

# AN ADAPTED, FOUR-WEEK MIND–BODY SKILLS GROUP FOR MEDICAL STUDENTS: REDUCING STRESS, INCREASING MINDFULNESS, AND ENHANCING SELF-CARE

Jeffrey M. Greeson, PhD, MS<sup>1#</sup> Michael J. Toohey, PhD<sup>2</sup> and Michelle J. Pearce, PhD<sup>3</sup>

**Objective:** Despite the well-known stress of medical school, including adverse consequences for mental and behavioral health, there is little consensus about how to best intervene in a way that accommodates students' intense training demands, interest in science, and desire to avoid being stigmatized. The objective of this study, therefore, was to evaluate the feasibility, acceptability, and initial effectiveness of an adapted, four-week stress management and self-care workshop for medical students, which was based on the science and practice of mind–body medicine.

**Methods:** The current study used a prospective, observational, and mixed methods design, with pretest and posttest evaluations. Participants ( $n = 44$ ) included medical and physician-scientist (MD/PhD) students from a large, south-eastern medical school. Feasibility was assessed by rates of workshop enrollment and completion. Acceptability was assessed using qualitative ratings and open-ended responses that queried perceived value of the workshop. Quantitative outcomes included students' ratings of stress and mindfulness using validated self-report surveys.

**Results:** Enrollment progressively increased from 6 to 15 to 23 students per workshop in 2007, 2009, and 2011,

respectively. Of the 44 enrolled students, 36 (82%) completed the workshop, indicating that the four-session extracurricular format was feasible for most students. Students reported that the workshop was acceptable, stating that it helped them cope more skillfully with the stress and emotional challenges of medical school, and helped increase self-care behaviors, such as exercise, sleep, and engaging in social support. Students also reported a 32% decrease in perceived stress ( $P < .001$ ;  $d = 1.38$ ) and a 16% increase in mindfulness ( $P < .001$ ;  $d = 0.92$ ) following the workshop. Changes in stress and mindfulness were significantly correlated ( $r = -0.42$ ;  $P = .01$ ).

**Conclusion:** Together, these findings suggest that a brief, voluntary mind–body skills workshop specifically adapted for medical students is feasible, acceptable, and effective for reducing stress, increasing mindfulness, and enhancing student self-care.

**Key words:** Medical students, mind–body medicine, mindfulness, stress, self-care

(*Explore* 2015; 11:186-192 © 2015 Elsevier Inc. All rights reserved.)

## INTRODUCTION

Although many students are resilient, medical school can be highly stressful, with consequences for academic performance, patient care, substance use, and increased rates of suicide compared to age-matched peers.<sup>1–4</sup> Beginning as early as the 1960s, over 600 articles have promulgated the need to offer extra support for medical students to protect and

enhance self-care and well-being.<sup>4–6</sup> Yet, there remain few empirically supported interventions that do so.<sup>3</sup> There are even fewer *brief* empirically supported interventions that address medical students' main concern: a lack of time for self-care activities that can help reduce stress and increase resilience.<sup>7</sup>

Mind–body medicine addresses self-care, stress, and health in the context of emotional, mental, social, spiritual, and behavioral factors.<sup>8,9</sup> Mind–body techniques, such as meditation and guided imagery, teach individuals how to self-regulate perceived stress and stress physiology through mental training that is designed to cultivate attention, self-awareness, relaxation, and equanimity (non-reactivity).<sup>8</sup> Together, these core self-regulation skills are intended to decrease sympathetically driven stress reactions and increase parasympathetically driven relaxation responses, thereby alleviating stress-related symptoms and enhancing mood, quality of life, and one's ability to function optimally under stressful circumstances.<sup>9</sup> Two widely popular mind–body medicine interventions with

1 Department of Psychiatry, Perelman School of Medicine, University of Pennsylvania, 3535 Market Street, Suite 670, Philadelphia, PA, 19104

2 Graduate Institute of Professional Psychology, University of Hartford, West Hartford, CT

3 Department of Family and Community Medicine, Center for Integrative Medicine, University of Maryland School of Medicine, Baltimore, MD

# Corresponding author.

e-mail: greeson@upenn.edu

---

formal training for instructors and standardized curricula are Mind–Body Skills Groups, developed by Dr. James Gordon, and Mindfulness-Based Stress Reduction (MBSR), developed by Dr. Jon Kabat-Zinn. Although both programs have been shown to effectively reduce subjective perceptions of stress for students,<sup>10–19</sup> most programs are quite lengthy, often ranging from eight weeks to eight to nine months (one academic year). Sample sizes reported in these studies to date have ranged widely, from 20–30 to over 300 participants.

Both, Mind–Body Skills Groups and MBSR consist of weekly meetings where didactic topics such as stress, stress management, and health are discussed, and ample time is devoted to guided practice of self-regulation skills, as well as group discussion regarding one's progress in building such skills week-to-week. Although Mind–Body Skills Groups typically include one or two formal mindfulness skills, such as mindful eating and mindful breathing, the emphasis is on learning a wide variety of mind–body techniques, including autogenic training, diaphragmatic breathing, biofeedback, self-expression through movement and drawing, and emotional disclosure.<sup>12</sup> In contrast, MBSR teaches a variety of meditation and gentle yoga practices, each of which is intended to foster mindfulness—defined as non-judgmental, present-focused attention and awareness, with the attitudinal qualities of kindness, compassion, and acceptance.<sup>13</sup> Both Mind–Body Skills Groups and MBSR have the goal of increasing self-care, decreasing stress-related physiological arousal, and increasing one's ability to concentrate and focus.<sup>8</sup> However, it remains to be determined how best to translate mind–body medicine training programs for optimal effectiveness in the context of medical school.

There is now initial evidence supporting the effectiveness of shorter mind–body training programs, which might prove more feasible and accessible for medical students, with comparable benefits. For example, one pilot randomized controlled trial (RCT) demonstrated self-reported efficacy from 42 participants for a “low-dose” mindfulness intervention where treatment lasted only six weeks, using one-hour sessions at the workplace with shorter required home practice time (20 min/day).<sup>20,21</sup> Another RCT examined self-reported changes in psychological distress, positive states of mind, distractive and ruminative thoughts and behaviors, and spiritual experiences among 83 students in the medical field who took part in a one-month mindfulness group (four 1.5-hour sessions plus a six-hour Saturday retreat), a somatic relaxation group, or a no-treatment control group.<sup>15</sup> Although both groups had significant improvements in distress levels and positive mood states, mindfulness training uniquely reduced rumination and mental distraction, which is considered to be an especially important ability for physicians.<sup>22</sup> One recent quasi-experimental study of 119 college students found that a brief, five-week MBSR program integrated into an academic course was associated with greater self-reported increases in mindfulness and self-compassion, but no differences in anxiety, compared to a parallel cohort control.<sup>23</sup> Finally, a recent RCT of 90 university students run through a campus counseling and psychological services center found significant improvements in self-reported ratings of perceived stress, mindfulness, self-compassion—the ability to treat oneself with kindness and compassion in diffi-

cult times—and sleep quality after a four-session mindfulness training program compared to a waitlist control.<sup>24</sup> Based on these findings with working adults and university students, investigations of shorter mind–body medicine programs specifically adapted to the needs of highly stressed medical students are warranted.

Given medical students' chronically demanding schedule and their commitment to training in science, many are unwilling to dedicate six or eight weeks—or a full day on the weekend—to learning mind–body or self-care skills, especially if such programs are voluntary and are perceived as unimportant, uninteresting, and/or lacking in scientific rigor.<sup>25,26</sup> Conversely, medical trainees may be more amenable to substantially shorter programs with sufficient scientific rationale and some realistic expectation for a healthy change.<sup>26</sup> In addition, combining mindfulness training with an opportunity to choose one's own self-care goals in the context of a mutually supportive environment could both normalize the common experience of stress, anxiety, and burnout, and add value to existing stress management programs.<sup>27,28</sup>

The purpose of the present study, therefore, was to evaluate a brief, extracurricular four-session workshop for medical students with an emphasis on self-care, the science of mind–body medicine, and the practice of mindfulness and other mind–body skills. We hypothesized that the adapted mind–body skills group for medical students would be associated with (1) reduced stress, (2) increased mindfulness, (3) enhanced engagement in self-care behaviors, and (4) increased understanding and utilization of stress management and relaxation skills.

## METHODS

### Participants

All students in the Duke University School of Medicine were eligible to take part in the study. A sample of 44 medical students (33 first-year, one second-year, three third-year, five fourth-year, and two MD/PhD students) volunteered to participate. Two-thirds of study participants were women ( $n = 29$ ). Six students enrolled in the Fall of 2007, 15 in the Spring of 2009, and 23 in the Fall of 2011. Of the 44 total students enrolled, 40 (91%) attended the first class and responded to the pre-workshop survey, and 36 (82%) completed the workshop as evidenced by post-survey measures.

### Study Design/Procedure

For this prospective, observational study, students were recruited through electronic flyers and email announcements distributed by the Associate Dean for Medical Education, supplemented by in-class announcements by the group facilitators (J.G. and M.P.). Email announcements were initially directed to first-year students only and then extended to students in all years of training in order to provide equal opportunity. Pre- and post-workshop surveys were distributed at the beginning and the end of the first and final group sessions, respectively. In order to allow students to practice new skills and self-care goals for four full weeks, post-workshop evaluations were collected one week after Class 4.

---

The study protocol was granted exempt status from the Duke University Medical Center Institutional Review Board (IRB).

## Measures

### *Quantitative*

*Cognitive and Affective Mindfulness Scale—Revised (CAMS-R)*. The CAMS-R is a self-report, pencil-and-paper scale used to measure four aspects of trait mindfulness, including (1) Attention (“I am able to pay close attention to one thing for a long period of time.”); (2) Awareness (“I can usually describe how I feel at the moment in considerable detail.”); (3) Acceptance (“I am able to accept the thoughts and feelings I have.”), and (4) Present focus (“I am able to focus on the present moment.”). Previous psychometric evaluation of the CAMS-R in students found the instrument to be reliable and valid,<sup>29</sup> and sensitive to change following MBSR.<sup>30</sup> Cronbach’s  $\alpha$  was 0.78 at pre-workshop evaluation and 0.84 at post-workshop evaluation in this study.

*Perceived Stress Scale (PSS)*. The 10-item PSS is a self-report, pencil-and-paper survey designed to measure perceived stress over the past month, defined by the degree to which one feels like life has been unpredictable, uncontrollable, or overwhelming. The PSS<sup>31</sup> has demonstrated reliability and construct validity in student samples and emerging adults and is sensitive to change with brief mindfulness training interventions.<sup>15,24</sup> PSS scores have been significantly correlated with objective biological markers of stress and inflammation in prior studies, supporting construct validity.<sup>32,33</sup> Cronbach’s  $\alpha$  was 0.90 at both time points.

*Qualitative*. In addition to the quantitative surveys, the pre-workshop evaluation asked students to list three individual goals related to their participation in the workshop. The post-workshop evaluation asked students to provide open-ended feedback about the perceived value of the workshop (Table 1).

### **Intervention**

“Mind–Body Medicine: A Skill Building & Self-Care Workshop” was developed as a voluntary, skills training program for students at a large, southeastern medical school. The workshop was based on an 11-week course developed by the Center for Mind–Body Medicine in Washington, DC. The adapted workshop for medical students consisted of four weekly 1.5-hour small group sessions and home practice of mind–body skills in between group meetings. In addition, students were also asked to choose (and monitor) a weekly self-care goal.

Following a series of consultations with the Duke Integrative Medicine Education Committee, Associate Dean for Medical Education, and supervisory faculty from the CMBM, a core curriculum for a model self-care workshop was adapted to meet the needs of Duke medical students and to accommodate both student and facilitator time constraints. The main objectives in offering the workshop were fourfold:

- (1) Decrease perceived stress
- (2) Increase mindfulness (i.e., present moment and non-judgmental awareness)

- (3) Support and enhance health-promoting, self-care behaviors
- (4) Increase understanding and utilization of stress management and relaxation skills

Each session followed a structured format, which included beginning with a few minutes of instructor-led meditation, followed by a check-in of 10–15 min where students shared their experience with home practice and self-care goals, a short didactic on the science of mind–body medicine, and a closing period of reflection and/or skill practice. The opening meditation provided an opportunity for students to prepare for the group meeting by bringing their focus to the present moment. Group discussion during check-in allowed students to share both what went well and what they struggled with during their home practice. Group facilitators used the discussion period to reinforce weekly achievements and positive changes in self-care behaviors and to highlight moments of insight regarding collective discovery of the mind–body connection as it manifests during medical training (e.g., while studying, taking exams, seeing patients, trying to fall asleep, etc.). Check-in was followed by a short didactic on a topic related to stress management (e.g., the physiology of the stress response, eliciting the relaxation response, nourishing the body, and the spirit). The didactic period was followed by guided instruction in one to two mind–body skills related to the didactic, which afforded students an opportunity to practice self-regulation skills as a learning community, with the assistance and support of professional guidance. Skill instruction included mindfulness meditation, relaxation breathing, guided imagery, creative self-expression through drawing, body awareness, progressive muscle relaxation, mindful eating, and a loving kindness meditation designed to cultivate positive emotions including gratitude and empathy. Following the practice of each skill, students were engaged in a discussion about their experience, and questions were answered. Each session ended with a check-out time during which reflections were shared about the group experience, remaining questions were answered, and homework practices were described and assigned. The group concluded with the reading of a poem or passage related to mindfulness and self-care.

Between group sessions, students were asked to practice mind–body skills six days per week. Home practice exercises were purposefully kept short (i.e., range: 2 to 30 min; mean = 12 min) to encourage daily practice and to demonstrate that one did not need to devote a large amount of time to achieve a more relaxed and aware state. Students were provided with a weekly self-monitoring log that outlined the assigned practice (i.e., meditations and individually-set self-care goals) and provided space to indicate when they had completed their practice; the logs, however, were not completed and returned routinely, due to time burden. Students were initially provided with two compact discs (CDs) on which the facilitators had recorded eight guided meditation and relaxation scripts to support home practice. CDs were later converted to MP3 files and uploaded to iTunes U where students could easily access and download the tracks to their smartphones and personal computers. Because no identifying information was

---

**Table 1.** Selected Verbatim Responses to Qualitative Post-Workshop Surveys

---

1. Do you feel you got something of *lasting value* from the workshop?

“Definitely more self-aware and gained the tools to sustain this self-awareness over time.”

“Be kind to one’s self; stress release can be done quickly; self-discovery through reflection is valuable; there are many aspects of self-care.”

“I feel this workshop was a great opportunity to reconnect with mindfulness as something that unfolds moment to moment, not just as an official practice set aside from daily life. The short tracks and self-care goals were very useful in illustrating that concept.”
  2. Are you *taking better care of self now* compared to when the workshop began?

“Yes! I think that I recognize signs of stress easier now and am faster at employing relaxation techniques as I learn them. I also feel that just because I am mentally stressed I don’t have to physically stress my system by eating poorly and forgoing exercise.”

“I don’t freak out with busy schedules. I am eating better.”

“Stress & sleep—my self-care practice of keeping a journal to dump my thoughts before bed made a big difference. Also, good at throughout the day check-ins with myself to catch & hopefully stop myself from clenching my jaw, holding my shoulders stiffly, etc.”
  3. What did you *find most helpful* about the workshop?

“Hearing everyone else’s perspectives was informative, self-care goals were great, and applying mindfulness concepts to our busy schedules in a more explicit way through discussion was helpful.”

“The creative self-expression where we had to draw our feelings. Comparing my ‘now’ to ‘where I want to be’ was very enlightening.”

“I really enjoyed the meditation and relaxation CDs, as well as the mindful eating. That was my favorite activity.”

“The original explanation about activating the parasympathetic nervous system with breathing deeply—This really made sense, and allowed me to dedicate myself to attempting to obtain the relaxed state.”
  4. What was *least valuable*, and *what would you recommend to improve the course*?

“I would include more in-class practice.”

“I would have liked more personal feedback and the opportunity to speak individually with course leaders. I also wish the course lasted longer or at least had the option for those who wished to continue after four weeks.”

“A longer course would be great—less rushed per session. For-credit elective would be great because there would be encouragement to come and I know many other students would benefit from this but won’t find the time.”
  5. *Additional Comments/Suggestions*

“I wish there was some way to make these skills and concepts available to the whole class. Maybe if there were a way to hold a couple of meetings about mindfulness and stress management in the lecture hall during lunch, before a 9–10 am lecture, etc. so that more students could be reached. That way, the tracks could be made available to the whole class without fear that they wouldn’t be understood in context.”

“Great class! I am motivated to keep using these skills I have learned to be a better and more balanced ‘me’.”

“Really enjoyed overall and has definitely influenced the way I think about and respond to stress. Also note that first year got much harder in the last three weeks! So pre and posttest may not be that different. I manage stress better but now there is more stress to manage.”
- 

collected as part of the IRB-exempt study, we were unable to retrieve download data from iTunes U, which would have required linking students’ school identification numbers with study-related data.

### Statistics/Analysis Plan

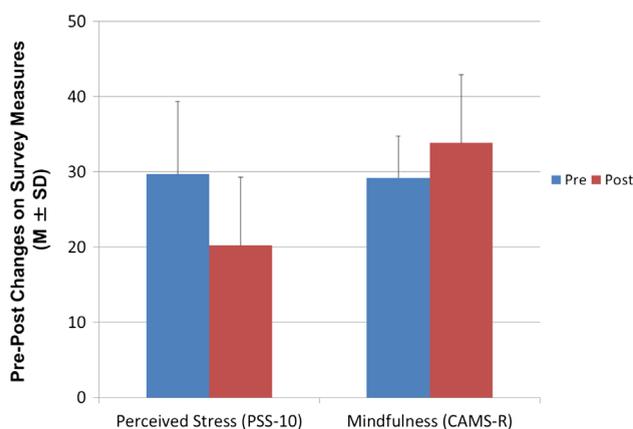
Descriptive statistics were used to assess distributional assumptions and to compare scale scores with published norms. Paired samples *t*-tests were used to assess changes in perceived stress and mindfulness following participation in the mind–body skills group. Effect sizes, calculated within-subjects as  $d = t/\sqrt{df}$ , were used to evaluate clinical significance of hypothesized changes in stress and mindfulness.<sup>34</sup> Qualitative feedback was analyzed using thematic analysis through the inductive categorization of student responses based on themes mentioned frequently throughout the

data.<sup>35</sup> Themes were induced for both pre-workshop goals and post-workshop feedback.<sup>36</sup>

## RESULTS

### Sample Characteristics and Preliminary Analyses

Survey data were approximately normally distributed (skewness and kurtosis lesser than two) and did not require transformation. At baseline, the medical student sample scored two standard deviations above the normative level of perceived stress reported by students with a bachelor’s degree, indicating a very high level of perceived stress.<sup>31</sup> The average mindfulness score fell about one standard deviation below the published norm for undergraduate students, indicating lower levels of attention, acceptance, awareness, and present moment focus.<sup>29</sup>



**Figure 1.** Quantitative changes in survey measures following a four-session Mind–Body Skills Group. Students reported significantly reduced levels of perceived stress ( $t = 7.90$ ;  $P < .001$ ) and increased levels of mindfulness ( $t = 5.27$ ;  $P < .001$ ), with large effect sizes. PSS-10, Perceived Stress Scale-10 item; CAMS-R, Cognitive and Affective Mindfulness Scale—Revised.

### Quantitative Findings

As shown in Figure 1, statistically significant changes were observed for perceived stress [Pre: M (SD) = 29.73 (9.61), Post: M (SD) = 20.25 (9.03),  $t_{33} = 7.90$ ,  $P < .001$ ,  $d = 1.38$ ] and mindfulness [Pre: M (SD) = 29.24 (5.54), Post: M (SD) = 33.88 (6.13),  $t_{33} = 5.27$ ,  $P < .001$ ,  $d = 0.92$ ]. Specifically, students reported a 32% decrease in stress level and a 16% increase in mindfulness, representing approximately 1-SD changes, and large effect sizes.<sup>37</sup> In addition, there was a significant correlation between reduced stress and increased mindfulness of thoughts and feelings following participation in the four-week workshop ( $r = -0.42$ ,  $P = .01$ ).

### Qualitative Findings

The most common themes that emerged for pre-workshop goals were (1) learn new ways to deal with stress, anxiety, frustration and inadequacy ( $n = 44$  endorsements); (2) learn relaxation techniques, including meditation ( $n = 24$  endorsements); (3) learn how to better care for myself ( $n = 11$  endorsements); and (4) have more happiness with life and enjoy the time I have ( $n = 8$  endorsements). Overall, 64% of post-workshop evaluation respondents said they met their pre-workshop goals, and another 14% partly achieved their goals. Out of the 36 students who returned a post-workshop evaluation, 100% reported receiving something of lasting value from the workshop, and 70% reported taking better care of themselves. Similarly, 75% of students reported being able to practice mind–body skills during the week, and 97% stated that they would recommend the workshop to other medical students.

A total of 139 verbatim responses from 36 students to five open-ended feedback questions were collected; a representative sample is shown in Table 1. When asked what was most helpful about the workshop, themes reported included the following: (1) increased self-awareness and mindfulness skills, “[I am] SO MUCH MORE self-aware to maintain stability and happiness”; (2) increased self-care, “[I learned] new ideas for

mindfulness & [sic] self-care...”; (3) increased relaxation and reduced stress, “It was such a warm, safe space to learn, share, and explore. I really feel like I’m more mindful of my emotions and stress and ways to deal with them to make life easier and preventing them from negatively affecting me”; (4) general enjoyment of the course, “I LOVED the course,” “WONDERFUL! Best decision I’ve made to take this class”; (5) life improvement, “I found that being in a place that allowed expression & resources for LIFE was extremely beneficial,” “I think that it will help me be more patient with myself”; and (6) opportunity for shared emotional expression and connection with other students, “Chances to discuss [stressors] with classmates,” “I also liked having my classmates around and knowing that I was not the only one feeling stressed.”

When asked to provide comments on what was least valuable and what they would recommend for the future, the most prominent emergent themes were to (1) tweak the wording, increase the pacing, and shorten the length of recorded exercises for home practice; (2) provide longer meditation practices in-session; (3) allow opportunities for individual feedback from course instructors; and (4) offer a longer version of the workshop for course credit. Many students agreed that the workshop could remain in a four-week format, especially if periodic follow-up sessions were offered.

### DISCUSSION

The main findings of this study supported the hypotheses that an adapted, four-week mind–body skills group for medical students was associated with significant improvements in (1) perceived stress, (2) mindfulness, (3) engagement in self-care behaviors, and (4) understanding and utilization of stress management and relaxation skills. Moreover, reduced levels of stress were significantly correlated with increased mindfulness scores, suggesting a relationship between core aspects of mindfulness such as being more attentive, aware, and accepting of one’s thoughts and feelings in the present moment and being less overwhelmed and stressed by medical school. These findings are consistent with other studies demonstrating the efficacy of meditation-based mind–body workshops for the general population and for medical students.<sup>12,15–19,38,39</sup> The primary difference between previous studies and this study is the length of the intervention. While prior stress management groups ranged from 10 weeks (two hours each class)<sup>12</sup> to four sessions (90 min each) plus a six-hour Saturday retreat,<sup>15</sup> the present mind–body skills workshop consisted of four sessions, 90 min each, with only 12-min/day, on average, of expected home practice and no full-day retreat. Importantly, we found that reducing the “dose” of training did not compromise effectiveness. Significant decreases in perceived stress and significant increases in mindfulness were reported, comparable to other, much longer training programs.

Consistent with prior reports,<sup>40,41</sup> the qualitative findings were also positive. Based on open-ended feedback from our sample of self-selected students, the four-session workshop was feasible, acceptable, and effective in helping students reduce stress, build stress management and relaxation skills,

---

and increase self-awareness. Most students reported achieving their workshop goals, which included an opportunity to pick one self-care activity each week to complement at-home practice of mind-body skills. Including an explicit focus on self-care for medical students was a deliberate strategy based on consulting with the Associate Dean for Medical Education. Highlighting the importance of self-directed, self-care was a unique addition to the conventional Mind-Body Skills Group training developed by the Center for Mind-Body Medicine. The majority of feedback responses included support for maintaining the four-week format of the workshop; students felt this was an acceptable and reasonable length of time to devote to an extracurricular activity and recommended the workshop be longer if it was offered for-credit. Given the large majority of comments were positive, including many recommendations to “not change a thing,” future medical students would likely benefit from a similar brief, adapted workshop.

There are, however, several limitations that merit discussion. Firstly, the study enrolled a relatively small, self-selected sample of 44 medical students. Although 80% of students completed the workshop, and quantitative findings were statistically significant, future studies using larger samples are needed to replicate the effects of the adapted mind-body skills group observed here. Secondly, this study lacked a control group. Though it is possible that a waitlist condition may have controlled for regression to the mean in a sample of highly stressed medical students, previous studies indicate that stress levels in medical school typically *increase* over the course of a semester without any intervention.<sup>1,7,16</sup> Thirdly, besides having students voluntarily report on adherence to weekly home practice exercises, the use of mind-body skills was not formally tracked; daily written or electronic logs or smartphone records could be used to track actual use in future studies. Fourthly, although every student who completed the workshop reported obtaining something of lasting value, the study lacked long-term follow-up, so the durability of positive changes in perceived stress, mindfulness, self-care behavior, and use of stress management skills remains to be determined. Fifthly, although validated survey measures of mindfulness and perceived stress were used, self-report assessment is prone to social desirability bias and can fluctuate in reliability and validity.<sup>42,43</sup> Finally, it is possible that non-specific factors such as social support, positive expectancy, and/or attention from an empathic instructor may have accounted, in part, for some of the beneficial effects observed. Future studies, with active comparison conditions such as a support group to control for non-specific therapeutic effects and objective biological markers of stress<sup>44</sup> are needed to discern the “active ingredients” of group-based, mind-body skills training programs.

In conclusion, the current study provides support for the shortest mind-body skills program developed to date specifically for medical students and in collaboration with medical school administration. A brief, low-cost mind-body skills workshop can be an efficient and effective tool for promoting mindfulness, self-care, and resilience to stress in medical students, with important implications for student health.

## Acknowledgments

Drs. Greeson and Pearce acknowledge the generous support of the George Family Foundation in providing full scholarships to attend the Mind-Body Medicine Professional Training Program and the Mind-Body Medicine Advanced Training Program through the Center for Mind-Body Medicine. The support also covered consultations with Bob Buckley, LCSW, to develop an adapted mind-body skills group for Duke medical students. In addition, Drs. Greeson and Pearce gratefully acknowledge financial and administrative support from the offices of Caroline Haynes, MD, PhD, Associate Dean for Medical Education and Director of Student Affairs at Duke University School of Medicine, and Michelle Bailey, MD, Director of Education at Duke Integrative Medicine. Finally, the authors thank all of the medical students who volunteered their valuable time to participate in the mind-body skills groups.

## REFERENCES

1. Dyrbye L, Thomas M, Massie F, et al. Burnout and suicidal ideation among U.S. medical students. *Ann Intern Med.* 2008;149(5):334–341.
2. Shapiro SL, Shapiro DE, Schwartz GE. Stress management in medical education: a review of the literature. *Acad Med.* 2000;75(7):748–759.
3. Shiralkar MT, Harris TB, Eddins-Folensbee FF, Coverdale JH. A systematic review of stress-management programs for medical students. *Acad Psychiatry.* 2013;37(3):158–164.
4. Dyrbye LN, Shanafelt TD. Medical student distress: a call to action. *Acad Med.* 2011;86(7):801–803.
5. Earley LW, Johnson DG. Medical student health. *J Med Educ.* 1969;44(1):35–45.
6. Perlow AD, Mullins SC. Marital satisfaction as perceived by the medical student's spouse. *J Med Educ.* 1976;51(9):726–734.
7. Estabrook K, Christianson H. Medical students healthcare barriers and solutions: perspectives of students. *Acad Psychiatry.* 2013;37(4):283–284.
8. National Center for Complementary & Alternative Medicine (NCCAM). Meditation: An Introduction. (n.d.). Accessible at: <http://nccam.nih.gov/health/meditation/overview.htm>. Retrieved August 11, 2013.
9. Goleman D, Gurin J. *Mind Body Medicine: How to Use Your Mind for Better Health.* Yonkers, NY: Consumer Reports Books; 1998.
10. Bond AR, Mason HF, Lemaster CM, et al. Embodied health: the effects of a mind-body course for medical students. *Med Educ Online.* 2013;18:20699.
11. de Vibe M, Solhaug I, Tyssen R, et al. Mindfulness training for stress management: a randomised controlled study of medical and psychology students. *BMC Med Educ.* 2013;13(1):107.
12. Finkelstein C, Brownstein A, Scott C, Lan Y. Anxiety and stress reduction in medical education: an intervention. *Med Educ.* 2007;41(3):258–264.
13. Greeson J. Mindfulness research update: 2008. *Complement Health Pract Rev.* 2009;14(1):10–18.
14. Irving J, Dobkin P, Park J. Cultivating mindfulness in health care professionals: a review of empirical studies of mindfulness-based stress reduction (MBSR). *Complement Ther Clin Pract.* 2009;15(2):61–66.
15. Jain S, Shapiro S, Swanick S, et al. A randomized controlled trial of mindfulness meditation versus relaxation training: effects on

- distress, positive states of mind, rumination, and distraction. *Ann Behav Med.* 2007;33(1):11–21.
16. Rosenzweig S, Reibel D, Greeson J, Brainard G, Hojat M. Mindfulness-based stress reduction lowers psychological distress in medical students. *Teach Learn Med.* 2003;15(2):88–92.
  17. Shapiro SL, Astin JA, Bishop SR, Cordova M. Mindfulness-based stress reduction for health care professionals: results from a randomized trial. *Int J Stress Manag.* 2005;12(2):164–176.
  18. Shapiro S, Schwartz G, Bonner G. Effects of mindfulness-based stress reduction on medical and premedical students. *J Behav Med.* 1998;21(6):581–599.
  19. Staples J, Gordon J. Effectiveness of a mind–body skills training program for healthcare professionals. *Altern Ther Health Med.* 2005;11(4):36–41.
  20. Klatt M, Buckworth J, Malarkey W. Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working adults. *Health Educ Behav.* 2009;36(3):601–614.
  21. Malarkey WB, Klatt M. Workplace based mindfulness practice and inflammation: a randomized trial. *Brain Behav Immun.* 2013;27(1):145–154.
  22. Epstein R. Mindful practice. *J Am Med Assoc.* 1999;282(9):833–839.
  23. Bergen-Cico D, Possemato K, Cheon S. Examining the efficacy of a brief mindfulness-based stress reduction (brief MBSR) program on psychological health. *J Am Coll Health.* 2013;61(6):348–360.
  24. Greeson JM, Juberg MK, Maytan M, James K, Rogers H. A randomized controlled trial of Koru: a mindfulness program for college students and other emerging adults. *J Am Coll Health.* 2014;62(4):222–233.
  25. Astin JA, Soeken K, Sierpina VS, Clarridge BR. Barriers to the integration of psychosocial factors in medicine: results of a national survey of physicians. *J Am Board Fam Med.* 2006;19(6):557–565.
  26. Sierpina V, Levine R, Astin J, Tan A. Use of mind–body therapies in psychiatry and family medicine faculty and residents: attitudes, barriers, and gender differences. *Explore (NY).* 2007;3(2):129–135.
  27. Dossett ML, Kohatsu W, Nunley W, et al. A medical student elective promoting humanism, communication skills, complementary and alternative medicine and physician self-care: an evaluation of the HEART program. *Explore (NY).* 2013;9(5):292–298.
  28. Linzer M, Levine R, Meltzer D, Poplau S, Warde C, West CP. Bold steps to prevent burnout in general internal medicine. *J Gen Intern Med.* 2014;29(1):18–20.
  29. Feldman G, Hayes A, Kumar S, Greeson J, Laurenceau J-P. Mindfulness and emotion regulation: the development and initial validation of the Cognitive and Affective Mindfulness Scale—Revised (CAMS-R). *J Psychopathol Behav Assess.* 2007;29(3):177–190.
  30. Greeson JM, Webber DM, Smoski MJ, et al. Changes in spirituality partly explain health-related quality of life outcomes after Mindfulness-Based Stress Reduction. *J Behav Med.* 2011;34(6):508–518.
  31. Cohen S, Janicki-Deverts D. Who's stressed? Distributions of psychological stress in the United States in probability samples from 1983, 2006, and 2009. *J Appl Soc Psychol.* 2012;42(6):1320–1334.
  32. Pruessner JC, Hellhammer DH, Kirschbaum C. Burnout, perceived stress, and cortisol responses to awakening. *Psychosom Med.* 1999;61(2):197–204.
  33. McDade TW, Hawkey LC, Cacioppo JT. Psychosocial and behavioral predictors of inflammation in middle-aged and older adults: the Chicago Health, Aging, and Social Relations Study. *Psychosom Med.* 2006;68(3):376–381.
  34. Rosenthal R, Rosnow R. *Essentials of Behavioral Research: Methods and Data Analysis* (2nd ed.). New York, NY: McGraw-Hill; 1991.
  35. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3:77–101.
  36. Yoshikawa H, Weisner TS, Kalil A, Way N. Mixing qualitative and quantitative research in developmental science: uses and methodological choices. *Qual Psychol.* 2013;1(S):3–18.
  37. Cohen J. *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Erlbaum; 1988.
  38. Dobkin PL, Hutchinson TA. Teaching mindfulness in medical school: where are we now and where are we going? *Med Educ.* 2013;47(8):768–779.
  39. Warnecke E, Quinn S, Ogden K, Towle N, Nelson MR. A randomised controlled trial of the effects of mindfulness practice on medical student stress levels. *Med Educ.* 2011;45(4):381–388.
  40. Irving JA, Park-Saltzman J, Fitzpatrick M, Dobkin PL, Chen A, Hutchinson T. Experiences of health care professionals enrolled in mindfulness-based medical practice: a grounded theory model. *Mindfulness.* 2012;5(1):60–71.
  41. Saunders PA, Tractenberg RE, Chaterji R, et al. Promoting self-awareness and reflection through an experiential Mind–Body Skills course for first year medical students. *Med Teacher.* 2007;29(8):778–784.
  42. Nisbett RE, Wilson TD. Telling more than we can know: verbal reports on mental processes. *Psychol Rev.* 1977;84(3):231–259.
  43. Schwarz N. Self-reports: how the questions shape the answers. *Am Psychol.* 1999;54(2):93–105.
  44. MacLaughlin BW, Wang D, Noone AM, et al. Stress biomarkers in medical students participating in a mind body medicine skills program. *Evid Based Complement Alternat Med.* 2011 article id: 950461.