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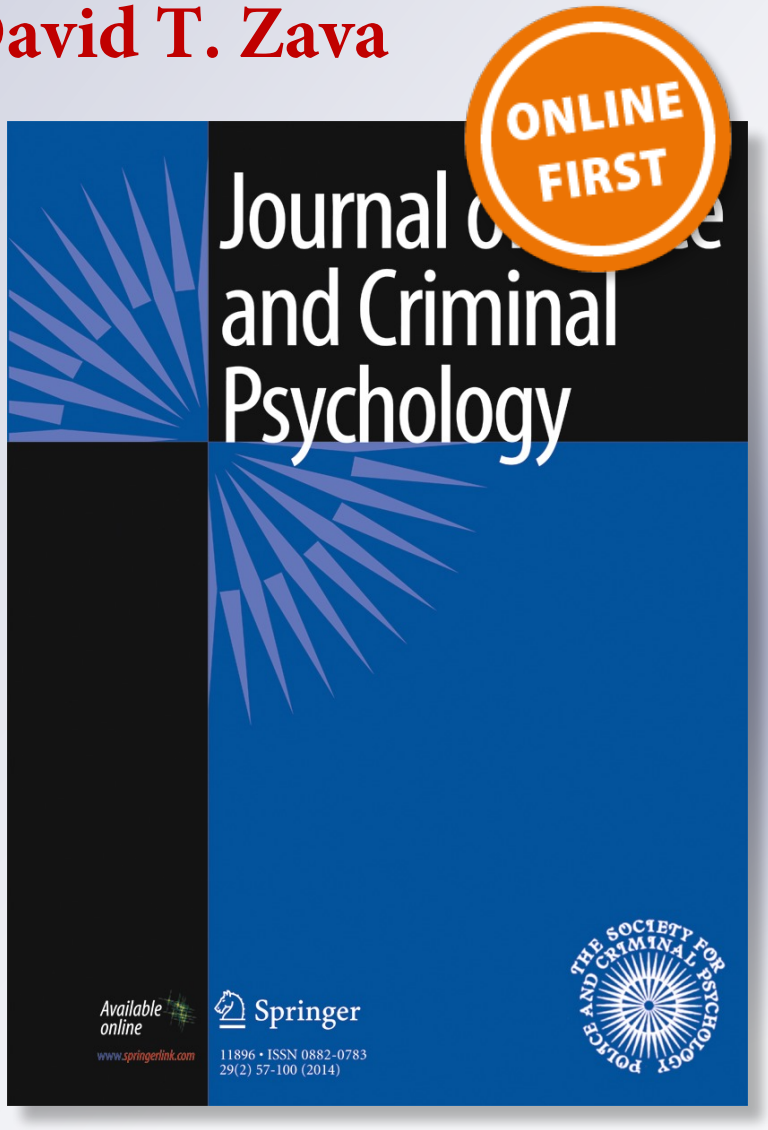

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A Pilot Study Evaluating the Effectiveness of a Mindfulness-Based Intervention on Cortisol Awakening Response and Health Outcomes among Law Enforcement Officers

Michael S. Christopher · Richard J. Goerling · Brant S. Rogers · Matthew Hunsinger · Greg Baron · Aaron L. Bergman · David T. Zava

ABSTRACT As first responders who are frequently exposed to job-related trauma, police officers are at an elevated risk of adverse mental and physical health outcomes. Evidence-based approaches to stress reduction are sorely needed to address the complex variety of problems that police officers face. In this pilot study we examined the feasibility and preliminary effectiveness of a mindfulness-based intervention designed to address police officer stress. A total of 43 police officers completed an 8-week Mindfulness-Based Resilience Training (MBRT) program, which was designed to improve mindfulness, resilience, stress, health outcomes, and emotional functioning. Using multilevel models we found significant improvement in self-reported mindfulness, resilience, police and perceived stress, burnout, emotional intelligence, difficulties with emotion regulation, mental health, physical health, anger, fatigue, and sleep disturbance. Although there were no significant pre-to-post-MBRT changes in cortisol awakening response (CAR), while controlling for pre-MBRT increase area under the curve (AUC_I), change in mental health was a significant predictor of post-AUC_I. Implications of these findings and areas for future research are discussed.

Keywords Police Officers · Stress · Mindfulness · Resilience

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INTRODUCTION

Policing is widely considered to be one of the most stressful occupations (Hartley et al. 2011b; Violanti et al. 2009a). Day-to-day work activities often put police officers in potentially life-threatening situations, and exposure to violence, pressure to perform efficiently, and public ambivalence contribute to an atmosphere of chronic stress (McCraty and Atkinson 2012; Waters and Ussery 2007). As a result, police officers have one of the highest rates of injury and illness among all professions (U.S. Department of Labor, retrieved from http://www.bls.gov/ooh/protective-service/police-and-detectives.htm), including firefighters and military personnel (Violanti, 2010). In addition to high operational stress, organizational stressors also contribute significantly to the demands of the job, including internal politics, litigation, lack of lateral or vertical specialty opportunities (e.g., "stuck in patrol"), criminal justice system outcomes (e.g., responded to a critical incident sexual assault, and suspect is released), irregular shifts, and regular policy changes (Gelderen et al. 2007; Juniper et al. 2010; Shane 2010; Tuckey et al. 2012).

Collectively, the various demands of the job result in a chronically stressful environment that puts police officers at higher risk than the general population for developing adverse mental and physical health outcomes (Hartley et al. 2011a). More specifically, officers experience higher rates of depression (Wang et al. 2010), post-traumatic stress disorder (PTSD; Marmar et al. 2006), and alcohol use disorders (Rees and

Smith 2008) relative to the general population. Moreover, police occupational and organizational stress has been shown to contribute to fatigue, sleep disruption, and irritability (Rajaratnam et al. 2011), as well as increased incidence of PTSD and depression symptoms (Wang et al. 2010). In turn, these mental health issues have been linked to poor coping (e.g., alcohol misuse) and increased suicide attempts among officers (Chopko et al. 2013; Larned 2010; Menard and Arter 2013). Police officers are more likely to die from suicide than in the line of duty, and officers who have 15 to 19 years of experience have the highest rates of completed suicides (Miller, 2006). This elevation in completed suicides by veteran officers speaks to the compounding effect of chronic stress on mental health (O'Hara et al. 2013). In terms of physical health, relative to the general population, police officers are at higher risk for sudden cardiac death (Joseph et al. 2009; McCraty and Atkinson 2012) and for developing diabetes, obesity, and metabolic syndrome (O'Hara et al. 2013; Paton et al. 2008). In addition to the impact these issues have on well-being, impaired officers are more likely to make serious administrative errors and exhibit other adverse work-related outcomes including uncontrolled anger toward suspects, absenteeism, and falling asleep while driving (Rajaratnam et al. 2011). The deleterious effects of work-related stress often pervade home life as well. For example, Anderson et al. (2002) found that following critical incidents, police officers often experience a significantly elevated heart rate that does not resolve before ending their shift and returning home, which has been linked to disruptive family relationships (Martinussen et al. 2007).

In several previous studies, salivary cortisol has been used as a biomarker to study stress and its associated consequences among police officers. For example, officers in training simulations who expected to be shot with marker ammunition evidenced increased cortisol secretion compared to officers who did not expect return fire (Taverniers et al. 2011). Temporarily heightened cortisol arousal may be beneficial; this has been related to enhanced quickness at identifying potential targets in a training scenario (Akinola and Mendes 2012). However, among police officers, chronically elevated cortisol has been implicated in higher incidents of metabolic syndrome, cardiovascular problems (Violanti et al. 2009b), and truncal obesity (Sharp et al. 2013).

Given the negative physical, mental, economic, and social health impact of policing, it is not surprising that burnout rate is high (Burke 1994). Among police officers burnout is correlated with emotional exhaustion, depersonalization, and lack of personal accomplishment (Lee and Ashforth 1996), especially when officers find their own personal values in conflict with situational and/or organizational demands (Schaible and Gecas 2010). A potential contributing factor to burnout is that police organizations and police culture do not adequately prepare officers to cope with the physical, emotional, and mental stressors associated with acute trauma and chronic stress (Anshel 2000). Law enforcement culture values emotional "toughness", suppression, and control (Burke 1994; Williams et al. 2010), which may dissuade officers from accessing available support services (Tuckey et al. 2012). Instead, police recruits are generally taught to manage emotions through avoidant and action strategies (Carlan and Nored 2008). Additionally, the forces of police culture and the routine occupational exposure to human suffering contribute to maladaptive stress coping throughout the arc of the officer's career. This cultural approach to stress management undermines psychological wellbeing and psychosocial safety (Burke 1998; Tuckey et al. 2012). Collectively, stress and its negative outcomes are problematic because successful policing requires rapid and accurate decision-making, and stress can severely impact the emotion regulation, self-awareness, and good judgment that policing demands.

Existing Police Officer Wellness Programs

The substantial physical, emotional, social, and economic costs of police officer stress and the limitations of the American Policing Institution (Goerling 2012) in managing these issues suggest a clear need for innovative and novel prevention programs to promote wellness and reduce violence. Existing programs have included elements of cognitive-behavior therapy (Gersons et al. 2000; Coulson 1987) and interventions such as visualization, progressive muscle relaxation, stress inoculation (Arnetz et al. 2009; Ranta 2009; Shipley and Baranski 2002) and cognitive decision-making training (Alpert and Rojek 2011) have resulted in positive psychological (e.g., decreased anger, depression, and anxiety) and physiological (e.g., reduced cortisol) outcomes. Additionally, McCraty and Atkinson (2012) found that police officers trained in heart rhythm coherence biofeedback experienced reductions in stress, negative emotions, depression, and increased peacefulness and vitality as compared to a control group. Despite these positive findings, overall doubts remain about the impact of these programs. In a recent meta-analysis, Patterson et al. (2012) examined the effectiveness of stress management interventions among police officers, and found such weak effect sizes across studies that they concluded the "results of the present review indicate that stress management interventions had no significant effect on psychological, behavioral or physiological outcomes. These results do not provide evidence to support the efficacy of stress management interventions for police officers or recruits" (p. 27). This suggests that despite some modest success in reducing stress and its negative outcomes in several isolated studies, additional

evidence-based approaches to stress reduction are sorely needed to address the complex variety of problems that police officers face (Violanti et al. 2011). One possible approach is the well-established Mindfulness-Based Stress Reduction (MBSR; Kabat-Zin 1990) program.

MBSR is theoretically grounded in secularized Buddhist meditation practices, mind-body medicine, and the transactional model of stress, which suggests that people can be taught to manage their stress by adjusting their cognitive perspective and increasing their coping skills to build self-confidence in handling external, stressful situations. MBSR and similar mindfulness-based interventions have been shown to enhance resilience (Fourer et al. 2013), decrease difficulties with emotion regulation (Robins et al. 2012), and decrease stress (e.g., Chiesa and Serretti 2009; Christopher et al. 2014) and its outcomes, including those known to be experienced at elevated rates among police officers, including burnout (Goodman and Schorling 2012), fatigue (Carlson and Garland 2005), poor sleep (Gross et al. 2011), anger (Singh et al. 2014), depression (e.g., Hofmann et al. 2010), and anxiety (e.g., Vøllestad et al. 2011). Additionally, in a number of meta-analyses, MBSR has evidenced medium to large effect sizes in enhancing a variety of physical and mental health outcomes (e.g., De Vibe et al. 2012; Eberth and Sedelmier 2012). Lastly, MBSR and other mindfulness-based interventions have been shown to alter salivary cortisol levels (e.g., Brand et al. 2012; Matousek et al. 2011) and the use of cortisol levels as a physiological marker of stress may be useful to validate self-reported benefits attributed to these programs (Matousek et al. 2010).

Mindfulness research on police officers is limited; however, self-reported mindfulness and several of its facets (e.g., accepting without judgment) were found to be inverse predictors of depression among police trainees (Williams et al. 2010) and PTSD symptoms among active-duty police officers (Chopko and Schwartz 2013). Unexpectedly Chopko and Schwartz (2009) found that accepting without judgment was an inverse predictor of posttraumatic growth. Additionally, Kelley and Lambert (2012) found that dispositional mindfulness related negatively with self-reported aggression and hostile attribution bias and positively with thought recognition among criminal justice majors. Relatedly, Berking et al. (2010) examined the effectiveness of a six week manualized emotion-regulation training (Integrative Training of Emotional Competencies; iTEC) that focuses on muscle relaxation, breathing relaxation, nonjudgmental perception of emotions, acceptance and tolerance of emotions, compassionate self-support, identification and causes of emotional reactions, and active modification of emotions. They found that the training increased officers' acceptance of negative emotions, compassionate self-support, and "readiness" to confront situations that cue negative emotions. Similarly, Mindfulness-Based Mind Fitness Training (MMFT®) is a 20-hour course designed to improve performance and enhance resilience for pre-deployment military personnel. MMFT blends (1) mindfulness skills training with (2) information and skills that promote stress resilience and (3) concrete applications for the operational environment. Among samples of Marines, more time engaged in MMFT exercises outside of class has been related to greater improvement in cognitive functioning and positive emotions, and larger decreases in perceived stress and negative emotions (Stanley and Jha 2009). Similarly, Johnson et al. (2014) found that Marines who received MMFT showed improved heart rate, breathing rate, and lower plasma neuropeptide Y concentration after stressful training relative to a control group. This is promising evidence suggesting that an adapted MBSR course may be an effective strategy for police officers to enhance resilience, mindfulness, and mental and physical health, and to decrease stress, burnout, anger and other negative outcomes.

Therefore, the purpose of this pilot study was to examine the feasibility and preliminary effectiveness of an adapted MBSR program—Mindfulness-Based Resilience Training (MBRT)—designed specifically to address police officer stress. Based on past research examining stressors and health outcomes for individuals in law enforcement and military professions, we made the following hypotheses.

1. MBRT would improve:
    a. mindfulness and resilience,
    b. health outcomes,
    c. stress and burnout,
    d. emotional functioning, and
    e. family functioning
2. Pre- to post-MBRT changes in mindfulness, physical health, mental health, and stress would predict post-MBRT salivary cortisol, while controlling for pre-MBRT salivary cortisol, and
3. Based on research findings that mindfulness starts improving before stress starts decreasing in standard MBSR training (Baer et al. 2012), we hypothesized that mindfulness and emotional functioning would improve during the MBRT training before officers reported improvements in the outcome variables noted above.

METHOD

Participants

Participants were recruited from a police department in a medium-sized city in the Pacific Northwestern United States from Spring 2013 to Spring 2014. Three separate 8-week

Mindfulness-Based Resilience Training (MBRT) courses were offered through a partnership with the Hillsboro Police Department, Pacific University, and a community-based wellness center all located in the same community (details of the MBRT program are provided below). All eligible personnel in the department were invited to apply to participate in one of the three MBRT courses, therefore the potential participant pool was 175. Due to the variable nature of work schedules among participants in our sample, we purposefully planned to offer the course on different days and times on three separate occasions (April, 2013; September, 2013; and January, 2014) to allow for the maximum number of potential interested personnel to participate. As an incentive to participate in the MBRT course, participants completed the training while on duty; all time spent in the training counted toward their weekly shift hours. A total of 72 participants enrolled in the MBRT courses; however, only data on the 62 police officers in the training is included in this study (data on 10 civilian support staff were excluded). The number of officers in each group was: 22 in April, 2013, 21 in September, 2013, and 19 in January 2014. The sample was 64% male, the average age was 43.76 years (*SD* = 7.22; range = 24-61), and in terms of race and ethnicity, 53 (85%) were Euro-American; 6 (10%) were Latino/a American; and 3 (5%) identified as Other. The sample was composed of 48 officers, 9 sergeants, 3 lieutenants, and 2 other. The average number of years on the force was 13.72 (*SD* = 5.96; range 2-25).

MBRT Intervention

MBRT is a learning intervention designed to enhance physical and mental resilience in the face of the stressors common in the culture of police officers. It is derived from the basic MBSR framework and maintains the same general intention for participants: learning to use one's inner, mindful resources to meet and work directly and effectively with life's difficulties. Parallel to the MBSR program, MBRT is an 8-week curriculum designed to train participants in a number of experiential exercises evoking qualities of mindfulness: mental focus, sustained attention and a broad sense of personal and situational awareness. These exercises include versions of the body scan (body awareness exercise), sitting meditation, mindful movement, walking meditation, eating meditation, mindful martial arts exercises and other elements of MBSR outlined by Kabat-Zinn (1990). During class there are periods of discussion exploring the experience of these exercises, as well as daily homework practice of the experiential mindfulness exercises, supplemented with several readings and journaling. Prior to the 8-week training there is an orientation session focused on the nature of practice of mindfulness, the physiology of the stress response, and the relevance of the training to the lives of police officers.

MBRT weekly classes are 2 hours in length, 30 minutes less than MBSR's class duration. In MBRT the seventh week is an extended class of 6 hours rather than the MBSR curriculum's 7-hour silent retreat on the sixth week of the program.

MBRT employs methods and exercises that are familiar to police officer culture. During MBRT class time there are far fewer invitations for interpersonal discussion of personal experience of the mindfulness exercises. We found this helpful because of the relatively personal disclosure-averse nature of police officer culture. Also, during the arc of the course didactic learning is much more prominent than in MBSR. We found this to be very helpful for participants as they sought to enhance their intention to endure the challenges of the training. An additional dimension of didactic learning in the tradition of typical police officer trainings is the inclusion of a debriefing at the conclusion of each class period to have participants ask questions and give frank feedback about the class.

The mindful encounters exercise is a derivation of the martial arts exercises employed in the MBSR curriculum to practice mindful interpersonal conflict. Hence the mindful encounters exercise is framed as off-the-job or at-home situations avoiding reference to taking-into-custody encounters and other on-duty type interactions. In another classroom exercise, reactivity awareness, participants settle into a sustained, reclined breath awareness practice and then with verbal instruction to sustain awareness, a 911 call center recording with emergency audio tone is played for 60 seconds and then tuned off. Participants are cued to continue sustained attention to body sensation and breath for a few more minutes helping them gain an experiential sense of stress physiology.

An example of a mindfulness exercise is a homework assignment in which participants are asked to bring moment-to-moment attentive awareness of their experience of donning and doffing their uniform. Another exercise unique to MBRT is the movement practice taught in MBRT termed mindful movement rather than yoga. It constitutes a generalized series of relatively rigorous physical activities evoking strength, agility, breath awareness, mental focus and stretching with none of the standard yoga postures taught in MBSR. In addition, participants are invited to include a quality of mindfulness during their regular exercise regimen such as running, swimming, or biking as part of their mindful movement homework.

Self-Report Measures

Participants completed all measures at time 1 (before the first class), time 2 (after week 4), and time 3 (after the last class).

All measures were administered across the three groups (April, 2013; September, 2013; and January, 2014) unless otherwise noted.

Mindfulness and Resilience

The **Five Facet Mindfulness Questionnaire** (FFMQ; Baer et al. 2006) is 39-item measure based on exploratory and confirmatory factor analyses of questionnaires assessing individuals' dispositional tendency to be mindful in daily life. The FFMQ consists of five facets of mindfulness: *observing*, *describing*, *acting with awareness*, *nonjudging of inner experience*, and *nonreactivity to inner experience*. Each facet is measured using eight items, with the exception of nonreactivity, which is measured using seven items. Participants indicate how often they engage in mindful activities using a Likert-type scale from 1 (*never or rarely true*) to 5 (*very often or always true*); several items are reverse scored and all items are summed to form a total mindfulness score. Higher scores indicate greater mindfulness. In past research, the FFMQ was found to demonstrate good internal consistency and convergent validity (Baer et al. 2006, 2008). To reduce participant burden, we used the 24-item version of the FFMQ developed by Bohlmeijer et al. (2011) and we only administered the *acting with awareness*, *nonjudging of inner experience*, and *nonreactivity to inner experience* subscales because the *describing* and *observing* facets have been found to be relatively less reliable across individuals with differing levels of meditation experience (e.g., Christopher et al. 2012; de Bruin et al. 2012). Each of these facets had five items resulting in a 15-item scale and the internal consistency of the scale in the present sample was good (pre-MBRT α = .82; post-MBRT α = .88).

The **Mindfulness Process Questionnaire** (MPQ; Erisman and Roemer 2012) is a 7-item self-report measure that assesses the extent to which mindfulness is intentionally practiced/attempted and the ability to bring compassionate awareness to the present moment after noticing attention is elsewhere or that one's awareness has a judgmental quality. Items are rated on a 5-point Likert-type scale, ranging from 1 (*not at all characteristic of me*) to 5 (*entirely characteristic of me*). All items were summed to create a total score, and higher scores indicate greater mindfulness. The internal consistency is adequate (α = .71) and it was moderately correlated with the MAAS (r = .39) and FFMQ (r = .49), suggesting that the measures are related, yet distinct constructs (Erisman & Roemer). The MPQ was also significantly negatively correlated with depression, stress, anxiety, and affective control, and positively correlated with subjective happiness and quality of life. In the present sample the MPQ demonstrated good internal consistency (pre-MBRT α = .81; post-MBRT α = .88).

The Brief Resilience Scale (BRS; Smith et al. 2008) is a 6-item measure designed to assess the ability to bounce back or recover from stress. Items are rated on a 5-point Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*), and three of the items are reverse scored. All items were summed to create a total score, and higher scores indicate greater resilience. The BRS has demonstrated good internal consistency (α = .83), a single factor structure, and expected correlations with a variety of constructs, including perceived stress, depression, and active coping (Smith et al. 2008). In the present sample the BRS demonstrated good internal consistency (pre-MBRT α = .87; post-MBRT α = .90).

Health Outcomes

The **Patient Reported Outcomes Measurement Information System (PROMIS®)** is an NIH Roadmap initiative designed to improve self-reported outcomes using state-of-the-art psychometric methods (e.g., item response theory) and technology (e.g. computer adaptive testing). In this study we used short form versions of several PROMIS domains to assess health outcomes. The *Global Health Short-Form* is a 10-item instrument representing multiple domains that can be scored into a *Global Physical Health* (GPH) component and *Global Mental Health* (GMH) component. Additionally, we assessed *Anger* (8 items), *Fatigue* (4 items), *Sleep Disturbance* (4 items), and *Pain Interference* (4 items). All items are rated on a 5-point Likert-type scale using various endpoints (e.g., 1 = *Never* to 5 = *Always*). Scores are reported on the *T* score metric [M = 50; standard deviation (SD) = 10] that is centered on the general United States population mean in terms of age, gender and race/ethnicity. For all PROMIS measures higher scores indicate more of the outcome being measured (e.g., anger, fatigue, mental health). All of the PROMIS short forms have demonstrated acceptable internal consistency, and correlations with expected constructs were observed for all scales (e.g., Cella et al. 2007). In the present sample *GPH* (pre-MBRT α = .64; post-MBRT α = .66), *GMH* (pre-MBRT α = .80; post-MBRT α = .82), *Anger* (pre-MBRT α = .89; post-MBRT α = .89), *Fatigue* (pre-MBRT α = .94; post-MBRT α = .94), *Pain Interference* (pre-MBRT α = .96; post-MBRT α = .97), and *Sleep Disturbance* (pre-MBRT α = .71; post-MBRT α = .67) demonstrated acceptable internal consistency.

Stress and Burnout

The 4-item **Perceived Stress Scale-4** (PSS-4; Cohen and Williamson 1988) was used to assess the degree to which situations in life are perceived as stressful. Items on the PSS-

4 are designed to capture how unpredictable, uncontrollable, and overloaded participants find their lives. Items are rated on a 5-point Likert-type scale ranging from 0 (*never*) to 4 (*very often*), and higher scores indicate greater stress. All items were summed to create a total score. The PSS-4 has adequate internal consistency ($\alpha = .78$) and has demonstrated expected correlations with a variety of constructs (Cohen and Williamson 1988). In the present sample the PSS-4 demonstrated acceptable internal consistency (pre-MBRT $\alpha = .69$; post-MBRT $\alpha = .68$).

The **Police Stress Questionnaire** (PSQ; McCreary and Thompson 2006) is a 40-item questionnaire consisting of two subscales measuring *operational* stressors (20 job content items) and *organizational* stressors (20 job context items) on a seven-point Likert-type scale, ranging from 1 (*no stress at all*) to 7 (*a lot of stress*), and higher scores indicate greater stress. For each type of stress, all items were summed to create a total score. The organizational and operational subscales have demonstrated excellent internal consistency (α's > .90), factorial validity, and expected correlations with other constructs (Shane 2010). In the present sample the PSQ *operational* (pre-MBRT $\alpha = .85$; post-MBRT $\alpha = .93$) and *organizational* (pre-MBRT $\alpha = .88$; post-MBRT $\alpha = .91$) demonstrated good internal consistency.

The **Oldenburg Burnout Inventory** (OLBI; Demerouti et al. 2003) is a 16-item measure of burnout with two dimensions: *exhaustion* and *disengagement*. The eight-item *exhaustion* subscale assesses general feelings of emptiness, overtaxing from work, a strong need for rest, and a state of physical exhaustion. The eight-item *disengagement* subscale assesses distancing oneself from the object and the content of one's work and negative, cynical attitudes and behaviors toward one's work in general. Items are rated on a 4-point Likert scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*). Four items on each subscale (8 items in total) are reversed scored. For the overall scale items were summed to create a total score, and higher scores indicate greater burnout. The OBLI has demonstrated acceptable internal consistency, factorial validity, and expected correlations with other constructs (Demerouti et al. 2010). In the present sample, the OLBI (pre-MBRT $\alpha = .85$; post-MBRT $\alpha = .88$) demonstrated acceptable internal consistency.

Emotional Functioning

The **Emotional Intelligence Scale** (EIS; Schutte et al. 1998) is a 33-item scale of emotional intelligence based on Salovey and Mayer's (1990) conceptualization. Items are rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and three items are reverse scored. All items were summed to create a total score, and higher scores indicate greater emotional intelligence. Previous research has found the total score on the EIS to be acceptably internally consistent (e.g., $\alpha = .90$) and it has demonstrated expected correlations with other constructs (Schutte et al. 1998). In the present sample the EIS demonstrated good internal consistency (pre-MBRT $\alpha = .94$; post-MBRT $\alpha = .95$). The EIS was only administered to the April, 2013 and September, 2013 groups.

The **Difficulties in Emotion Regulation Scale** (DERS; Gratz and Roemer 2004) is a 36-item measure that assesses clinically relevant difficulties in emotion regulation (with a particular emphasis on negative emotions). Items are scored on six scales, labeled: *lack of emotional awareness* (6 items), *lack of emotional clarity* (5 items), *difficulties controlling impulsive behaviors when distressed* (6 items), *difficulties engaging in goal-directed behavior when distressed* (5 items), *non-acceptance of negative emotional responses* (6 items), and *limited access to effective emotion regulation strategies* (8 items). Items are rated on a 5-point Likert-type scale ranging from 1 (*almost never* [0-10%]) to 5 (*almost always* [91-100%]), and several items are reverse scored. All items were summed to create a total score, and higher scores indicate greater difficulty with emotion regulation. The DERS has demonstrated good test-retest reliability ($p < .01$) and internal consistency ($\alpha = .93$; Gratz and Roemer 2004). Support for the construct and predictive validity of DERS have also been found (Gratz and Roemer 2008). In the present sample the DERS demonstrated good internal consistency (pre-MBRT $\alpha = .92$; post-MBRT $\alpha = .93$). The DERS was only administered to the September, 2013 and January, 2014 groups.

Family Functioning

The **Family Assessment Device** (FAD; Epstein et al. 1983) is a 60-item measure assessing family functioning. The FAD consists of six subscales and a seventh subscale (*general family functioning: GFF*) incorporates items from the six subscales. In this study we only used the 12-item GFF scale, which can be used as an indicator reflecting global family functioning (Kabacoff et al. 1990). The GFF items are rated on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*), and 6 of the 12 items are reverse scored. All items were summed to create a total score, and higher scores indicate poorer family functioning. The GFF subscale has demonstrated good internal consistency ($\alpha = .84$), test re-test reliability, and evidence of expected correlations with other constructs (Shek 2001). In the present sample the GFF demonstrated good internal consistency (pre-MBRT $\alpha = .89$; post-MBRT $\alpha = .90$). The GFF was

only administered to the September, 2013 and January, 2014 groups.

Saliva Collection

Saliva was collected in 5 ml polypropylene tubes using procedures as described by ZRT Laboratory (http://www.zrtlab.com). This noninvasive technique can be used at home and interferes only minimally with normal daily routines. Participants collected approximately 2-3 ml of saliva at 0, 30, and 45 minutes after awakening in the morning pre- and post-MBRT. Participants were instructed to log their study code number and the date and the time they collected each sample directly on the label affixed to each tube. Pre-MBRT saliva collection was performed within the first 5 days preceding the commencement of the 8-week program, while post-MBRT saliva collection was performed within the 5 days following the completion of the 8-week program. Awakening was either spontaneous or by alarm clock. Participants were asked to refrain from eating, drinking (except for water), smoking, brushing teeth, taking medications, and exercising before completing all sample collections. Saliva was processed and assayed for cortisol with an FDA-approved direct (non-extracted) salivary EIA cortisol kit (Pantex). Cortisol was measured in 25 microliter saliva samples by slight 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 were not transformed. Salivary cortisol was only collected from the September, 2013 and January, 2014 groups, and complete pre and post data were available for 24 participants.

The regulation of cortisol in humans follows a strong circadian rhythm – levels are highest in the morning after awakening, and decline throughout the day with the nadir around midnight, to rise again in the early morning hours (Matousek et al. 2011). A distinct characteristic of the HPA axis is the cortisol awakening response (CAR). The CAR, reflecting the organism's response to the natural stressor of awakening, is a discrete part of the cortisol circadian cycle. In healthy individuals, it is characterized by a sharp rise (between 50 and 75%) of cortisol levels within the first 30 minutes after awakening (Clow et al. 2010). Repeated measurement of free cortisol levels within the 60 minutes after awakening in the morning is considered a stable and reliable biological marker of adrenocortical activity (Pruessner et al. 1997). In this study we sought to investigate the usefulness of employing the CAR as a stress marker before and after the MBRT program. Given this novel approach, the analyses are exploratory in nature.

Design and Analyses

To examine changes in our measures during the course of MBRT, we used a multilevel modeling approach with restricted maximum likelihood estimation (REML) to examine linear change over time as a fixed effect. We used REML because our data collection resulted in varying sample sizes for our measures. Multilevel modeling with REML allows for more accurate estimates with small sample sizes and missing data that are missing at random or completely at random (Maas and Hox 2005; Snijders and Bosker 1993). To test whether changes in mindfulness, emotional intelligence, and difficulties with emotion regulation (i.e., process variables) preceded changes in mental health, physical health, stress, pain interference, anger, fatigue, sleep disturbance, burnout, resilience, and family functioning (i.e., outcome variables), using the multilevel modeling approach, we first examined which variables significantly changed from time 1 to time 2, from time 2 to time 3, and from time 1 to time 3. If increases in the process variables preceded improvements in the outcome variables, we may see significant changes halfway through the program for mindfulness, emotional intelligence, and difficulties in emotion regulation, but at some time after the midpoint of the training for global mental health, global physical health, stress, pain interference, fatigue, sleep disturbance, burnout, resilience, and family functioning.

To analyze the CAR, we utilized multilevel modeling with REML examining the main effects of phase of measurement (pre, post) and time after waking (0, 30, 45 minutes), as well as the interaction between the main effects. In addition, we investigated the association between the cortisol response patterns and change in several variables, namely mindfulness (FFMQ), stress (PSS-4), physical health, and mental health. For that purpose, we computed the area under the curve with respect to increase (AUC_I) to analyze the linear relationship between each independent variable and cortisol awakening levels. Cortisol levels were transformed into a single value by calculating the AUC_I for each assessment day (1 pre and 1 post). These variables were then used in a hierarchical linear regression with pre-AUC_I entered in step 1, and change in stress, physical health, mental health, and mindfulness entered in step 2, to predict post-AUC_I. Alpha was set at .05 for all analyses.

RESULTS

Figure 1 shows the participant flow. A total of 62 police officers provided written consent to enroll in the study. Three participants withdrew (citing lack of time or scheduling

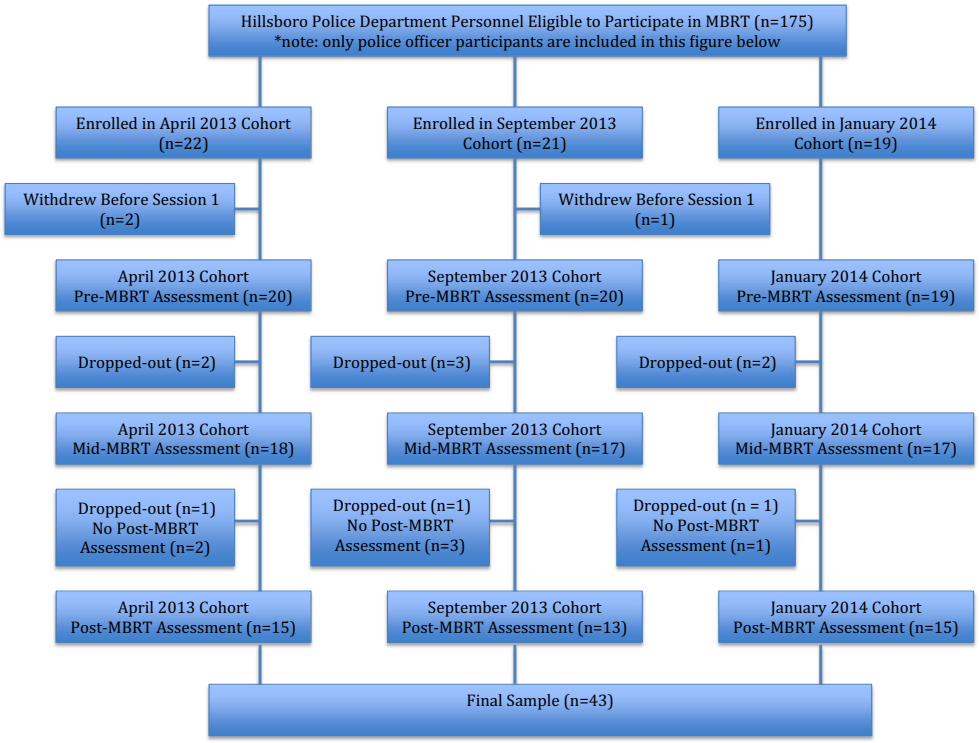

Figure 1 Participant flow for Three MBRT Groups

conflicts) before the program commenced; thus, 59 officers began the program. Seven participants dropped out before the 4th MBRT session, 3 participants dropped out between sessions 4 and 8, and 6 participants were unable to complete the post-MBRT measures, resulting in a final sample of 43. Participants reported a variety of reasons for dropping out of the program (e.g., difficulty attending the training due to their work schedule) that suggested the missing data were missing completely at random.

Changes across MBRT

First we tested whether all of our hypothesized self-report variables improved over the course of MBRT. Analyses revealed that mindful process, all three facets of mindful outcome (*acting with awareness*, *nonjudging of inner experience*, and *nonreactivity to inner experience*), resilience, mental health, physical health, and emotional intelligence increased (i.e., improved) across the training, *p*s < .05. Additionally, analyses revealed that sleep disturbance, anger, fatigue, burnout, difficulties with emotion regulation, general stress, organizational police stress, and operational police stress decreased (i.e., improved) during the training, *p*s < .05. There was a marginally significant decrease in pain interference ($p = .07$) and the training did not significantly impact family functioning ($p > .10$). See Table 1 for all descriptive and inferential statistics.

Assessing whether Mindfulness, Emotional Intelligence, and Difficulties with Emotion Regulation Changed Before the Other Variables

We were also interested in whether mindfulness (both process and outcome), emotional intelligence, and difficulties with emotion regulation improved before the other variables improved. First, we examined whether each variable significantly changed by the mid-point of the training and from the mid-point to the end of the training. Analyses revealed a marginally significant increase in participants' overall mindful outcome scores by the mid-point of the training ($p = .06$). We did not find statistical evidence for changes at the mid-point for the separate mindful outcome facets (*p*s > .10; *acting with awareness*, *nonreactivity to inner experience*, and *nonjudging of inner experience*); however, all means were in the expected direction. All of the variables, except for family functioning, significantly improved from the mid-point to the end of the training and from the beginning to the end of the training (*p*s < .01); and pain interference showed a marginally significant improvement ($p = .07$). These analyses provide weak evidence that mindfulness increased before mental and physical health, resilience, burnout, and stress improved.

Changes in CAR and association between CAR and outcomes

Analyses examining changes in cortisol revealed no significant changes across measurement periods (pre- and post-

Table 1 Descriptive and Inferential Statistics for Study Final Sample (N = 43)

	Time 1 M (SD)	Time 2 M (SD)	Time 3 M (SD)	*F*-value, *p*-value	Effect Size (CI of Difference Score) Pre-Post
FFMQ Total Score	46.18 (6.89)	48.56 (6.49)	55.16 (7.89)	38.26, < .001	1.19 (12.89, 6.44)
FFMQ Non-reactivity	14.58 (3.03)	15.39 (3. 07)	17.81 (3.20)	25.74, < .001	1.19 (4.79, 2.24)
FFMQ Non-judging	17.05 (3.53)	17.56 (3.78)	19.79 (3.47)	13.44, < .001	.73 (3.99, 1.19)
FFMQ Act Awareness	14.55 (3.39)	15.45 (3.31)	17.55 (3.56)	18.90, < .001	.87 (5.18, 1.93)
MPQ	20.55 (4.20)	21.78 (3.80)	24.76 (4.44)	24.66, < .001	.70 (5.78, 1.62)
BRS	21.50 (4.26)	22.18 (4.02)	24.37 (4.20)	11.27, .001	.70 (4.70, 1.29)
OLBI	39.19 (6.87)	37.88 (6.71)	33.89 (7.44)	13.70, < .001	.74 (-3.08, -10.22)
EIS	113.92 (16.64)	115.88 (16.21)	125.28 (18.45)	6.90, .01	.74 (17.37, 5.28)
DERS	60.28 (15.25)	58.02 (14.74)	50.87 (12.71)	6.60, .01	.83 (-2.11, -15.80)
PSQ Organizational	69.01 (18.78)	66.03 (19.12)	56.63 (19.91)	9.86, .002	.72 (-6.75, -23.09)
PSQ Operational	62.23 (18.09)	58.96 (18.75)	52.29 (16.69)	7.57, .007	.56 (-2.81, -16.62)
PSS	9.70 (2.73)	9.29 (2.59)	7.67 (2.57)	13.73, < .001	.75 (-.86, -2.76)
GFF	22.63 (6.46)	22.10 (6.91)	20.03 (5.99)	2.48, .12	.22 (4.49, -2.16)
PROMIS PH	45.72 (7.57)	45.76 (7.20)	48.82 (6.61)	4.18, .04	.48 (2.03, .19)
PROMIS MH	45.95 (7.45)	46.92 (6.70)	51.64 (8.04)	13.83, < .001	.78 (3.67, 1.21)
PROMIS Fatigue	54.71 (8.41)	52.44 (6.80)	49.04 (8.31)	12.89, < .001	.59 (-.90, -4.57)
PROMIS Sleep Disturbance	52.83 (6.97)	51.86 (7.68)	48.12 (6.28)	10.50, .001	.74 (-1.25, -4.15)
PROMIS Pain Interference	50.33 (8.42)	50.75 (8.89)	47.03 (7.57)	3.53, .07	.37 (2.37, -.08)
PROMIS Anger	53.55 (6.30)	52.08 (7.60)	47.44 (6.88)	18.28, < .001	.63 (-1.44, -6.40)

Note. FFMQ Non-reactivity = Five-Facet Mindfulness Questionnaire - Non-reactivity Facet, FFMQ Non-judging = Five-Facet Mindfulness Questionnaire - Non-judging facet, FFMQ Act Awareness = Five-Facet Mindfulness Questionnaire - Act with Awareness facet, MPQ = Mindfulness Process Questionnaire, BRS = Brief Resilience Scale, OLBI = Oldenburg Burnout Inventory, EIS = Emotional Intelligence Scale, DERS = Difficulties in Emotion Regulation Scale, PSQ Organizational = Police Stress Questionnaire - Organizational, PSQ Operational = Police Stress Questionnaire - Operational, PSS = Perceived Stress Scale, GFF = Global Family Functioning, PROMIS PH = Patient Reported Outcomes Measurement Information System – Physical Health, PROMIS MH = Patient Reported Outcomes Measurement Information System – Mental Health PROMIS Fatigue = Patient Reported Outcomes Measurement Information System – Fatigue, PROMIS Sleep Disturbance = Patient Reported Outcomes Measurement Information System – Sleep Disturbance, PROMIS Pain Interference = Patient Reported Outcomes Measurement Information System – Pain Interference, PROMIS Anger = Patient Reported Outcomes Measurement Information System – Anger

MBRT) and times after waking (0, 30, 45 min), *p*s > .05; in addition, the interaction effects for these variables were not significant, *p*s > .05. See Table 2 for *M*'s and *SD*'s for pre- and post-MBRT cortisol values and AUC_I. In addition, we tested a hierarchial linear regression with pre-AUC_I entered in step 1, and change in stress, physical health, mental health, and mindfulness entered in step 2, to predict post-AUC_I. Only change in mental health was a significant predictor of post-AUC_I (β =

Table 2 Salivary Cortisol Values across Mindfulness-Based Resilience Training (nmol/L)*

	Minutes After Awakening			
	0 M (SD)	30 M (SD)	45 M (SD)	AUC_I M (SD)
Pre-MBRT	12.37 (6.44)	14.39 (6.18)	14.29 (5.99)	60.01 (203.08)
Post-MBRT	13.74 (6.48)	15.65 (6.54)	13.74 (6.69)	43.18 (216.53)

*Main effect of minutes after awakening (0, 30, 45): $F(1, 146) < 1$, $p > .10$; Main effect of training measure period (pre-MBRT, post-MBRT): $F(1, 146) < 1$, $p > .10$; Interaction effect of minutes of awakening by training measure period: $F(1, 146) < 1$, $p > .10$.

-.61, $p = .02$). As shown in Figure 2, lower CAR post-MBRT was associated with more improvement in mental health scores from pre- to post-MBRT, while controlling for pre-AUC_I.

DISCUSSION

The purpose of this pilot study was to examine the feasibility and preliminary effectiveness of a mindfulness-based intervention designed to address police officer stress. Based on past research examining stressors and health outcomes for individuals in law enforcement and military professions, we hypothesized that MBRT would improve mindfulness, resilience, stress, burnout, health outcomes, emotional functioning, and family functioning. We also examined the impact of MBRT on salivary cortisol, and the relationship between pre-to-post MBRT changes in mindfulness, physical health, mental health, stress, and salivary cortisol. Lastly, we were also interested in examining whether changes in mindfulness and emotional functioning preceded changes in the other outcomes we examined.

To the best of our knowledge, this is the first study to specifically examine the impact of a mindfulness-based intervention on police officer functioning. Consistent with prediction, we found significant increases in mindfulness, resilience, mental health, physical health, and emotional intelligence. This replicates previous research with MBSR across various populations (e.g., De Vibe et al. 2012; Eberth and Sedelmier 2012; Fourer et al. 2013) including the military (Kearney et al. 2013; Omidi et al. 2013). Similarly, after the 8-week MBRT course, our sample demonstrated significant decreases in sleep disturbance, anger, fatigue, burnout, difficulties with emotion regulation, general stress, organizational police stress, and operational police stress. These results are also consistent with previous research (e.g., Carlson and Garland 2005; Chiesa and Serretti 2009; Christopher et al. 2014; Goodman and Schorling 2012; Gross et al. 2011, Robins et al. 2012; Singh et al. 2014), demonstrating the transdiagnostic impact of mindfulness-based interventions. Two self-report variables did not evidence statistically significant change—family functioning and pain

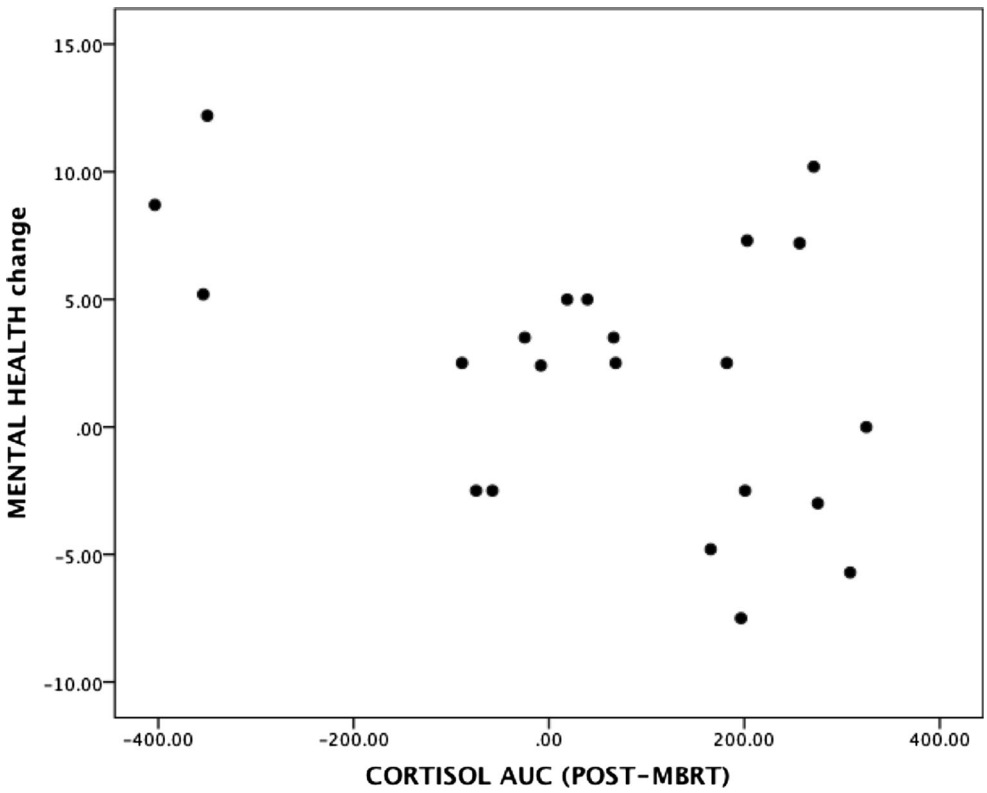

Figure 2 Associations between CAR and changes in mental health

interference—although the decrease in pain interference was marginally significant and the means for family functioning trended in the expected direction.

Although we found statistically significant improvement from pre-to-post MBRT for most self-report measures, there were no significant changes in CAR. Several other studies have examined the impact of MBSR on CAR and have found mixed results. Among a sample of patients receiving treatment for substance abuse in a therapeutic community, Marcus et al. (2003) found significant reductions in salivary cortisol levels from pre- to post-MBSR, such that the increase in cortisol on awakening post-intervention was less than the increase prior to the intervention. Similarly, Brand et al. (2012) found that after an 8-week introductory MBSR course, CAR levels decreased. Although Marcus et al. (2003) and Brand et al. (2012) found decreases in CAR post-MBSR, Matousek et al. (2011) found that CAR showed a prolonged increase after awakening at the post-MBSR assessment period among women receiving treatment for breast cancer. It is important to note that post-traumatic stress disorder is characteristically associated with an attenuated CAR with a low first waking sample (Fries et al. 2009). Matousek et al. (2011) noted that their sample consisted exclusively of women following treatment for breast cancer, which they suggested, given the traumatic nature of cancer and its treatment, may have resulted in the participants exhibiting a blunted CAR at baseline. Collectively, the participants' CAR levels in our sample neither increased nor decreased; however, the baseline CAR levels of our sample were very similar to the Matousek et al. (2011) sample, which may suggest that our sample may have also had a blunted CAR at baseline as a result of their exposure to chronic work-related stress.

Despite no change in pre-to-post-MBRT CAR levels, we did find that pre-to-post MBRT changes in mental health negatively predicted post-MBRT AUC_I, while controlling for pre-AUC_I. This suggests that improvement in mental health symptoms over the 8-week course was inversely related with post-MBRT AUC_I. This finding is supported by similar studies that have found correlations between various aspects of mental health functioning and CAR (Adam et al. 2014; Shibuya et al. 2014; Vrshek-Schallhorn et al. 2013). Additionally, Daubenmier et al. (2014) recently found that dispositional mindfulness moderated the relationship between psychological distress and CAR, such that psychological distress was associated with CAR at lower levels of dispositional mindfulness but not at higher levels. Although no mindfulness-based intervention was delivered in the Daubenmier et al. study, these results suggest that mindfulness may mitigate the impact of distress on CAR.

Also partially consistent with prediction, we found weak statistical evidence for changes in mindful outcome at the mid-point of the training. There was a marginally significant increase in overall mindful outcome scores by the midpoint of the training (p = .06). There was no statistical evidence for mindful process and emotional functioning (i.e., emotional intelligence and difficulties with emotion regulation) improving by the mid-point. All of the variables, except for family functioning and pain interference, significantly improved from the mid-point to the end of the training. These analyses provided weak evidence for aspects of mindfulness increasing before mental and physical health, resilience, burnout, and stress improved. This weak evidence is consistent with Baer et al. (2012), who found that mindfulness starts improving before stress starts decreasing in standard MBSR training. Even though our experimental design did not allow causal conclusions regarding the impact of mindfulness on health, our results are consistent with improvements in mindfulness driving improvements in health.

This study has several notable limitations. First, although repeated measurement of free cortisol levels within the 60 min after awakening in the morning is considered a stable and reliable biological marker of adrenocortical activity, given the day-to-day variability in cortisol production, multiple days of testing pre- and post-participation in a MBSR program is suggested instead to obtain an accurate reflection of cortisol regulation (e.g., Matousek et al. 2010). Our design of a single day collection pre- and post-MBRT may have introduced a higher rate of error and decreased the confidence in our results. Second, without the benefit of a control group, we cannot make claims of causality regarding the impact of the MBRT intervention. Third, this relatively small sample of homogenous participants was gathered from a single police department, which limits the generalizability of the findings. Fourth, the small sample size, particularly for the cortisol analyses (n = 24) may have limited the ability to detect changes over time. Finally, several of our measures, particularly the PROMIS Physical Health and PSS-4, had relatively low estimates of internal consistency, which may have resulted in attenuated correlations between change in these measures over time and CAR.

Additional practical limitations, such as a lack of funding for wellness programs at many police departments and the time required of busy officers to engage in a mindfulness practice, may limit the applicability of mindfulness-based interventions in a law enforcement. Future research should examine briefer protocols, as well as qualitative designs to investigate officers' perceptions of participating in a mindfulness-based intervention. Additionally, several interesting studies have found a relationship between dispositional or naturally occurring mindfulness and positive outcomes among police officers (e.g., Chopko and Schwartz 2013; Williams et al. 2010). In explaining their finding that dispositional mindfulness related negatively with self-reported aggression and hostile attribution bias among criminal justice majors, Kelley and Lambert (2012) hypothesized that mindful people have quieter minds, higher-quality thinking, and good mental health, including the traits

and skills necessary to handle threats in a responsive manner without anger and unnecessary aggression. They suggest that thought recognition may be a pivotal factor, which may operate by allowing the natural predisposition toward mindfulness (and other positive traits) to occur and enhance mental health, without a formal intervention. Thought recognition and other mechanisms that contribute to the development of dispositional mindfulness in police officers, and ultimately, to positive outcomes should be further explored.

Despite the limitations of this study, we believe these results have important implications. Given voluminous research on stress and related consequences, and the dearth of research on effective stress management interventions among police officers, these preliminary findings suggest that an 8-week intervention can be both feasible and effective. Continued exploration in this area may help us understand and measure the mental qualities that lead to the improvements in health and functioning observed in MBRT. Accordingly, future research should focus on larger-scale studies of the impact of mindfulness-based interventions among police officers, as well as the physiological and psychological processes that mediate the impact of training on health and performance. Future research should also collect data from multiple police departments to understand if and how variability in organizational structure and culture impacts the effectiveness of training.

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