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Mindfulness Training, Implicit Bias, and Force Response Decision-making

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Abstract

Objective: The goal of this study was to assess the preliminary efficacy of a Mindfulness-Based Training (Mindfulness-based Resilience Training; MBRT) in improving weapon identification among Law Enforcement Officers (LEOs).

Methods: Participants ($N = 61$) were randomly assigned to either MBRT or a no-intervention control group (NIC). A self-report questionnaire assessing mindfulness and a computerized measure assessing implicit stereotype reliance were administered at baseline, post-training, and three months following intervention completion. We also collected information about meditation practice outside of the training for LEOs in the MBRT group.

Results: Inferential analyses yielded improvements in mindfulness in the MBRT group compared to NIC. Analyses did not provide evidence for implicit stereotype reliance at baseline and therefore did not yield a significant impact of MBRT versus NIC on implicit stereotype reliance, $ps > .05$; however, participants across both conditions exerted more control when responding to Black male targets compared to White male targets, $F(1,74) = 3.98$, $p = .05$, 95% CI [−.05, −.01], $d = .36$.

Conclusions: Our results do not provide evidence for the impact of MBRT on weapon identification, but do suggest that LEOs exerted more effort when responding to images of Black males compared to White males. We discuss recommendations for future clinical trials assessing

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Author Contributions

MH: designed and executed the study, performed data analyses, and wrote the methods, results, and discussion sections. MC: designed and executed the study, provided feedback on data analyses, and provided feedback on writing the manuscript. AS: wrote the introduction section and provided feedback on the rest of the manuscript. All authors approved the final version of the manuscript for submission.

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Ethical standards: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The reported research was approved by the Interval Review Board at the home institution of all authors (Pacific University).

Informed consent: Informed consent was obtained from all individual participants included in the study.

implicit stereotype reliance, viz., that researchers utilize measures more sensitive to a wider range of LEO samples and with higher ecological validity, and we discuss potential reasons why our results do not align with past research.

Keywords

mindfulness; implicit bias; police

Policing is one of the most highly stressful occupations (Violanti et al., 2006; Violanti et al., 2011). Unpredictable exposure to critical incidents and violence, as well as societal expectations for optimal performance in these situations, can create an intensely stressful work environment and lead to significant negative mental health, professional, and behavioral outcomes for law enforcement officers (LEOs) (Avdija, 2014; McCrathy & Atkinson, 2012; O'Hara et al., 2013). LEOs must be prepared to respond adaptively based on situational context; doing so involves navigating several decision points, including accurately identifying the level of danger posed, which can include weapon identification. In addition, there are the decisions regarding appropriate level of force to use and whether to use firearm force (i.e., force response decision-making). Force response decision-making (FRDM) requires engagement of several cognitive systems, many of which are sensitive to impacts of stress and emotional states and vulnerable to perceptual distortions.

The appropriate use of force, including use of firearms, is a necessary component of successful policing. However, acute and chronic stress can heighten physiological reactivity (Gouin, Glaser, Malarkey, Beversdorf, & Kiecolt-Glaser, 2012; McEwen, 2012) and tax cognitive resources (Dias-Ferreira et al., 2009; Porcelli & Delgado, 2009), which can negatively impact rapid decision-making. During states of emotional arousal, such as the elevated levels of anxiety that many LEOs experience when responding to high-stress incidents, the activation of the sympathetic nervous system may trigger a fight-or-flight response. In this state of anxiety, the body prioritizes allocation of resources to the sympathetic nervous system over the pre-frontal cortex, which houses several brain systems involved in exerting control, namely executive functioning (Andersen & Gustafsberg, 2016), which includes attentional control (Nieuwenhuys, Savelsbergh, & Odejans, 2011) and inhibition of automatic responses (Kleider, Parrott, & King, 2010). Indeed, stress-influenced poor decision-making is often implicated as the primary mechanism in excessive use of police force (McCrathy & Atkinson, 2012; Nieuwenhuys, Savelsbergh, & Oudejans, 2012).

While law enforcement training prepares LEOs to take appropriate action based on the situation at hand, sensory perception and interpretation of situational risk plays a crucial role in determining which action to take. Cognitive factors play a central role in perception and estimation of risk and, consequently, reactivity and responsiveness. As cognitive resources are compromised, the likelihood of experiencing sensory distortions increases. Such distortions include impairments of peripheral vision (i.e., “tunnel vision”) as well as auditory acuity (DuCharme, 2003), enhancing the likelihood of a LEO falsely identifying a suspect as carrying a weapon (Nieuwenhuys, Savelsbergh, & Oudejans, 2011). As emotion regulation, sensory perception, and executive function systems become impaired by physiological reactivity, individuals become more likely to react in an automatic manner,

rather than respond adaptively based on objective and relevant information (Andersen & Gustafsberg, 2016; Dror, 2007; Nieuwenhuys et al., 2011).

In addition to the impact of emotional arousal and perceptual distortions, automaticity and control also play a role in LEO-citizen interactions. Over the past two decades, an abundance of research on bias has emerged, indicating that we hold bias at both conscious (explicit) and unconscious (implicit) levels. Explicit bias, which is part of explicit social cognition, refers to deliberate and conscious beliefs about attributes (i.e., stereotypes) and evaluations (i.e., prejudice) of social groups. In contrast, implicit bias refers to automatic associations that link social groups to evaluations and/or attributes, is engendered by cultural norms/artifacts (e.g., racial stereotypes based on images in the media) and past experience, requires few cognitive resources to activate, exists outside of conscious awareness, is activated without conscious intention or initiation, and can guide perceptions and behavior without conscious awareness (Gawronski & Bodenhausen, 2006; Holmes & Smith, 2012).

In rapid decision-making, behaviors are subject to the impact of both automaticity and control (Payne, 2006). Therefore, entering an environment similar to settings in which one has previously encountered danger can negatively impact rapid decision-making through engendering reliance on habitual responses and unconscious associations linking social groups to danger. Research suggests that White-Americans tend to associate African- and Latin-American males with criminality and violent behavior more so than members of other racial groups (Cottrell & Neuberg, 2005; Eberhardt, Davies, Purdie-Vaughns, & Johnson, 2006; Hetey & Eberhardt, 2014). Therefore, it is likely that White-American LEOs hold unconscious racial biases against racial minorities in the form of automatic associations. As such, automatic associations linking minority racial groups to violence and aggression are likely to activate when a LEO is interacting with a member of a racial minority group, regardless of whether the association is relevant to the current situation, thereby increasing the potential of the LEO to misperceive a scene as dangerous and use an excessive level of force.

Relying solely on broad, automatic associations to interpret information and determine action may have deleterious consequences. The interactive effect of automatic and control processes is considered to be implicated in FRDM (Payne, 2001). In policing, cognitive control manifests, in part, as intentional responsiveness (Kubota & Ito, 2014; Payne, 2006). As discussed above, as stress levels and task-demands increase, executive functioning, including cognitive control, is significantly reduced (Andersen & Gustafsberg, 2016; Dror, 2007; Nieuwenhuys et al., 2011). In order to circumvent the compromised ability to engage control processes, the brain recruits the most resource-efficient processes to react (Plessow, Schade, Kirschbaum, & Fischer, 2017), such as automatic processes, including implicit biases. Even in states of cognitive depletion, automatic associations remain readily accessible (Wang et al., 2016). Therefore, when responding to a scene, a LEO may be required to rapidly identify whether a potential suspect poses an imminent threat, and then immediately respond using an appropriate level of force. If the civilian is a Black male, automatic associations linking Black males to violence may cause a White-American LEO to be more likely to incorrectly identify the nature of the object (i.e., misidentify a harmless object as a weapon) and experience an impulse to react with excessive force. This

misperception can lead to threat perception failure in that minority individuals, including unarmed minority individuals, are perceived as a greater threat to safety than they actually are (Fachner & Carter, 2015; Nix, Campbell, Byers, & Alpert, 2017). In a study on the factors involved in situations in which LEOs used firearm force with unarmed suspects, threat perception failure was found to be one of the main factors; moreover, Black suspects were more likely than White suspects to be the subject of a threat perception failure (Fachner & Carter, 2015). In contrast to the impact of automaticity on threat perception, conscious control processes may influence decision-making by leading a LEO to identify the object correctly, mitigating the impulse to use excessive force (Payne, 2001). If the LEO's executive functioning was compromised due to sympathetic nervous system activity, unconscious associations, versus control processes, will be more likely to guide perception and behavior.

In implicit bias research, automaticity and control are commonly differentiated by the levels of processing required when reacting; either reacting impulsively (fewer cognitive resources required) or responding with deliberate intent (greater taxation of cognitive resources) (Amodio et al., 2004; Greenwald, Poehlman, Uhlmann, & Banaji, 2009). In tasks assessing racial biases in FRDM, automaticity is commonly measured by differences in errors made when the target is White compared to Black. In contrast, control is frequently measured by a delay in decision-making. A recent meta-analysis (Mekawi & Bresin, 2015) found that on the Shooter Bias Task (SBT, Correll et al. 2002), a simulation of FRDM focusing on weapon identification, participants were generally quicker to "shoot" armed Black (relative to White) targets, slower to *not* shoot unarmed Black (relative to White) targets, and more likely to have an overall liberal shooting threshold for Black compared to White targets (i.e., a lower threat threshold for Black compared to White targets), demonstrating implicit bias against Black males. These error rate and response latency findings indicate that individuals' responses to Black targets (compared to White targets) were driven by automaticity. Moreover, Mekawi and Bresin also found these patterns in samples of LEOs, suggesting that both control and automatic processes impacted simulated FRDM with trained professionals. There is also research finding that LEOs are able to correct for the activation of automatic associations. In three studies using a shooter simulator that more closely resembles what LEOs face in the field by utilizing videos with actors and actresses instead of using static images, James and colleagues (2013, 2014, 2016) found a reversal of the race bias typically found such that LEOs were more likely to shoot unarmed White suspects compared to unarmed Black suspects, and slower to shoot armed Black suspects compared to armed White suspects. Moreover, they found that the majority of LEOs demonstrated implicit stereotype activation, as measured by the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), but that IAT responses did not predict decisions to shoot on the shoot simulator task, suggesting that implicit bias activation did not impact FRDM.

There are also studies using the SBT that find no evidence for racial bias in error rates among LEOs; however, this can depend on factors such as cognitive resources and the prototypicality of the targets. Ma and Correll (2011) found that when Black targets showed an average level of prototypicality (i.e., in terms of facial features), community members showed racial bias against Black males in error rates on the SBT, but LEOs did not;

however, when prototypicality was high, LEOs demonstrated racial bias against Black males in error rates, but less so than community members. Ma et al. (2013) found evidence for racial bias in error rates on the SBT for police recruits when they reported mean or low levels of sleep (low to moderate cognitive resources); however, racial bias was not present when recruits reported high levels of sleep (high cognitive resources). Lastly, there are studies suggesting that the impact of implicit bias on FRDM can be limited to response latencies. Correll et al. (2007) found that a sample of LEOs demonstrated implicit bias in their response latencies to armed and unarmed Black versus White males, but not in their error rates.

Together, these studies suggest that the impact of implicit bias on FRDM in LEO samples depends on factors such as prototypicality of facial features and cognitive depletion. The results also suggest that LEOs, in correcting for the impact of implicit bias on FRDM, may overcompensate and demonstrate biased responding against majority/dominant group members. Given the variability in findings across studies using the SBT and more true-to-life shooter simulators with LEO samples (in terms of whether racial bias is found and in what form) and presence of racial bias in FRDM in the majority of published studies (whether the bias is directed towards the minority or majority group), interventions are needed that eliminate biased responding altogether instead of having it shift from the minority group to the majority group.

Research on implicit bias suggests that better understanding the interrelationship between implicit bias and FRDM is instrumental in moving towards achieving equal treatment of ethnic and racial majority and minority groups by LEOs. Attempts to directly change individuals' implicit biases have largely proven to be unreliable and to have variable utility in impacting behavior (Forscher et al., 2017). Instead of targeting unconscious associations, another approach is to target control processes in order to sever the link between the activation of unconscious associations and behavior. Cognitive control is a domain of executive functioning that is inherently targeted throughout LEO training; as LEOs develop their impulse control abilities and inhibitory responses, they may become more adept at ignoring the activation of implicit biases (Correll, Hudson, Guillermo, & Ma, 2014). Focusing efforts on capitalizing on and further enhancing areas of strength may support sustainable and meaningful change in policing.

As cognitive processes and perception can become dramatically impaired by the effects of stress (Andersen & Gustafsberg, 2016; Nieuwenhuys, Savelsberg, & Oudejans, 2011), LEO interventions that mitigate stress, improve executive functioning, and improve the ability to act with awareness of relevant information may improve FRDM. Preliminary evidence suggests mindfulness training (MT) may be a promising approach. Research on benefits of MT has garnered significant empirical support in laboratory, clinical, and community-based research, evincing outcomes such as improvements in executive functioning, viz., decision-making and working memory (Akinola & Mendes, 2012; Chiesa, Calati, & Serretti, 2011; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010), as well as reduced overreliance on habitual behavioral (Whitmarsh, Uddén, Barendregt, & Petersson, 2013) and emotional responses (Uusberg, Uusberg, Talpsep, & Paaver, 2016). Additionally, recent research demonstrates that MT reduces stress (for a meta-analysis see Chiesa & Serretti, 2009),

enhances emotion regulation (Wheeler, Arnkoff, & Glass, 2017), and reduces negative affect (Crosswell et al., 2017).

MT interventions have been successfully implemented among LEOs and other first responders, with results indicating that MT may be effective in reducing stress, aggression, and sleep disturbances (Christopher et al., 2018), as well as improving psychological resilience (Kaplan, Bergman, Christopher, Bowen, & Hunsinger, 2017). In addition, mindfulness has been shown to be negatively correlated with hyperarousal and intrusive thoughts among LEOs (Chopko & Schwartz, 2013). Given the impact of MT on executive functioning and the impact of compromised executive functioning on the expression of implicit bias, MT is likely to decrease the impact of implicit bias on FRDM among LEOs through improving executive functioning (viz., cognitive control). However, the question of whether MT decreases the impact of implicit bias on FRDM, to the best of our knowledge, has not yet been addressed in the research literature. There is limited research finding that a single session of mindfulness meditation can impact the activation of implicit associations (Lueke & Gibson, 2014) and discriminatory behavior (Lueke & Gibson, 2016). Although Lueke and Gibson (2016) provided initial evidence that mindfulness meditation can impact discriminatory behavior, it did so with a Trust Game activity. Given this, the current study aimed to explore whether an eight-week MT would decrease the impact of implicit racial stereotypes on one aspect of FRDM (i.e., weapon identification) in a sample of LEOs.

The aim of the present study was to assess the impact of MT (in this study, Mindfulness-based Resilience Training; MBRT) on weapon identification among LEOs. Based on past research finding biased FRDM in LEO samples (see Mekawi & Bresin, 2015), we hypothesized that LEO participants would demonstrate implicit stereotype reliance at baseline in the form of error rates (i.e., automatic estimates) and response latencies indicative of implicit bias against Black males. Error rates on the SBT indicative of bias against Black males entail a tendency to identity unarmed Black targets as armed more often than unarmed White males. In other words, if a LEO holds unconscious associations linking Black males to violence and aggression to a greater degree than White males, we would expect LEOs to make more mistakes with unarmed Black (compared to White) targets if those unconscious associations are impacting FRDM. Likewise, we would also expect the activation of implicit racial bias to cause LEOs to be quicker to identify armed Black males as armed more quickly than armed White males. Second, based on past research suggesting that MT improves executive functioning (Akinola & Mendes, 2012; Chiesa et al., 2011; Jha et al., 2010), we hypothesized that MBRT would reduce implicit stereotype reliance compared to a no-intervention control (NIC) group at post-training and follow-up compared to baseline, indicated by the following changes across time points in the MBRT group, but not in the NIC group: a decrease in differential error rates for unarmed Black males versus unarmed White males (i.e., a decrease in automatic estimates) and a decrease in differential response latencies for armed Black males versus armed White males. Finally, we hypothesized that participants in both MBRT and NIC conditions would exert more control when responding to Black targets compared to White targets (i.e., higher control estimates for Black compared to White targets). In other words, we expected that the more cognitive control participants exerted, the more often they would respond correctly to an armed target relative to how often they responded incorrectly to an unarmed target. This prediction is

based on past research finding that in some situations, LEOs eliminated biased FRDM towards Black males, but may overcompensate and show biased FRDM towards White males (James and colleagues, 2013, 2014, 2016). This suggests that LEOs were exerting more cognitive control when responding to Black males compared to White males.

Method

Participants

LEOs were recruited from six local police departments in the pacific northwest region of the United States through emails, flyers, and face-to-face interactions. A total of 68 LEOs were screened, 61 of whom enrolled in the trial. The sample size was determined by an a priori power calculation using a two-sided alpha = .05, a medium effect size, pre-post correlation of .50, and a power level of .80. The majority of participants identified as Caucasian (86%), Male (90%), and not of Hispanic/Latino origin (93%). LEOs had a mean age of 43.97 (*SD* = 6.03) and a mean of 18.23 years (*SD* = 6.83) working as a LEO, in a variety of job titles. Among the LEOs who enrolled in the study, the majority worked in police departments in urban settings (51%) with 1,000 full-time, sworn officers; 41% worked in departments in suburban settings with 100-300 full-time, sworn officers; three LEOs (5%) worked in small town settings with 15-30 full-time, sworn officers, and two (3%) worked for federal services (one for the FBI and one for the U.S. Marshall Service). Participants completed baseline measures and were randomized into an MBRT (n = 31) or no-intervention control (NIC; n = 30) group. Fifty LEOs returned for post-training data collection (n_{MBRT} = 24; n_{NIC} = 26), and 49 LEOs returned for the three-month follow-up data collection (n_{MBRT} = 24; n_{NIC} = 25). We collected information from the LEOs who dropped out of the study. All but two LEOs provided information about the reasons for dropping out, which included scheduling conflicts because of changes in work shift (n = 6), not wanting to continue with MBRT (n = 2), and displeasure with randomization (n = 2).

Procedure

MBRT intervention.—To test the impact of MT on FRDM, we utilized an MT protocol we developed based on the standard MBSR training (Kabat-Zinn, 1990), which we call Mindfulness-based Resilience Training (MBRT). The language and contents of MBSR were modified through collaboration between the primary interventionist, a police lieutenant, and select LEOs in the training division of a local police department, and were informed by qualitative feedback solicited from LEOs in an initial version of MBRT used in a pilot study (Christopher et al., 2016). LEOs met with an MBSR-certified teacher for eight two-hour weekly sessions. Sessions included didactic exercises centering on stress and resilience, and mindfulness practices such as body scans, seated meditation, walking meditation, mindful movement, followed by group discussion. The primary foci of the curriculum were development of mindfulness skills and application of these skills to typical LEO professional activities, e.g., critical incidents, interpersonal interactions during work, and interpersonal interactions outside of work. In-session content and exercises were supplemented with related homework exercises. Implicit bias was not explicitly mentioned during the training, as the training goal was building resilience and mindfulness. However, as described above, MBRT, like MBSR, targets executive functioning, which is implicated in the impact of

implicit bias on behavior; therefore, MBRT has the potential to impact FDMR without directly addressing implicit bias and the impact of implicit bias on FDMR.

No-intervention control group.—Participants in the NIC group did not participate in any kind of activity during the intervention training phase of the study. NIC participants simply attended data collection sessions during the same timeframe as MBRT participants.

Measures

The Shooter Bias Task (SBT; Correll et al., 2002) was used to assess the impact of implicit race stereotypes on one aspect of force response decision-making (i.e., weapon identification). The SBT has been used in past studies to measure the degree to which the stereotypic link between crime and Black American men impacts people's decision-making in a rapid task simulating object identification. In this task, participants have to decide within a very short period of time whether an individual is armed or unarmed. Guns and harmless objects occur with equal frequency during the task; therefore, using skin color as a piece of diagnostic information about object type, driven by implicit stereotypes about race and danger, constitutes implicit bias.

Participants completed three blocks of trials, the first two of which provided the opportunity to practice the task. The first block (8 trials) allowed participants to become familiar with the task with minimal response constraints. In each trial, participants viewed stimuli in the following succession: a fixation point was displayed for 1000 ms; an unpopulated scene (e.g., a city plaza or college campus) was displayed for 500, 700, 900, or 1,100 ms (chosen randomly within participants across trials); and, finally, the scene was filled with a Black or White male holding a gun or a harmless object (i.e., a cell phone or soda can) for 1,000 ms. The task typically entails providing a "shoot" response if the target is holding a gun and a "don't shoot" response if the target is holding a harmless object. After initial pilot testing with LEOs in the training division of a local police department, we used a dichotomous "armed" versus "unarmed" response set to maximize the degree to which decision-making in the task reflects the decision-making process for LEOs in the field (i.e., LEOs do not necessarily use firearm force if a citizen is armed). If participants responded incorrectly or did not respond within the 1,000 ms timeframe, an error message appeared and they automatically moved to the next trial. In a second practice block (12 trials), participants underwent the same sequence of stimuli, but had a shorter response window (700 ms) once the target appeared in the scene. The third block (80 trials), which served as the data collection block (i.e., critical trials), was identical to the previous block (700 ms response window) but with more trials. In this final block, stimuli were randomly selected from a pool of 80 stimuli which included 20 scenes paired with 4 targets (one armed Black and White man, one unarmed Black and White man). All stimuli were taken from Correll et al. (2002).

To create a measure of implicit racial bias based on responses on the SBT, we primarily examined the pattern of error rates across critical trials for Black and White targets separately using the Process Dissociation Procedure (PDP; Jacoby, 1991). PDP considers responses on a given task to be jointly, but independently, determined by automatic and control processes, and creates parameters that estimate the influence of each type of process;

therefore, PDP results in separate automatic estimates for responses to Black and White targets as well as separate control estimates for responses to Black and White targets. In the SBT, control processes are needed to fulfill the task goal of accurately identifying whether each target is armed or unarmed. Fulfilling this goal requires focusing on the object being held by the target while simultaneously ignoring irrelevant information such as the race of the target. Automatic processes are involved in the SBT to the extent that participants associate Black men with crime and violence. If so, trials with Black men will activate "Black + Danger" stereotypes automatically, regardless of the object he is holding, which will push participants to assume that because he is Black he must be armed. PDP entails considering two kinds of trials – congruent trials (trials in which an armed response would result from both control and automatic processes) and incongruent trails (trails in which control and automatic processes conflict and would result in different responses).

Control estimates derived from PDP reflect the degree to which participants exerted effort to correctly identify guns and differentiate them from harmless objects when responding to Black and White targets. This estimate is calculated by examining the pattern of error rates; more specifically, how often participants responded correctly to an armed Black or White target relative to how often they provided an "armed" response for an unarmed Black or White target. Algebraically, we derive the control estimate with the following formula:

$$\text{Probability (Correct response} \mid \text{Congruent trial)} - \text{Probability (Stereotypic error} \mid \text{Incongruent trial)}$$

In other words, the more control a LEO exerts, the more likely s/he will respond correctly and the less likely s/he will mistakenly identify an unarmed target as armed, resulting in a larger control estimate.

The automatic estimates derived from PDP reflect the degree to which unconscious "Black + Danger" and "White + Danger" associations influenced responses to Black and White targets, respectively. This estimate is also calculated by examining the pattern of errors rates; more specifically, how often participants are providing an "armed" response for an unarmed Black or White target. Algebraically, automatic estimates take into account control and stereotypic responses on incongruent trails:

$$\text{Probability (Stereotypic error} \mid \text{Incongruent trial)} \,/\, (1 - \text{Control estimate})$$

This formula assesses the likelihood of a LEO responding incorrectly to an unarmed target when control fails. Therefore, the automatic and control estimates do not represent two estimates in opposition to each other mathematically, but instead estimates of the dynamic process that occurs between automaticity and executive functioning across the 80 critical trials (i.e., LEOs could be exerting control across trials and automaticity could also be impacting responses on trials when control fails).

Our training expectancy measure (see Christopher et al., 2018 for a full description and citation) assessed the degree to which participants expected the training to improve

stress levels, job performance, and resilience, which we assessed using three sets of questions asking about beliefs about change, feelings about change, and the percentage of improvement expected. We created composite scores for each set of questions by computing a mean response across questions for stress, job performance, and resilience.

The Five Facet Mindfulness Questionnaire-short form (FFMQ-SF; Bohlmeijer, ten Klooster, Fledderus, Veehof, & Baer, 2011), which is based on the 39-item version of the FFMQ (Baer, Smith, Hopkins, & Krietmeyer, 2006), was used to assess trait mindfulness, i.e., the dispositional tendency to be mindful in daily life. The FFMQ-SF has five factors (*Non-reactivity, Non-judgment, Acting with Awareness, Describing* and *Observing*), we excluded the *Observe* and *Describe* factors due to their relatively lower reliability with novice and non-meditating populations (de Bruin, Toppers, Muskens, Bögels, & Kamphuis, 2012; Lilja, Lundh, Josefsoon, & Falkenström, 2013). Use of the remaining factors resulted in a 15-item scale, with higher scores reflecting greater levels of trait mindfulness. In our study, internal consistency for the *Acting with Awareness* ($\alpha_{Baseline}$=0.81; $\alpha_{Post\text{-}training}$=0.81; $\alpha_{Follow\text{-}up}$=0.86), *Non-judgment* ($\alpha_{Baseline}$=0.86; $\alpha_{Post\text{-}training}$=0.70; $\alpha_{Follow\text{-}up}$=0.81); and *Non-reactivity* ($\alpha_{Baseline}$=0.74; $\alpha_{Post\text{-}training}$=0.80; $\alpha_{Follow\text{-}up}$=0.85) sub-scales were acceptable to good.

We also collected home meditation practice data by issuing LEOs iPods (Apple, Inc.) with guided formal and informal meditation practices. LEOs were instructed to use the iPod when practicing meditation outside of the training. The iPods recorded when and for how long LEOs engaged in meditation practice using iMINDr, a software application that tracks meditation practice adherence (Wahbeh, Zwickey, & Oken, 2011). At the end of the study, we collected iPods from LEOs and therefore had access to information about when how often and for how long they used any of the guided meditation practices.

Participants completed the expectancy measure and a demographics measure at baseline; and the SBT and FFMQ-SF at all three time points. Analyses examining the general feasibility/acceptability of MBRT as well the impact of the training on other outcome measures are described in Christopher et al. (2018).

Data Analyses

We used an RCT design to assess the impact of MBRT on weapon identification. We first assessed potential group differences at baseline for demographic variables, training expectancies, and weapon identification variables using independent-samples *t*-tests. To assess the impact of MBRT on weapon identification, we conducted mixed Analysis of Covariance (ANCOVA) analyses with group (MBRT vs. NIC) as the between-subjects variable; time (baseline, post-training, and follow-up) as the repeated measures variable; and training expectancies at baseline and years on the police force as covariates. We used a complete-case analysis approach (i.e., conducted analyses without imputing data for missing data) to examine our hypotheses because the missing data were likely to be missing completely at random (Little's Missing-ness test, $p > .10$) and there was a large amount of attrition (from baseline to post-training, 22% in the MBRT group and 13% in the NIC group).

Results

We first examined whether participants in the MBRT and NIC groups differed at baseline on the demographic variables, responses on the SBT, and training expectancies. The only variable for which MBRT and NIC participants differed at baseline was the training expectancy for the percentage improvement composite. Participants in the NIC group (M = 46.96, SD = 20.51) reported expecting greater improvement compared to the MBRT group (M = 35.37, SD = 23.26), $t(59) = -2.06$, $p = .04$.

We found greater increases in the *Non-reactivity* factor on the FFMQ in the MBRT group compared to the NIC group from baseline to post-training, but no change for the other factors. We found no differences in trait mindfulness from baseline to follow-up. For a full description of analyses for changes in mindfulness across study time points, see Christopher et al. (2018). We also examined potential correlations between implicit stereotype reliance and mindfulness. There were no correlations between the FFMQ facets and PDP automatic estimates at baseline, post-training, and follow-up, ps > .05.

To assess the degree to which LEOs in the MBRT group engaged in meditation practice outside of the training, we examined the frequency data tracked with the iMINDr software from baseline to post-training and post-training and follow-up for LEOs in the MBRT group. During the course of the 8-week training, LEOs engaged in 14.4 days of practice on average (SD = 11.24) and an average of 36.17 minutes (SD = 4.59) each week. Given that LEOs were instructed to practice for 30 minutes a day outside of the training, as a group, the MBRT LEOs practiced 17.2% of the assigned practice time. During the follow-up phase of the study, only two LEOs in the MBRT group engaged in any meditation practice outside of the training.

To test our hypothesis that participants would demonstrate racial bias in weapon identification at baseline, we first assessed whether automatic estimates for Black and White targets differed from each other by conducting a mixed ANCOVA with Target Race (White vs. Black) and Group (NIC vs. MBRT) as the independent variables and automatic estimates at baseline as the dependent variable. This analysis revealed no main effect of Target Race, suggesting that participants did not differ in their error rates when responding to Black targets compared to White targets, and therefore did not demonstrate racial bias at baseline, $p > .05$. The analysis revealed neither a main effect of Group nor a Group x Target Race interaction effect, ps > .05. To assess racial bias at baseline, we also examined response latencies by conducting a mixed ANCOVA with Target Race (White vs. Black), Object Type (Non-weapon vs. Weapon), and Group (NIC vs. MBRT) as the independent variables and response latencies at baseline as the dependent variable. This analysis also did not provide evidence for racial bias at baseline; the analysis revealed only a main effect of Object Type such that participants were quicker to respond to armed targets (M = 489.77, SD = 38.34) compared to unarmed targets (M = 551.61, SD = 32.46), $F(1,49) = 9.38$, $p < .01$, 95% CI [−63.85, −53.75], $d = 2.82$.

Next, we examined our hypothesis that MBRT would reduce racial bias by conducting a mixed ANCOVA with Target Race (White vs. Black), Time (Baseline, Post-training,

and Follow-up), and Group (NIC vs. MBRT) as the independent variables, and automatic estimates as the dependent variable. The omnibus ANCOVA suggested no main effects and no interaction effects, *p*s > .05. We also conducted a similar analysis with response latencies. A mixed ANCOVA with Target Race (White vs. Black), Object Type (Non-weapon vs. Weapon), Time (Baseline, Post-training, and Follow-up), and Group (NIC vs. MBRT) as the independent variables and response latency as the dependent variable revealed only a significant main effect of Object Type such that participants were quicker to respond to armed targets (M = 488.42, SD = 33.28) compared to unarmed targets (M = 548.96, SD = 28.45), $F(1,46) = 5.47$, $p < .01$, 95% CI [−63.86, −53.60], $d = 2.87$. Together, these results suggest that MBRT did not impact the degree to which implicit danger associations influenced responses on the SBT.

Finally, we examined our hypothesis that participants would exert more control on the SBT when responding to Black compared to White targets by conducting a mixed ANCOVA with Target Race (White vs. Black), Time (Baseline, Post-training, and Follow-up), and Group (NIC vs. MBRT) as the independent variables, and control estimates as the dependent variable. The omnibus ANCOVA revealed only a main effect of Target Race such that participants exerted more control when responding to Black targets (M = .82, SD = .09) compared to White targets (M = .79, SD = .10), $F(1,74) = 3.98$, $p = .05$, 95% CI [−.05, −.01], $d = .36$. See Tables 1-3 for descriptive statistics for automatic estimates, control estimates, and response latencies.

Discussion

Being in a high-stress, high-risk profession, such as law enforcement, exposes an individual to a range of situations that are likely to compromise cognitive resources, potentially causing perceptual distortions. Stress and intense negative emotions activate a series of neurophysiological events that can impact perception and compromise executive functions such as working memory (Dias-Ferreira et al., 2009; Jha et al., 2010; Kleider et al., 2010; Porcelli & Delgado, 2009). These conditions are likely to impact FRDM, beginning with deciding whether an individual is armed. Research finds that White-Americans tend to associate Black males with violence both explicitly and implicitly (Cottrell & Neuberg, 2005; Eberhardt, Davies, Purdie-Vaughns, & Johnson, 2006; Hetey & Eberhardt, 2014). Depleted cognitive resources due to stress and/or intense negative emotional states can increase the impact of these implicit stereotypic associations on behavior (Friese, Hoffmann, & Wänke, 2008; Hofmann, Rauch, & Gawronski, 2007; Hofmann & Friese, 2008). Researchers have developed interventions targeting stress reduction among LEOs with promising results (Christopher et al., 2016; Christopher et al., 2018); however, there is little research on the impact of MT interventions on LEOs. Moreover, there is no research we know of that has investigated the impact of MT interventions on implicit bias among LEOs. Research on the impact of meditation/mindfulness training on executive functioning (Akinola & Mendes, 2012; Chiesa, Calati, & Serretti, 2011; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010) suggests MT is a promising intervention to reduce the impact of implicit bias on FRDM. The current pilot trial provided an initial investigation of the impact of MT on implicit bias in a sample of LEOs by examining the impact of MBRT on one of the

first decision points in FRDM, i.e., whether or not an individual is holding a weapon or a harmless object.

The goal of our trial was to investigate the impact of MBRT on unconscious stereotype reliance. Our study did not provide evidence for a reduction of the impact of implicit racial bias on FRDM. This may have been due to a floor effect for error rates; across the four kinds of trials on the SBT, LEOs in both experimental groups demonstrated a 6-10% error rate; therefore, there may not have been room for MBRT to improve performance through reducing error rates. This finding is consistent with past research finding that racial bias against Black males on the SBT tends to show up primarily in response latencies versus errors among LEOs (see Mekawi & Bresin, 2015), which is not surprising given the professional training LEOs undergo. However, there are studies that have found implicit bias against Black males on the SBT in the form of error rates in LEO samples (also see Mekawi & Bresin, 2015). In the present study, we did not find evidence for implicit bias against Black males in either error rates or response latencies.

There are two possible non-mutually exclusive explanations of this finding. Our analyses with PDP control estimates suggest that LEOs exerted more effort to respond correctly when responding to Black targets compared to White targets. It is possible that the low error rates when responding to Black targets were due to LEOs exerting relatively higher levels of effort to respond correctly to Black targets compared to White targets (i.e., filter out skin color when responding to a Black male to a greater degree than when responding to a White male), thereby severing the link between the activation of implicit danger stereotypes and behavior (i.e., object identification) in general and more so for Black males. This possibility is supported by a main effect of target race when examining control estimates, which suggests that more effort was exerted when responding to Black males, compared to White males, even at baseline. Past research finding that biased responding in FRDM may even reverse in favor of Black (versus White) males (James & colleagues, 2013, 2014, 2016) suggests that LEOs may tend to exert more cognitive control when responding to Black males compared to White males. This is not surprising given the current climate in the United States around policing. During the past decade, police use-of-force with minority populations has come more and more into the public spotlight. This is likely to lead LEOs to be more aware of their behavior when engaging in encounters during which force may be necessary, especially when interacting with individuals from minority populations. This awareness may then lead to an increase in cognitive effort exerted during FRDM with Black and White males, even when the decisions are occurring within a simulated situation. Therefore, our results for the control estimate are in line with James and colleagues' findings and speculation that the bias against Black males can be absent because of the engagement of executive functioning processes that override the impact of implicit bias.

Another potential reason why we did not find evidence of biased responding against Black males, which may work in concert with differential amounts of effort to respond accurately, is that the SBT may not be sensitive enough to capture the impact of implicit bias on FRDM with highly trained professionals such as LEOs across a wide range of samples. There may be differences in training and awareness of implicit bias across police departments in the United States that impact the degree to which implicit bias against Black males shows up

on the SBT in the form of error rates and/or response latencies. For example, one of the police departments in our sample has been undergoing training in the past few years that helps LEOs learn how to better navigate situations in which a person has a severe mental illness. Even though this training does not touch on implicit racial bias, the training may impact awareness such that it engenders a general awareness regarding the ways in which the unconscious mind can impact behavior. In addition, our sample contained LEOs with, on average, close to two decades of experience on the force. This amount of training and professional experience may have undermined, to some degree, the SBT's ability to detect the impact of implicit bias on FRDM and therefore any changes in that impact. Measures of FRDM that capture more nuanced and richer information than the presence vs. absence of a weapon with a static image may be necessary to measure the impact of bias across a wide range of LEO samples.

The variability in findings across samples of LEOs using shooter simulators (i.e., implicit racial bias is evident in error rates and response latencies, only in response latencies, or absent in both) suggests the presence of moderators. One of those moderators may be years of experience on the force. Research by James and colleagues (2013, 2014, 2016) and our study did not find evidence of racial bias against Black males in errors rates and response latencies among LEOs with close to two decades of experience on the force. In contrast, Ma et al. (2013) found evidence of implicit bias in error rates on a shooter simulator among two thirds of a group of police recruits. As an exploratory analysis, we re-ran our analyses using years of experience as an independent variable (using a median split to create a dichotomous, categorical variable) instead of as a covariate to see if years of experience moderated the impact of MBRT on FRDM. These analyses did not reveal any significant effects, suggesting that years of experience did not moderate the impact of MBRT on FRDM in our sample. Another moderator that is likely to be at work is the degree to which a sample of LEOs is experiencing cognitive depletion while engaging in simulated FRDM. Ma et al. found biased responding against Black males with police recruits with moderate to low levels of sleep (moderate to low cognitive resources), but not with well-rested recruits (high cognitive resources). Future research will need to investigate years of experience, cognitive resources, and other potential moderators.

Based on our findings, we have several recommendations for future trials investigating the impact of an MT intervention on FRDM with LEOs. Throughout the planning process, our LEO collaborators provided critical and invaluable guidance regarding modifications to the SBT to optimize its ecological validity. We recommend future trials include collaboration with local law enforcement agencies to insure optimal ecological validity of tasks employed to assess the impact of implicit bias on FRDM among LEOs. Our second recommendation to trialists is to employ shooter simulators that more closely resemble situations LEOs face and allow one to extract more nuanced information about FRDM. Our study, paired with past research using the SBT (Mekawi & Bresin, 2015), suggests that the SBT may not be sensitive enough to consistently capture the impact of implicit bias on FRDM, and therefore changes in the impact of implicit bias, across a wide range of LEO samples. One option is to modify the SBT to increase ecological validity by using images that more closely resemble the situations in which LEOs engage in FRDM, e.g., images with individuals in poses that range from neutral body language to threatening body language. Another option is to use a

task that is more interactive and dynamic. There are FDMR scenario simulators that police departments use for training that allow LEOs to interact with videos that portray simulated scenarios with escalating threat. This kind of task more closely simulates situations LEOs face in which the behavior of a suspect unfolds over time, requiring LEOs to integrate multiple streams of information (e.g., is the suspect holding a weapon and, if so, what is the likelihood the person will use the firearm) and adjust their decisions as a suspect adjusts his/her behavior.

Limitations and Future Research

Our trial has several limitations that limit our ability to generalize the impact of MBRT to a wide range of LEOs and to identify which component of MBRT could have an impact on FRDM. Our sample consisted mainly of LEOs working in an urban and suburban settings. Given differences in demographics across urban, suburban, and rural settings in the United States (Parker et al., 2018), findings from our mainly urban- and suburban-based LEO sample cannot necessarily be generalized to LEOs in rural settings. Future research will need to sample LEOs from rural settings to examine whether and to what degree variables such as population density and demographics are related to the impact of MBRT. Even though most of the LEOs in our sample work in urban and suburban police departments, the racial/ethnic diversity of the urban departments are atypical compared to other urban police departments in the United States (“Police Department Race and Ethnicity Data,” n.d.). This suggests that the LEOs in our sample in urban departments constitute a unique urban LEO population and the results of our study may not generalize to LEOs in other urban departments in the United States. Future research will need to take into account both the setting in which LEOs work and the demographic characteristics of the police department(s).

Additionally, our study design limits our ability to draw conclusions about the component of MBRT that may impact FRDM. Although we did not obtain evidence for the impact of MBRT on FRDM, isolating the causal ingredient in an intervention is important to consider in future research assessing the impact of MBRT on FDMR. Our control group was a no-treatment control group; therefore, participants in the control group were not exposed to any kind of intervention. Future research will need to investigate the impact of MBRT relative to an active control group in order to isolate the mindfulness component of the training and rule out the impact of non-specific factors (e.g., group interaction).

As discussed above, lack of significant changes in error rates on the SBT may have been due to insufficient sensitivity to assess implicit stereotype reliance in our sample. If this is the case, the sensitivity of the SBT would constitute a limitation of our trial, which would have impacted our ability to assess changes in the impact of implicit stereotype reliance due to MBRT. Future research will need to explore additional measures that are sensitive to the impact of implicit stereotype reliance on FRDM across a wide of range of LEOs samples.

Using the SBT introduced an additional limitation in relation to ecological validity. The SBT is a computerized task that presents static images. LEOs, during training and in the field, interact with citizens in a dynamic context. Therefore, the SBT is limited in capturing the dynamic nature of police-citizen interactions. Use-of-force simulators that provide one-way dynamic interactions with simulated scenarios (i.e., one-way because the actors and

actresses in the videos do not respond to LEO decisions and behaviors) overcome this limitation to a large degree and provide richer and more nuanced information about FRDM.

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Table 1

Means and Standard Deviations for PDP Automatic Estimates on the Shooter Bias Task

		White Targets *M* (*SD*)	Black Targets *M* (*SD*)
Baseline			
	NIC	.42 (.20)	.50 (.20)
	MBRT	.42 (.22)	.43 (.22)
Post-training			
	NIC	.51 (.18)	.50 (.20)
	MBRT	.42 (.21)	.51 (.24)
Follow-up			
	NIC	.49 (.20)	.45 (.23)
	MBRT	.45 (.23)	.48 (.22)

Note: MBRT = Mindfulness-based resilience training; NIC = No-treatment control group.

Table 2

Means and Standard Deviations for PDP Control Estimates on the Shooter Bias Task

		White Targets *M* (*SD*)	Black Targets *M* (*SD*)
Baseline			
	NIC	.78 (.10)	.82 (.05)
	MBRT	.81 (.11)	.84 (.09)
Post-training			
	NIC	.77 (.10)	.82 (.11)
	MBRT	.82 (.08)	.83 (.07)
Follow-up			
	NIC	.75 (.12)	.83 (.07)
	MBRT	.81 (.08)	.86 (.07)

Note: MBRT = Mindfulness-based resilience training; NIC = No-treatment control group.

Table 3

Means and Standard Deviations for Response Latencies on the Shooter Bias Task

		Armed White Targets *M* (*SD*)	Armed Black Targets *M* (*SD*)	Unarmed White Targets *M* (*SD*)	Unarmed Black Targets *M* (*SD*)
Baseline					
	NIC	496.64 (38.37)	484.80 (42.78)	548.27 (37.59)	559.25 (34.84)
	MBRT	494.27 (33.04)	487.45 (39.34)	545.19 (29.26)	555.34 (27.37)
Post-training					
	NIC	484.48 (40.27)	478.81 (40.16)	539.93 (38.64)	552.70 (35.67)
	MBRT	498.92 (35.91)	493.50 (35.84)	547.51 (27.56)	552.50 (29.23)
Follow-up					
	NIC	482.96 (43.81)	473.81 (40.63)	536.23 (32.63)	548.69 (37.45)
	MBRT	496.94 (35.80)	487.61 (31.30)	544.52 (25.89)	547.33 (27.17)

Note: MBRT = Mindfulness-based resilience training; NIC = No-treatment control group.

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