-or-flight response (Andersen, Dorai, Papazoglou, & Arnetz, 2016). Cortisol is also an integral feature of the natural sleep-wake cycle, the disruption of which is an important factor in stress reactivity (Menet & Rosbash, 2011; Nater, Skoluda, & Strahler, 2013). The cortisol awakening response (CAR), an indicator of HPA axis functioning, is a commonly used combination of stress reactivity and circadian rhythm (Stalder et al., 2016). A healthy CAR is characterized by a distinct peak after awakening, followed by a gradual decline over 30 to 40 minutes (Stalder et al., 2016; Violanti et al., 2017). Healthy adults have been found to exhibit a CAR magnitude between 50 and 156 percent above baseline (Clow, Thorn, Evans, & Hucklebridge, 2004a). Research shows healthier and more adaptive cortisol function in those scoring higher on a measure of positively adapting to stress (Moskowitz & Epel, 2006). A study of LEOs indicated that more resilient participants demonstrated a healthier stress reactivity profile as measured by cortisol, whereas those endorsing less resilience are more impacted physiologically by acute psychological stress (Galatzer-Levy et al., 2014). Physiological stress reactivity is also susceptible to environmental stressors such as threat perception and stressful anticipation, which may initiate and sustain the fight-or-flight stress reaction (Andersen et al., 2016).

Previous research has found that chronic HPA reactivity to stress may result in deregulated (e.g., either exaggerated or reduced) CAR (Rapcencu, Gorter, Kennis, van Rooij, & Geuze, 2017). Amongst LEOs, abnormally elevated CAR has been associated with features common in the profession, including depression, anxiety, and cardiovascular disease (Clow,
Hucklebridge, & Thorn, 2010). Although CAR is situated in the physiological system of stress, studies of the relationship between it and occupational stress are largely inconclusive.

Relevant to LEOs, dysfunctional cortisol in the short term predicts elements of problematic stress reactivity such as increased threat perception, negative emotion, and a lack of control, all of which have detrimental impacts on LEO performance (Lovallo, 2015). Negative effects of problematic stress reactivity among LEOs include poor memory during critical incident response and information processing impairments (Andersen et al., 2016). Other studies of LEOs have found a positive relationship between cortisol and occupational stress (Austin-Ketch et al., 2012; Groer et al., 2010; Walvekar, Ambekar, & Devaranavadagi, 2015), and have indicated that cortisol is often dysfunctional in this population (Andersen et al., 2016) and among military personnel (Morgan et al., 2000). While other occupations such as elite athletes exhibit similarly dysfunctional cortisol profiles, only LEOs are at risk for associated negative outcomes (Violanti et al., 2007), likely due to LEO-specific stress such as threats to their lives and other chronic sources of stress (Andersen et al., 2016; Binder & Holsboer, 2012; Lovallo, 2015).

**Dysfunctional cortisol.** Research has described a wide-spread, systemic relationship between cortisol and physiological functions, such as blood pressure regulation and metabolic processes, which may be influenced by dysfunctional cortisol (Lovallo, 2015). Chronically deregulated cortisol, a common product of chronic stress, significantly increases risk of diabetes and cardiovascular disease (Sapolsky, 2004), and dysfunctional CAR predicts increased negative outcomes such as acute stress disorder (Inslicht et al., 2011). Among LEOs, research has described a negative relationship between occupational stress and CAR (Violanti et al., 2017).
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Although some research has referred to CAR as an index of stress reactivity and resilience, its role as a mediator in in context of MT requires further study to determine.

**Resilience as a mediator in MT.** Previous research has found that MT effectively enhances resilience (Meredith et al., 2011) and improves stress reactivity (Hoge et al., 2013). For example, engaging in mindfulness buffers against attentional lapses during high-stress scenarios among military personnel, and cognitive resilience is developed as a result (Jha, Morrison, Parker, & Stanley, 2017). Similarly, in an RCT of MBRT among LEOs, psychological resilience demonstrated a medium-to-large effect size ($d=.64$), suggesting resilience is responsive to MT in this population (Christopher et al., 2018). Improved resilience has a positive impact on many clinical outcomes such as depressive- and anxiety-related disorders (Foisson et al., 2014), and is an important factor in buffering the impact of occupational stress among nursing staff (García & Calvo, 2012), civil workers (Hao et al., 2015), and physicians (Taku, 2014). Resilience is also amenable to intervention, and previous studies have demonstrated improvement in resilience in the context of intervention relating to decreases in burnout among high-stress populations (Gager & Elias, 1997), including firefighters and LEOs (Kaplan et al., 2016). Despite these promising findings, further research is necessary to clarify the role of resilience as a mediator in MT. The present study will examine models in which psychological and physiological resilience mediate the relationship between MT and aggression and burnout among LEOs in order to test the following hypotheses.

**Hypotheses**

It is hypothesized that among LEOs who completed an MT course, improvements in psychological resilience will mediate reductions in aggression and burnout, and that positive
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changes physiological resilience (represented by reductions in $AUC_I$ salivary cortisol) will mediate reductions in aggression and burnout as well.
Chapter Three

Proposed Methodology
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Method

The present study is a secondary data analysis of a larger parent study evaluating the feasibility and preliminary efficacy of Mindfulness-Based Resilience Training (MBRT; see (M. S. Christopher et al., 2018)). This archival study will make use of the variables listed below to test the role of psychological and physiological resilience as mediators of the impact of MBRT on aggression and burnout among a sample of LEOs.

Participants

Participants were LEOs recruited from various levels of law enforcement agencies throughout the greater metropolitan area of a major city in the Pacific Northwestern United States. Recruitment methods included emails to superior officers and departmental contacts (e.g., mental health staff), general canvassing, and in-person presentations conducted by members of the research team in the presence of administrative staff and potential participants. A complete list of demographic variables will be found in Table XXX.

Measures

Self-Compassion Scale-Short Form (SCS-SF). The SCS-SF (Raes, Pommier, Neff, & Van Gucht, 2011) is a 12-item version of the 26-item Self-Compassion Scale (Neff, 2003). These measures assess kindness and understanding toward oneself, specifically in moments of pain or failure, perception of one's experiences in the context of general human experience, and the ability to be mindfully aware of painful thoughts and feelings. Sum scores on the SCS-SF range from 12-60, with higher scores indicating greater self-compassion. In the initial validation study among a non-clinical university student sample, the authors found $M = 36.00$ and $SD = 7.33$ (Raes et al., 2011). In the initial development study, the SCS-SF demonstrated good internal consistency, factorial validity, and expected correlations with other versions of the SCS,
including the long-form SCS and non-English versions (Raes et al., 2011). Another study found support for convergent validity by showing an inverse relationship between between the SCS-SF and a measures of perfectionism, depression, and social anxiety, and for discriminant validity demonstrated by showing no correlation between the SCS-SF and several measures of substance use (J. A. Hayes, Lockard, Janis, & Locke, 2016). The SCS-SF demonstrated good internal consistency in the present sample ($\alpha_{\text{Pre}} = .84; \alpha_{\text{Post}} = .80$) and in the original validation study ($\alpha = .87$).

**Oldenburg Burnout Inventory (OLBI).** The Oldenburg Burnout Inventory (OLBI; Demerouti, Bakker, Vardakou, & Kantas, 2003; Halbesleben & Demerouti, 2005) is a 16-item measure of burnout with subscales of exhaustion and disengagement from work, two factors that contribute to burnout amongst LEOs (Adebayo et al., 2008). In the initial validation study, each subscale of the English-translation version of the OLBI demonstrated adequate internal consistency, with Cronbach’s $\alpha$ values ranging from .74 – .87. Factorial validity was also evaluated in this study, and the original two-factor solution (exhaustion and disengagement (Demerouti et al., 2003) was upheld. Convergent validity has also been found with the Maslach Burnout Inventory (MBI (Maslach, Jackson, & Leiter, 2016) (Demerouti et al., 2003; Demerouti, Mostert, & Bakker, 2010; Halbesleben & Demerouti, 2005). Scores on the OLBI ranges from 1-4, with higher scores indicating higher burnout. In a normative sample of employees, the authors found $M = 2.07$, $SD = .44$ (Demerouti et al., 2010). The OLBI has been used in previous studies of MBRT amongst LEOs (M. Christopher et al., 2015), as well as mediation analyses amongst first responders (Kaplan et al., 2016). In the present sample, the OLBI demonstrated adequate internal consistency ($\alpha_{\text{Pre}} = .73; \alpha_{\text{Post}} = .76$).
Psychological resilience -- Connor-Davidson Resilience Scale (CD-RISC). The CD-RISC is a 25-item measures used to assess psychological resilience, defined as qualities that allow a person to thrive in the presence of adversity (Connor & Davidson, 2003). The CD-RISC is scored from 0-100, with greater scores indicating higher psychological resilience. The initial development and validation study found excellent internal consistency in the CD-RISC ($\alpha = .93$), discriminant validity by showing no significant relationship between the CD-RISC and a measure of sexual experiences, and evidence of convergent validity via significant inverse relationship between the CD-RISC and a measure of perceived stress ($r = -0.76, p < .0001$), a measure of vulnerability to stress ($r = -0.32; p < .0001$), and a significant positive relationship with a measure of social support ($r = 0.36; p < .0001$) (Connor & Davidson, 2003). In this initial development and validation study, the authors administered this measure to several other groups, including the general population ($M=80.4, SD=12.8$), primary care staff ($M=71.8, SD=18.4$), and patients with PTSD ($M=52.8, SD=20.4$) (Connor & Davidson, 2003). In another validation study, the CD-RISC demonstrated predicted convergent validity with constructs such as career optimism and general well-being (Perera & Ganguly, 2016) and in a study of LEOs following Hurricane Katrina, the CD-RISC demonstrated good internal consistency ($\alpha = .87$ (McCanlies, Mnatsakanova, Andrew, Burchfiel, & Violanti, 2014). In a large LEO sample authors found $M=77.28$ and $SD=10.40$ (Devilly & Varker, 2013). The CD-RISC demonstrated good to excellent internal consistency in the present sample ($\alpha_{Pre} = .90; \alpha_{Post} = .89$).

Physiological resilience -- Cortisol awakening response (CAR). In accordance with consensus guidelines (Stalder et al., 2016), participants provided saliva samples (2-3 ml) in their homes at timepoints of 0, 30, and 45 minutes after waking on three consecutive days both pre- and post-MBRT, and were asked to complete logs on collections days verifying the precise times
of collection. This collection procedure avoids pitfalls of single timepoint collection, including intra-individual variability and poor ecological validity (Rapcencu et al., 2017; Schulz & Knabe, 1994; Stalder et al., 2016), and has been used in previous studies of CAR amongst LEOs (Violanti et al., 2017). Participants were also asked to refrain from eating, drinking any liquid except water, smoking, brushing their teeth, taking medications, and exercising before collecting samples. Additionally, in accordance with consensus guidelines for cortisol collection (Stalder et al., 2016), participants were asked to complete logs on days of collection attesting to the presence of any of these potentially influential factors in their sample. For example, previous research has found that smokers exhibit a slightly attenuated cortisol rise after awakening (Clow, Thorn, Evans, & Hucklebridge, 2004b; Wust et al., 2000), woman show significantly larger increases in cortisol after awakening compared to men (Pruessner et al., 1997), and those women who were premenopausal at the time of collection show a sustained increase in cortisol after awakening (Clow et al., 2004a). Additionally, those experiencing fatigue demonstrate a CAR with a slower rise and more plateau-like peak (Kumari et al., 2009), individuals in pain exhibit a decreased CAR (Mayes et al., 2009), and lower socioeconomic status has an inverse relationship with CAR magnitude (Wright & Steptoe, 2005). The assessment of relevant covariates is crucial to protect against possible confounding (Stalder et al., 2016). Participants returned completed samples to the research team by mail using prepaid insulated boxes provided to them at the time of assessment. Samples were stored in a -80°C freezer until being processed and assayed for cortisol with an FDA-approved direct (non-extracted) salivary EIA cortisol kit (Pantex; Santa Monica, CA) at ZRT Laboratory (Beaverton, OR). Cortisol was measured in 25 microliter saliva samples with minor modifications of a previously described method (Du et al., 2013). Inter-assay
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coefficient of variation for cortisol is 8% at 1 ng/ml, 7.1% at 4 ng/ml, and 7.6% at 12.9 ng/ml. The detectable limit is 0.1 to 30 ng/ml. All cortisol values were converted from ng/ml to nmol/L.

Multiple timepoint collection allows for the calculation of area under the curve (AUC) (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003; Stalder et al., 2016). Computing AUC increases the measurement power via multiple data points, and simplifies statistical analyses (Pruessner et al., 2003). When calculating AUC, there are two specific formulas for computing different characteristics of the data: AUC\(_G\): area under the curve with respect to ground, and AUC\(_I\): area under the curve with respect to increase. The former formula, AUC\(_G\), assesses overall intensity of the cortisol response, whereas AUC\(_I\) is intended to assess changes in cortisol response over time (Pruessner et al., 2003). The CAR refers specifically to an individual’s change in cortisol levels (AUC\(_I\) over a particular time, rather than one’s total cortisol secretion over that same period of time (AUC\(_G\)) (Stalder et al., 2016). Previous research has indicated that AUC\(_I\) is the standard by which CAR should be measured (Stalder et al., 2016). One rationale provided is that CAR is a dynamic process and that AUC\(_I\) treats it as such (Clow et al., 2010; J. E. Khoury et al., 2015). Additionally, AUC\(_I\) has been found to respond to treatment, whereas AUC\(_G\) appears more resistant to intervention (Rapcencu et al., 2017). For these reasons, AUC\(_I\) will be used as the measure of physiological resilience, and a reduction in AUC\(_I\) is considered to be indicative of positive change from pre- to post-MBRT.

Procedure

In April 2016, two MBRT groups were conducted. After the final follow-up assessment period in October 2016, NIC participants were offered the training at no charge. The Pacific University IRB approved all study procedures, including this secondary data analysis. Recruitment was conducted using several methods. Recruitment emails with study information
and attached informational flyers for distribution were sent to police department chiefs in the urban and larger metropolitan area near the study location. Research team members also delivered brief in-person informational and recruitment presentations to potential participants at local police departments.

Eligibility criteria included being a full-time sworn LEO with no exposure to MBRT or similar mindfulness program. Eligible participants were scheduled for a pre-training assessment appointment, during which they provided written informed consent and completed all computerized measures. Following assessment, LEOs were randomly assigned using permuted-block randomization (1:1 ratio) with stratification (gender and age) to MBRT or NIC. At pre- and post-training, participants were given kits to collect awakening saliva samples and postage with which to mail the kits back to the research lab.

**Mindfulness Training.** MBRT was specifically designed to enhance resilience for LEOs in the context of acute and chronic occupational stressors. Based on Mindfulness-Based Stress Reduction (J. Kabat-Zinn, 1990), MBRT was delivered in this study through eight weekly 2-hour sessions with a 6-hour session in the seventh week. Sessions contained didactic and experiential exercises, including body scan, sitting and walking meditations, mindful movement, and group discussion. Specific content, including language and exercises were adapted for a LEO population; the primary focus of the curriculum was to learn strategies to manage stressors inherent to police work, such as critical incidents, job dissatisfaction, and public scrutiny, as well as interpersonal, affective and behavioral challenges common to LEOs.

**Data Analytic Approach.** In order to examine the role of
psychological and physiological resilience as significant mediators of the MBRT on aggression and burnout, four mediation models will be tested (see Figure 1).

In the context of randomized controlled trials, it has been suggested that residualized change scores (i.e., post-intervention scores predicting pre-intervention scores) should be used (MacKinnon, 2012). This method accounts for regression toward the mean, and has been used in studies of mindfulness among LEOs (Bergman et al., 2016) and in trials of MT (Greeson et al., 2011). Residualized change scores between pre- and post-intervention will be used for all variables rather than follow-up scores, which in the parent study were found to be not significantly different between conditions (M. S. Christopher et al., 2018). In order to more thoroughly assess the relationship between study variables, and how these relationships may differ based on the independent variable (MBRT vs WL), effect sizes will also be calculated in accordance with best practices for mediation analyses in RCT datasets (Kraemer, 2016; Kraemer & Kupfer, 2006). Specifically, Cohen’s $d$ (Cooper & Hedges, 1993; Hedges & Olkin, 1985), which was designed for responses on study variables across conditions that approximate a normal distribution (Kraemer & Kupfer, 2006), will be used. Effect sizes will be calculated using the PROCESS macro for SPSS (A. Hayes, 2012).

Hayes’ (A. Hayes, 2012) PROCESS macro for SPSS will be used to test the mediation models in Figure 1. PROCESS uses an ordinary least squares method of estimation to assess direct and indirect effects of mediation. More specifically, PROCESS will be used to: (1) estimate the direct effect of condition (MBRT vs. WL) on aggression and burnout at follow-up, as well as the total and specific indirect effects for each proposed mediator (changes scores for psychological resilience and physiological resilience) on aggression and burnout; (2) produce the Sobel test for the specific indirect effects of the proposed mediators; (3) generate 90% bias-
correct bootstrap confidence intervals for the indirect effects using 10,000 bootstrap samples; and (4) estimate regression coefficients using the 10,000 bootstrap samples. The direct effect of condition on aggression and burnout will be used to determine partial or full mediation (i.e., reduced or rendered non-significant, respectively).

PROCESS uses a two-fold method to examine the presence of mediation: bias-corrected bootstrapping and confidence intervals are calculated to estimate the indirect effect in addition to the normal theory approach (i.e., Sobel test). The bootstrap confidence interval method is an ideal compromise between the overly conservative normal theory approach, and the overly liberal Monte Carlo confidence interval method (Hayes & Scharkow, 2013). Further, Hayes (A. Hayes, 2014) argues the bootstrap confidence interval method is preferable to the Sobel test due to the latter’s impractical assumption of normality in the sampling distribution for the indirect effect.

PROCESS allows for the inclusion of covariates in the computation of indirect effects, thereby allowing a test of the significance of the proposed mediators in the presence of other possible mediators of MT (i.e., self-compassion). This analytic component satisfies Kazdin’s second criterion of demonstrating the specificity of the proposed mediators. Effect sizes for strength of the mechanistic effect of psychological resilience and physiological resilience in the presence of relevant covariates will be estimated by assessing: (1) whether the mediation effects of psychological and physiological resilience on aggression and burnout are full or partial; (2) the ratio of the indirect effect to the total effect; and (3) the ratio of the indirect effect to the direct effect.

**Data completeness.** Intent-to-treat analyses will be used to allow data from all participants, including those who dropped out of treatment, to be included. For participants who dropped out,
we were able to obtain data regarding reasons for dropping out: scheduling conflict \((n=10)\) and displeasure with randomization assignment \((n=2)\). Based on these reasons, we assume their data to be *missing not at random*. To address the missing cortisol data and general missingness resulting from drop out, multiple imputation to minimize the introduction of bias via non-random missingness will be used (Donders, van der Heijden, Stijnen, & Moons, 2006; Sterne et al., 2009). This will be performed via the “Impute Missing Data values” command in SPSS. This command runs several (5 by default) of these simulations wherein the data set is supplemented with the best pattern of imputed data, as previously described. Following this process, the resulting simulations are averaged together to take into account the variance of the missing values. SPSS provides two methods of multiple imputation: the Markov Chain Monte Carlo and monotone. To determine the proper course of action, the “Automatic” feature of SPSS’ multiple imputation feature will be used in the present proposal. This function scans the data for monotonicity, or a pattern of missingness, as a check for the nature of missing data (e.g., not at random). If monotonicity is found, this is an indication of a discernable pattern of missingness, and therefore the data will be determined to be missing not at random. Given the nature of the missing data in the parent data set, we predict the data will be determined to be missing not at random, in which case SPSS will utilize the monotone method of multiple imputation. In this method, each variable is fit to a model with all preceding variables as predictors, then missing values are imputed for the variable being predicted to assess for best fit.
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Chapter Four

IRB Approval Letter

August 5, 2016

Registered: August 4, 2016
Registration Expires: August 4, 2021
IRB Reference Number: 092-16
Project Title: [937373-1] Psychological and Physiological Resilience as Primary Mechanisms of Action in Mindfulness Training among Law Enforcement Officers
Investigators: Josh Kaplan
Faculty Advisors: Michael Christopher, PhD

Review Category: Exempt Review

This letter signifies that the above research project has been reviewed by the Institutional Review Board at Pacific University and has been registered for five (5) years based on the provided materials. While being mindful of participant confidentiality, keep this letter on file, along with all informed consent and release forms, until the expiration date listed above. The IRB has determined this project is EXEMPT from 45 CFR 46 requirements in accordance with 45 CFR 46.101(b)(2).

As this project was deemed exempt, it does not require continuing review from the IRB. However, if a research-related incident (i.e., adverse event, issue of noncompliance, unanticipated problem) occurs during the course of the study, or if you anticipate modifying the project in any way, please complete the necessary paperwork (available on the IRB website) and submit it to the IRB immediately. As a researcher, you are responsible for the well-being and safety of your participants.

This project automatically will be closed by the IRB at the end of the five (5) year registration period. A project closure request will not be necessary. However, if your project lasts for a period of greater than five (5) years, you must submit a new proposal no less than thirty (30) calendar days before the expiration date listed above. This is required because federal regulations and/or IRB policies and procedures may change during the registration period, thereby requiring further scrutiny of the project.

If you have any questions, please do not hesitate to contact Breanna Grove at 503-352-1478 or irb@pacificu.edu. Please include the Pacific University IRB Reference Number 092-16 and your project title in all correspondence with this committee.

Sincerely,

Pacific University Institutional Review Board

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Pacific University's records.