The Effects of Mindfulness-Based Stress Reduction on Trauma in Victims of Gun Violence: A Pilot Study

Khatib L.[*], Riegner G.[*], Dean J.[*], Oliva V.[*], Cruanes G.[*], Zeidan F.[*]

[*]*Department of Anesthesiology, University of California San Diego, La Jolla, CA, 92093*

*Corresponding author
Fadel Zeidan, Ph.D.
Department of Anesthesiology
9500 Gilman Drive | MC 0719
La Jolla, CA 92093
Email: fzeidan@ucsd.edu
Phone: +1 (858) 246 - 2391

Abstract

Objectives: Gun violence is one of the most significant problems in the United States of America (USA). It is responsible for killing approximately 35,000 Americans per year and was the third leading cause of death for children in the USA from 2010 to 2019. Gun violence produces lifelong psychological adversity, posttraumatic stress and grief. In the face of this epidemic, efficacious self-regulatory therapies that assuage gun violence-based trauma and negative health are lacking. The proposed pilot study examined the effects of an 8-week Mindfulness-Based Stress Reduction (MBSR) program on traumatized individuals as a direct consequence of gun violence. It was hypothesized that MBSR would significantly lower trauma and corresponding comorbidities. It was also predicted that the benefits of MBSR would be significantly stronger from baseline to five and eight weeks of training.
Methods: Twenty-four grieving individuals completed a battery of psychological assessments before, after five, and eight-weeks of MBSR training, respectively.
Results: Before MBSR, study volunteers exhibited high levels of trauma, depression, sleep difficulty and grief. MBSR significantly improved trauma, posttraumatic stress, depression, sleep difficulty, and overall life satisfaction. The most pronounced improvements in psychological disposition were exhibited within first four weeks of MBSR. However, these benefits were largely preserved after completion of the eight week course. Importantly, increases in dispositional mindfulness predicted lower trauma, complicated grief, and sleep difficulties.
Conclusions: The present findings should be interpreted with caution because they were derived from an uncontrolled, non-randomized trial. However, said findings provide evidence that MBSR significantly reduces trauma and improves overall well-being in gun violence victims.

Key words: Mindfulness-Based Stress Reduction · Gun violence · Trauma · Grief · Depression

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Introduction

Gun violence is an American public health epidemic that has catastrophic consequences on individual and societal well-being. In this study, gun violence is characterized as the assault on individuals using firearms. This includes firearm-based homicide, violent crime, attempted suicide, suicide, and unintentional death and injury. According to the Centers for Disease Control and Prevention (CDC), gun violence was the leading cause of death for Black youth and the second leading cause of death for American youth in 2019. Over 39,000 Americans were killed by a gun in 2019 and over 30,000 were left injured. In 2020, said figure increased to over 43,000 deaths caused by firearms with over 30,000 injured (Gun Violence Archive, 2021). Gun violence costs the United States of America (USA) economy approximately $229 billion annually in medical treatments, family care, judicial expenditures, loss of income, and daily care/support. Further, firearm-based mass shootings, suicide, domestic violence and unintentional deaths have risen dramatically in the past 20 years, causing the USA to have the highest rate of mortality from firearms amongst other developed nations (Krouse & Richardson, 2015; Grinshteyn & Hemenway, 2016; Centers for Disease Control and Prevention, 2021). Gun violence has become so prominent in the USA that the likelihood of knowing a victim of gun violence within any individual's network is 99.9% (Kalesan et al., 2016).

Despite the vast prevalence of this epidemic, research on gun violence is scarce when compared to other leading causes of death (Stark & Shah, 2017). However, there is extant research demonstrating that mass shootings produce a high occurrence of posttraumatic stress and depression (Lowe & Galea, 2015; Séguin et al., 2013; Suomalainen et al., 2011; North et al., 2001; Vicary & Fraley, 2010; Bardeen et al., 2013; Littleton et al., 2009; Smith A.J. et al., 2015; Hawdon et al., 2012). Although the lasting, detrimental effects of mass shootings have been made apparent, these events only account for less than 2% of gun-related deaths a year (Gun Violence Archive, 2021). The limited number of studies that have examined the psychological effects of gun violence, independent of mass shootings, have underscored the unique, deleterious consequences that arise from the sudden and maliciously violent nature of these events.

A recent study found that individuals exposed to gun violence fatalities are significantly more likely to suffer from psychological distress, depression, suicidal ideation, and psychotic-like experiences (Smith M.E. et al., 2020). Another study revealed that the death of a loved one from a shooting led to high levels of posttraumatic stress, grief, and the severity of posttraumatic stress predicted persistent grief (Smith A.J. et al., 2015). Taken together, these findings reveal that victims of gun-violence are at high risk for severe posttraumatic stress, persistent grief, and depression. However, no study to date has identified effective interventions to ameliorate the coping and grieving process for gun violence victims.

Mindfulness-Based Stress Reduction (MBSR), an eight-week evidence-based program designed to treat chronically ill patients that "have fallen through the cracks", may be advantageous for individuals who are suffering from a traumatic experience caused by gun violence (Kabat-Zinn, 1982). MBSR provides intensive training on nonjudgmental reactivity to positive and stressful sensory events by focusing attention on somatic sensations (breath, body) through mindfulness practices such as "body scan" (i.e., nonjudgmental focus on different parts of the body) and mindful awareness of breath (Fischer et al., 2017; Sauer-Zavala et al., 2013). MBSR improves a

variety of mental and physical health outcomes including stress, depression, anxiety, and chronic pain in both clinical and nonclinical settings (Chiesa & Serretti, 2009; Biegel et al., 2009; Hazlett-Stevens & Oren, 2012; Serpa et al., 2014; Khoury et al., 2015; Rosenzweig et al., 2010). More recently, MBSR has been used to treat symptoms of trauma that are not related to gun violence.

It was recently demonstrated that MBSR significantly reduced PTSD symptoms in 14 individuals that suffered from traumatic stress in response to car accidents, child abuse, and a spectrum of other disturbing events (Müller-Engelmann et al., 2017). Additionally, recent randomized, controlled trials examining the effects of MBSR on veterans suffering from PTSD, found that MBSR was more effective than present-centered group therapy (PCGT), an intervention specifically tailored to treating trauma and PTSD, at reducing PTSD symptomology (Davis et al., 2019; Polusny et al., 2015). Still, the trauma that arises from grieving the death of a loved one to gun violence may be more complicated than other forms of trauma as the unanticipated and cruel nature of these circumstances often leads to other adverse symptoms along with trauma, such as intense grief, a loss of trust in humanity, and a loss of meaning in oneself and the world around them (Bailey et al., 2013; Armour, 2003). Thus, whether MBSR can improve trauma and other psychological outcomes that arise as a result of the death of a loved one to gun violence is an open question.

It is evident that the alleviation of trauma and suffering in the growing number of gun violence victims in the USA is needed. The primary aim of the present pilot study is to examine whether MBSR is efficacious in reducing trauma and improving the overall well-being in individuals who experienced a traumatic event caused by gun violence. The secondary aim of this study is to investigate whether the benefits of MBSR change as a function of training dosage. Exploratory regression analyses tested whether MBSR increases dispositional mindfulness and if increased dispositional mindfulness from MBSR is predictive of improvements in trauma and corresponding comorbidities.

Methods

Participants

Twenty-four volunteers (median age = 53 years; 21 female) were recruited and screened by "Survivors Empowered", a non-profit organization that provides support and referrals for survivors of gun violence. Survivors Empowered also provides victims of gun violence with a social support network, and a "safe space" to share stories and collaborate on ways to reduce gun violence. All recruited participants reported experiencing daily trauma and grief directly as a cause from gun violence. Twenty-three participants lost an immediate family member to a gun and one participant was shot himself (Table 1).

Table 1. Participant Demographics

Gender	*N*	%
Male	3	12.5%
Female	21	87.5%
Ethnicity	***N***	**%**
White	18	75.0%
Black or African American	5	20.8%
Other	1	4.2%
Relationship Status	***N***	**%**
Married	20	83.3%
Divorced	2	8.3%
Single	2	8.3%
Highest Level of Education	***N***	**%**
High School	7	29.2%
Associate's	6	25.0%
Bachelor's	5	20.8%
Master's	4	16.7%
Professional	2	8.3%

Table 1 *Self-reported demographics of study population (N=24). During data collection, participants resided in Arizona, California, Colorado, Connecticut, Florida, Illinois, Indiana, Kentucky, Maryland, Michigan, New York, New Jersey, Nevada, South Carolina, and Texas.*

Measures

A battery of psychometrically validated questionnaires was employed to determine if MBSR improves well-being in victims of gun violence. All assessments were delivered and automatically scored using REDCap (Research Electronic Data Capture; Harris et al., 2009). All research technicians were blinded to self-report scales until study completion.

Trauma Symptom Checklist-40 (TSC-40)

The Trauma Symptom Checklist-40 (TSC-40) is a widely used 40-item self-report scale that assessed the frequency in which distressing symptoms arise from past traumatic experiences (Elliott & Briere, 1992). The TSC-40 consists of six subscales: dissociation, anxiety, depression, trauma history, sleep disturbances, and sexual problems. Subscale data are not presented here. Higher scores indicated higher frequency of trauma symptoms.

PTSD Checklist-5 (PCL-5)

The PTSD Checklist-5 (PCL-5; Weathers et al., 2013) is a 20-item self-report measure that evaluated the severity of one's experience with the 20 *DSM-5* PTSD symptoms (e.g., repeated, disturbing, and unwanted memories of the stressful experience) in the past month. Higher scores indicated higher PTSD.

Inventory of Complicated Grief (ICG)

The Inventory of Complicated Grief (ICG; Prigerson et al., 1995) is a 19-item self-report scale that measured pathological grief. Participants were asked to complete the ICG in reference to a loved one they have lost due to gun violence. A warning and an option to opt out of this survey was given to participants due to the potentially triggering nature of this survey. Consequently, 11 participants opted out of completing this scale.

Beck Depression Inventory-II (BDI-II)

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996) is a 21-item assessment that measured depressive symptomology, mood disturbance, negative affect, and depressive mood. Higher scores indicated greater levels of depressive symptomology/mood (Adler-Neal, 2019).

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) contains 19 self-report items that assessed quality of sleep (Buysse et al., 1989). The PSQI consists of seven "component" scores including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Subscale data are not presented here. Higher scores indicated more severe sleep difficulties.

Satisfaction with Life Scale (SWLS)

The Satisfaction with Life Scale is a 5-item scale that was used to assess one's holistic life satisfaction (Diener et al., 1985). Higher scores indicated higher life satisfaction.

Five Facet Mindfulness Questionnaire (FFMQ)

Hypothesized changes in dispositional mindfulness were measured using the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). The FFMQ consists of five subscales: observation, description, aware actions, non-judgment, and non-reactivity. Subscales are not presented here. Higher scores represented higher levels of trait mindfulness.

Intervention

Mindfulness-Based Stress Reduction

All subjects participated in a standard 8-week MBSR course and there were no explicit didactics tailored to addressing trauma and grief. MBSR consisted of eight 2.5-hour weekly classes. After five weeks of MBSR, subjects participated in a daylong (7 hours) silent meditation retreat. The course was taught in two separate cohorts by four ethnically diverse, certified mindfulness teachers who closely followed the guidelines described by Kabat-Zinn (1990). Two trauma-informed therapists were also present but did not explicitly interact with participants. Therapists attended MBSR sessions in case of any adverse events.

The aim of MBSR was to provide participants with formalized mindfulness didactics to better incorporate mindfulness-based coping strategies and direct attenuation of negative and positive appraisals of discursive sensory, cognitive and affective events. Participants were taught to attend to the present moment, engaging a number of somatic (body, breathing) and ruminations non-reactively. In addition to the spectrum of guided mindfulness-based practices (e.g., sitting meditation, body scan, and Hatha Yoga) introduced in the first four weeks of the course, the last four weeks also included real-life applications of mindfulness such as emotional regulation and compassion for others. Participants were also provided daily assignments to be performed outside of the formal training. To promote adherence and compliance to MBSR, study participants were provided workbooks, audiobooks, and explicit instructions to practice meditation outside of MBSR class.

Procedure

The proposed research activities were approved by the UCSD Institutional Review Board (IRB#192007) and were conducted online during the global novel Coronavirus (COVID-19) pandemic (January 4th, 2021 to April 6th, 2021). Participants were screened and enrolled into the proposed project by the study team. Prior to providing informed consent, participants completed pre-intervention assessments (pre-MBSR). Participants then attended five, 2.5-hour weekly MBSR classes via the videoconferencing platform, Zoom (Zoom Video Communications Inc., 2019) (Figure 1). Participants then completed assessments at five weeks (mid-MBSR). After 8-weeks of MBSR, participants completed post-intervention assessments (post-MBSR). Seven of the twenty-four participants did not complete Mid-MBSR assessments.

Biological sample kits were also administered but only 5 participants completed these assessments. Thus, biological data are not presented here.

{Insert Figure 1 Here}

Fig. 1 *Assessments were administered one week before MBSR courses started, after the completion of five courses but before the day-long retreat, and after completion of the course. The Inventory of Complicated Grief had less responses due to the option to opt out of this survey (N=13 for pre and post-MBSR; N=9 for mid-MBSR).*

Behavioral Analyses

Paired samples t-tests (SPSS version 26.0) examined if MBSR produced significant improvements in all measures (i.e., trauma symptoms (TSC-40), posttraumatic stress (PCL-5), grief (ICG), depression (BDI-II), sleep difficulty (PSQI), life satisfaction (SWLS), and dispositional mindfulness (FFMQ)), respectively. All t-tests were Bonferroni corrected for multiple comparisons ($p < .007$).

Seventeen of the twenty-four participants completed assessments for all three time points (Figure 1). Repeated measures ANOVAs examined if there were significant changes in outcomes from before to the middle (5 weeks) and after MBSR (after 8 weeks). A priori simple effects tests were performed to interpret significant main effects.

Exploratory simple linear regressions were computed to test if improvements in dispositional mindfulness from pre to post-MBSR predicted changes in a) trauma (TSC), b) posttraumatic stress (PCL-5), c) grief (ICG), c) depression (BDI-II), d) sleep (PSQI), and e) satisfaction with life (SWLS).

Results

Victims of gun violence exhibited high levels of trauma, grief, depression, and sleep difficulties at baseline

At baseline (Pre-MBSR), 38% of participants met the criteria that is indicative of probable PTSD (PCL-5; National Center for PTSD, 2021). Seventy-nine percent (79%) of participants scored above the cutoff point on complicated grief that is considered "at high risk for requiring clinical care" (ICG; Prigerson et al., 1995). Thirty-eight percent (38%) of participants also met the criterian for clinical depression (Beck et al., 1996). Seventy-nine (79%) of participants scored above the standardized cutoff point that distinguishes a "poor" sleeper (PSQI; Buysse et al., 1989).

MBSR significantly improved gun violence related trauma and corresponding comorbidities

Eight weeks of MBSR significantly reduced trauma by 37% [TSC-40; $t(23) = -5.38$, $p < .001$, *Cohen's d (d)* = -1.10] and posttraumatic stress by 52% [PCL-5; $t(23) = -4.71$, $p < .001$, $d = -0.96$].

MBSR also significantly reduced depression by 52% [BDI-II; $t(23) = -5.50$, $p < .001$, $d = -1.12$]. MBSR reduced grief by -23% [ICG*;* $t(12) = -2.83$, $p = .02$, $d = -0.78$], however, this effect did not survive Bonferroni correction.

Sleep difficulties significantly reduced by 26% from pre to post-MBSR [PSQI; $t(23) = -3.81$, $p = .001$, $d = -0.78$] and participants reported an increase in overall life satisfaction by 16%, [SWLS; $t(23) = 2.93$, $p = .008$, $d = 0.60$].

Differential effects of MBSR on trauma-based disposition as a function of MBSR training stage

MBSR produced a significant main effect of time on self-reported trauma [$F(2, 16) = 10.10$, $p = .002$; Figure 2a] that was driven by the significant reductions from pre to mid-MBSR and from pre to post-MBSR ($p \leq .001$), respectively. There was no significant change in trauma from mid to post-MBSR ($p = .42$)

The significant main effect on posttraumatic stress [$F(2, 16) = 8.64$, $p = .002$; Figure 2b] was a result of the significant reductions from pre to mid ($p < .05$), and pre to post-MBSR ($p = .001$), but not from mid to post-MBSR ($p = .11$).

Similarly, the significant main effect of depression [$F(2, 16) = 17.02$, $p < .001$; Figure 2d] was associated with significant decreases from pre to mid and pre to post-MBSR ($p \leq .001$), but not mid to post-MBSR ($p = .12$).

Changes in sleep difficulties [$F(2, 16) = 7.00$, $p = .003$; Figure 2e] were also significant across time. This effect was driven by significant increases from pre to mid ($p = .02$) and pre to post-MBSR ($p = .005$), but not mid to post-MBSR ($p = .24$).

There were no significant changes in grief (p = .140; Figure 2c) or life satisfaction (p = .180; Figure 2f).

{Insert Figure 2 Here}

Fig. 2 *a) Trauma significantly decreased from pre to mid, and pre to post-MBSR (TSC-40; N=17), b) Posttraumatic stress significantly decreased from pre to mid, and pre to post-MBSR (PCL; N=17), c) Complicated grief reductions were not significant (ICG; N = 9), d) Depression significantly decreased from pre to mid, and pre to post-MBSR (BDI-II; N=17) e) Sleep difficulty significantly decreased from pre to mid, and pre to post-MBSR (PSQI; N=17), f) Life satisfaction increases were not significant (SWLS; N = 17),* $^{*}p \leq .05$, $^{**}p \leq .01$, $^{***}p \leq .001$. *Error bars: +/- 1 SE*

Dispositional mindfulness predicted improvements in trauma, sleep, and grief.

As predicted, MBSR significantly increased dispositional mindfulness by 15% [FFMQ; $t(23)$ = 7.10, $p < .001$, $d = 1.45$]. The main effect of time on dispositional mindfulness scores [$F(2, 16) = 27.67$, $p < .001$; Figure 3a] demonstrated a significant linear increase across training stages (pre to mid: $p = .03$, pre to post: $p < .001$, and mid to post-MBSR: $p < .001$).

Heightened dispositional mindfulness predicted greater reductions in a) trauma symptoms [$F(1, 23) = 7.67$, $p = .01$, $R^2 = 0.26$; Figure 3b], b) grief [$F(1, 12) = 4.95$, $p = .048$, $R^2 = 0.31$; Figure 3c] and c) sleep difficulties [$F(1, 23) = 4.69$, $p = .04$, $R^2 = 0.18$; Figure 3d]. Mindfulness was not significantly associated with improvements in posttraumatic stress (p = .12), depression (p = .54), or satisfaction with life (p = .27).

{Insert Figure 3 Here}

Fig. 3 *a) Dispositional mindfulness significantly increased from pre to mid, mid to post, and pre to post-MBSR (FFMQ; N=17),* $^{*}p \leq .05$, $^{**}p \leq .01$, $^{***}p \leq .001$. *Error bars: +/- 1 SE. Changes (post -pre) in mindfulness predicted changes (post-pre) in b) trauma (TSC-40; $R^2 = 0.26$), c) grief (ICG; $R^2 = 0.31$), d) and sleep difficulties (PSQI; $R^2 = 0.18$)*

Discussion

In this pilot study, we investigated the effects of MBSR on improving trauma and associated psychological outcomes in gun violence victims. Not surprisingly, the present sample of gun violence victims reported frequent and severe symptoms of trauma and PTSD compared to averages reported in the literature of individuals who suffered from abuse or a "stressful life event" (Neal & Nagle, 2013; Blevins et al., 2015). This sample also reported high complicated grief compared to non-gun-related bereveaved individuals (Prigerson et al., 1995). Depression and sleep difficulties were also high compared to healthy samples (von Glischinski et al., 2019; Buysse et al., 1991). Nevertheless, MBSR produced meaningful improvements across these outcomes. MBSR also significantly increased dispositional mindfulness and satisfaction with life. Improvements in mindfulness predicted lower trauma, complicated grief, and sleep difficulties.

Notably, eight weeks of MBSR training significantly improved scores on all measures, except complicated grief, with medium to large effect sizes observed for all measures. Interestingly, the rate of improvement was much faster and stronger in the first four weeks of MBSR, when compared to the latter half. These findings are consistent with previous work demonstrating high efficacy after brief mental training (Quaglia et al., 2019; Possemato et al., 2016; Zeidan et al., 2010). Yet, the improvements were largely sustained and improved upon with more frequent training, providing supplementary evidence that mindfulness training is analagous to physical training and can produce long lasting, stabilized improvements in psychological disposition. What is unclear is if these sustained improvements, during the intervention, were attributable to non-specific effects such as social support, facilitator attention, and demand characteristics. Nevertheless, the improvements in psychological disposition are quite profound considering the high level of trauma and stress this particular population faces on a daily basis. Only thirteen of the twenty 24 participants completed the Inventory of Complicated Grief due to the "triggering" nature of the scale. Thus, the 23% improvement in grief from MBSR did not survive Bonferonni correction. More work is needed to determine if MBSR-induced grief reductions are sustainable when compared to more active therapeutic interventions.

The present study is novel because it examined dosage effects of MBSR across time of the intervention. This approach demonstrated that dispositional mindfulness significantly increases as a function of meditation frequency and dosage. Importantly, increases in dispositional mindfulness were associated with reductions in trauma, grief, and sleep difficulty. Increases in dispositional mindfulness may also potentially help individuals transform alter their *relationship* with their grief. That is, it is postulated that because of potential feeling of guilt or a sense of betrayal, victims of gun violence and generalized trauma may not want to forget or be distracted away from or even feel better about the source of their grief. Rather, they are motivated to seek ways to carry on in their lives by altering the contextualization of their moment to moment experience. This is where the individual can *hold* mindful awareness of their loved one in their arising momentary experiences without allowing the corresponding trauma, grief, and dysphoria to obliterate said awareness. Thus, the individual is postulated to allow oneself to grieve and mourn without experiencing the health-debilitating effects of constant stress and depression that is prevalent in individuals experiencing this level of trauma and loss.

However, the results of this nonrandomized, uncontrolled pilot trial on victims of gun violence should be interpreted with caution. There was no control group and participants were self-selected. Thus, these effects could simply be due to demand characteristics, time elapsing, social support and other non-mindfulness effects. Thus, this project is a first step in demonstrating the feasibility and efficacy of alleviating negative symptomology in victims of gun violence. Future studies on gun violence should have a more accurately representative demographic. According to the Center for Disease Control (2021), young Black men are 20 times more likely to be killed by a gun than White males of the same age group. However, the participants that completed this study were mostly White (75%). Regardless of these limitations, the results of this study are noteworthy. The widespread positive changes in the psychological health outcomes measured support the use of mindfulness-based interventions to help mitigate the suffering of those exposed to gun violence. This project is an important first step in the employment of mindfulness-based therapy for gun violence induced trauma.

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