# Interventions to Reduce the Consequences of Stress in Physicians A Review and Meta-Analysis

Cheryl Regehr, PhD,\*† Dylan Glancy, BSc,‡ Annabel Pitts, MSW,\* and Vicki R. LeBlanc, PhD§//

Abstract: A significant proportion of physicians and medical trainees experience stress-related anxiety and burnout resulting in increased absenteeism and disability, decreased patient satisfaction, and increased rates of medical errors. A review and meta-analysis was conducted to examine the effectiveness of interventions aimed at addressing stress, anxiety, and burnout in physicians and medical trainees. Twelve studies involving 1034 participants were included in three meta-analyses. Cognitive, behavioral, and mindfulness interventions were associated with decreased symptoms of anxiety in physicians (standard differences in means [SDM], -1.07; 95% confidence interval [CI], -1.39 to -0.74) and medical students (SDM, -0.55; 95% CI, -0.74 to -0.36). Interventions incorporating psychoeducation, interpersonal communication, and mindfulness meditation were associated with decreased burnout in physicians (SDM, -0.38; 95% CI, -0.49 to -0.26). Results from this review and meta-analysis provide support that cognitive, behavioral, and mindfulness-based approaches are effective in reducing stress in medical students and practicing physicians. There is emerging evidence that these models may also contribute to lower levels of burnout in physicians.

Key Words: Anxiety, stress, burnout, physician, cognitive-behavioral, mindfulness

(J Nerv Ment Dis 2014;202: 353-359)

D uring the last decade, there has been increasing attention placed on the impact of the medical environment on physicians' and trainees' mental well-being. Sources of stress among medical students include concerns about meeting demands for academic performance, adjusting to clinical responsibilities, developing a professional identity, exposure to death and human suffering, and exposure to ethical conflicts (Dyrbye et al., 2005; Murphy et al., 2009; Stewart et al., 1997). Once entering medical practice, additional stressors include shift work, long workdays, high case loads, time pressures, poor sleep habits and high performance expectations (Rutledge et al., 2009; Stucky et al., 2009), challenging patients, personal fears regarding competency, and changing roles in the workplace (Lee et al., 2009). In addition, physicians and trainees regularly face suffering, fear, failures, and death, as well as difficult interactions with patients, families, and other medical personnel (Wallace et al., 2009).

Researchers report that, as a result of regular exposure to these stressors, there are high rates of burnout and anxiety in physicians and trainees (Dyrbye et al., 2006; Quill and Williamson, 1990; Rutledge et al., 2009; Thomas, 2004; Zuardi et al., 2011). For instance, a self-report survey of 704 general practitioners in the United Kingdom revealed excessive anxiety in 31.1%, exhaustion and stress in 61.7%, and sleep difficulties in 46.7% (Chambers and Belcher, 1994). A

Social Work and Institute of Medical Science, University of Toronto, 27 King's College Circle, Toronto, Ontario, Canada, M5S 1A1.

Copyright © 2014 by Lippincott Williams & Wilkins ISSN: 0022-3018/14/20205-0353

DOI: 10.1097/NMD.00000000000130

study of 451 physicians in China revealed that 18% experienced anxiety and 31.7% experienced depression (Shen et al., 2012). An estimated 25% to 60% of physicians experience burnout (Goehring et al., 2005; Panagopoulou et al., 2006; Renzi et al., 2005). Compared with the general population, physicians are significantly more likely to have symptoms of burnout and to be dissatisfied with their worklife balance (Shanafelt et al., 2012). These high rates of emotional distress are compounded by the fact that physicians seem to be poor in tending to their wellness needs and are reluctant to seek help from others (Wallace et al., 2009). According to the Canadian Medical Association, only 25% of physicians who self-identified as depressed had considered seeking help and only 2% actually did get help (Myers, 2003).

Anxiety and burnout stemming from regular exposure to the stressors of medical practice and training have been linked to increased absenteeism and job turnover, early retirement, and increased physician disability premiums, as well as decreased patient satisfaction, diminished quality of care, and increased rates of medical errors (Brown et al., 2009; Rutledge et al., 2009; Van Den Hombergh et al., 2009). In a series of self-report studies, researchers at the Mayo Clinic observed that higher burnout scores related to depersonalization and emotional exhaustion were associated with greater likelihood of reporting medical errors (Shanafelt et al., 2010; West et al., 2006, 2009). However, in a study using active surveillance, whereas residents who were depressed were 6.2 times more likely to make medication errors, as documented by daily chart and medication order reviews, residents experiencing burnout did not have higher rates of error (Fahrenkopf et al., 2008). The high rate of burnout reported in this study (92% of respondents) may have influenced these results because there was little variation in burnout between participants. Simulation-based studies of clinical performance during high-stress events reveal that clinical performance of medical trainees is impaired in situations that induce elevated subjective and physiological stress responses (Arora et al., 2010; Harvey et al., 2012; Pottier et al., 2013). Greater stress responses are associated with greater impairments in procedural skills (Arora et al., 2010) and clinical reasoning (Pottier et al., 2013).

In light of research findings that suggest that physicians and medical trainees are faced with a wide variety of stressors that result in acute symptoms of stress, anxiety, and burnout that ultimately may affect patient care, we conclude that there is a considerable need for interventions that target stress in this population. This article is a meta-analysis of interventions with the aim of providing an evidencebased approach for interventions to reduce stress in physicians and medical students. Medical students were included in this analysis because early interventions can potentially have a lasting impact during the course of a medical career. Although meta-analyses have previously been conducted on the use of various models of intervention for mixed groups of people with anxiety and depression (Hunot et al., 2007; Jorm et al., 2008; Krisanaprakornkit et al., 2006; Regehr et al., 2013), meta-analyses and reviews have not determined whether such interventions are effective for physicians.

#### **METHODS**

This analysis included studies evaluating intervention programs aimed at reducing stress in physicians and medical trainees.

<sup>\*</sup>Factor-Inwentash Faculty of Social Work, and †Institute of Medical Science, University of Toronto, Toronto, Ontario, Canada; ‡Queens University, Kingston, Ontario, Canada; §Wilson Centre, Toronto, Ontario, Canada; and ||Faculty of Dentistry and Department of Medicine, University of Toronto, Toronto, Ontario, Canada. Send reprint requests to Cheryl Regehr, PhD, Factor-Inwentash Faculty of

E-mail: Cheryl.regehr@utoronto.ca.

Initially, studies were eligible for the analysis if they used a) random assignment to treatment and control groups or b) parallel cohort designs in which intervention and comparator groups were assessed at the same points in time. Single-group designs were initially excluded from the analysis. During the review, it became evident that a number of studies targeted reduction of burnout as a primary outcome. However, because of the paucity of controlled trials addressing burnout, studies using single-group designs for evaluating burnout are included in the summary of studies (Table 1). The primary outcome of psychological stress and anxiety symptoms was measured by various standardized scales such as the Spielberger State Trait Anxiety Inventory (STAI; Spielberger, 1983), the Perceived Stress Scale (PSS; Cohen et al., 1983), and the Profile of Mood States (POMS) (McNair et al., 1971). The secondary outcome, burnout, was consistently measured by the Maslach Burnout Inventory (Maslach and Jackson, 1986).

## Search Strategy

Searches were conducted on electronic databases including the Cochrane Database on Systematic Reviews, MEDLINE, EMBASE, PsycINFO, ERIC, Applied Social Science Abstracts, Social Sciences Abstracts, Social Work Abstracts, and Dissertation Abstracts International. Reviewers checked the reference lists of all relevant articles, including those from previously published reviews. The screening of the studies was carried out by a three-stage procedure as follows: a) review of titles and abstracts to determine potentially relevant studies, b) review of full copies of potentially relevant articles to determine whether studies met inclusion criteria, and c) data extraction from articles that passed the two previous levels of screening. The assessment of the methodological quality of each study was based on criteria established in the Cochrane Collaboration Handbook (Higgins and Green, 2011). Where data were not available in the study report of eligible studies, the reviewers corresponded with investigators, requesting further information. Using this method, additional information was obtained from two groups of researchers, thus allowing these studies to be included in the meta-analysis (Ro et al., 2008, 2010; Warnecke et al., 2011).

The searches included any article published before February 21, 2013, and yielded 1992 potentially relevant studies. Eighty-seven titles and abstracts were deemed to be potentially relevant and were subject to detailed evaluation. Sixty-four of these studies were excluded because they tested patient satisfaction, offered support to physicians in litigation, or did not test an intervention. Of the 23 remaining studies, 8 studies were screened out because they did not meet design criteria or they did not have stress and/or burnout as an outcome measure. In the end, four controlled studies using random assignment to groups or parallel cohort design to examine stress interventions for physicians (Justo, 2010; McCue and Sachs, 1991; Saadat et al., 2012; Sood et al., 2011) and four controlled studies examining stress interventions for medical students (Finkelstein et al., 2007; Rosenzweig et al., 2003; Shapiro et al., 1998; Warnecke et al., 2011) were deemed to be appropriate through a process of consensus by members of the meta-analysis research team. Three additional studies on stress interventions for medical students, conducted between 17 and 28 years before this review, did not have sufficient data for meta-analysis (Holtzworth-Munroe et al., 1985; Palan and Chandwani, 1989; Whitehouse et al., 1996).

Of the studies included in the meta-analysis on stress interventions, one study on physicians (McCue and Sachs, 1991) and two studies on medical students (Finkelstein et al., 2007; Rosenzweig et al., 2003) used parallel cohort designs (see Table 1). In each case, there was a possible selection bias in that participants either selfselected into the treatment condition (Finkelstein et al., 2007; Rosenzweig et al., 2003) or were ineligible to participate in the intervention because of the nature of their duties (McCue and Sachs, 1991). Thus, the nature of the control groups represents risk to the validity of the studies. Further, in common with other studies of psychological interventions, blinding and allocation concealment were not possible.

One randomized controlled trial (Martins et al., 2011) and three single-group design studies examined interventions to reduce burnout in physicians (Goodman and Schorling, 2012; Krasner et al., 2009; Ro et al., 2010). Single-group design (or quasi-experimental) studies are generally recommended for exclusion from meta-analysis because of threats to validity from factors such as maturation bias, historical confounds, testing bias, or statistical regression toward the mean (Littell et al., 2008). Nevertheless, given the state of the research in many areas, such as medical education, meta-analyses commonly do include quasi-experimental studies (Colliver et al., 2008; Stroup et al., 2000). Colliver et al. (2008) acknowledge this dilemma and recommend that, if such studies are to be included in a meta-analysis, threats to validity must be evaluated. Given the absence of controlled trials examining interventions for reducing burnout in physicians, single-group designs were assessed for suitability for inclusion in a meta-analysis. In each of the three studies examined, burnout is measured using the most common standardized measure, the Maslach Burnout Inventory (Maslach and Jackson, 1986). Two studies (Goodman and Schorling, 2012; Krasner et al., 2009) advertised for participants from a wide range of physicians and offered continuing medical education credits for participation; thus, the circumstances of each of the participants will have been different and were not subject to a common history or environmental confound. In addition, Goodman and Schorling offered the intervention at different times to different groups, thereby reducing the risk for an environmental confound. The third study (Ro et al., 2008, 2010) provided the intervention to a group of physicians attending a physician resource center. At the follow-up time, they compared the level of burnout symptoms with that of a representative sample of physicians and determined that the postintervention scores of the study group became comparable with those of physicians in the general population. Thus, although these studies did not include control groups, it was determined that considerable efforts had been made to control for confounds.

# Description of Interventions Targeting Stress Reduction

Among the eight controlled trials that examined the effects of stress reduction interventions on physicians or medical students, length of interventions was variable. Five studies used multiple weekly sessions (7–16) led by trained practitioners. In two studies, a single intervention was used, lasting 90 minutes (Sood et al., 2011) or 4 hours (McCue and Sachs, 1991). In one study, the intervention consisted of self-directed use of audiotapes during an 8-week period (Warnecke et al., 2011; see Table 1).

All of the included studies examined interventions that incorporated components of cognitive-, behavioral-, and/or mindfulnessbased techniques. Hayes (2004) characterizes these techniques as representing three waves, the first wave focusing on behavioral techniques, the second incorporating social learning and cognitive components, and the third including mindful awareness and acceptance of present experiences (Hayes, 2004). Others argue that all these techniques share fundamental characteristics and should not be considered different waves but rather as different forms of cognitive-behavioral therapy (Hoffman et al., 2010). It is nevertheless useful to consider the relative contributions of cognitive, behavioral, and mindfulness interventions in addressing stress and anxiety responses. Behavioral stress reduction interventions often focus on control of physical stress reactions through controlled breathing or muscle relaxation. Cognitive therapy aims to assist individuals to identify and modify dysfunctional beliefs that influence response to stimuli and subsequent physiological and psychological distress. Cognitive-behavioral approaches

354 www.jonmd.com

© 2014 Lippincott Williams & Wilkins

TABLE 1. Summa	iry of Stress and Burnout	t Interventions					
						Stress	
				Nature of	Length of	Outcome	
Study	Design		Population	Intervention	Intervention	Measures	Meta-Analyses
Controlled trials with	h physicians						
Justo, 2010	Randomized controlled: no treatment	19 int 19 control	Primary care physicians, Spain	Mindfulness meditation (adapted MBSR)	Ten 1-hr sessions	PSS, STAI	Stress
Martins et al., 2011	Randomized controlled: no treatment	37 int 37 control	Pediatric residents, Argentina	Burnout workshops	Two 2.5-hr sessions	MBI	Burnout
McCue and Sachs, 1991	Parallel cohort control: residents who could not be released from duties	43 int 21 control	Residents, United States	Stress management	One 4-hr workshop	ESSI, MBI	Stress, insufficient data for burnout
Saadat et al., 2012	Randomized controlled: no treatment	20 int 20 control	Anesthesiology residents, United States	Wellness intervention (stress management)	Sixteen 1.5-hr sessions	STAI	Stress
Sood et al., 2011 Controlled trials with	Randomized controlled: waitlist	20 int 12 control	Physicians, United States	SMART	One 90-min program	PSS Smith Anxiety Scale	Stress
Finkelstein et al., 2007	Parallel cohort control: students who did not enroll in course	26 int 25 control	Medical students, United States	Mind-body skills course	Ten 2-hr sessions	POMS, SCL-90	Stress
Rosenzweig et al., 2003	Parallel cohort control: students in alternative medicine seminar	120 int 162 control	Medical students, United States	MBSR	Ten 90-minute sessions	POMS	Stress
Shapiro et al., 1998	Randomized controlled: waitlist	37 int 36 control	Paramedic and medical students, United States	MBSR	Seven 2.5-hr sessions	STAI, SCL-90	Stress
Warnecke et al., 2011	Randomized controlled: waitlist	24 int 32 control	Medical students, Tasmania	MBSR	Audiotape daily for 8 wks	PSS Depression and Anxiety Stress Scale	Stress
Sungle-group uesign Goodman and Schorling, 2012	Pre-post, no control	51	Physicians, United States	MSBR	2.5 hrs per week, 8 wks, one 7-hr workshop	MBI	Burnout
Krasner et al., 2009	Pre-post, no control	70	Physicians, United States	Mindful communications course	2.5 hrs per week, 8 wks, one 7-hour workshop	POMS, MBI	Burnout
Ro et al., 2010	Pre-post, no control	a) 135, b) 29	Physicians, Norway	One-day counseling session course on communications and coping	a) 7 hrs, b) 5-day course	MBI SCL-5	Burnout, single-group design studies not included in meta-analysis for stress
ESSI indicates Stress	Symptoms Inventory; int, interve	ntion; MBI, Maslach Bur	nout Inventory.				

Copyright © 2014 Lippincott Williams & Wilkins. Unauthorized reproduction of this article is prohibited.

© 2014 Lippincott Williams & Wilkins

www.jonmd.com | 355

view functioning to be a product of reciprocal interactions between personal and environmental variables and addresses dysfunctional interactions through a combination of cognitive and behavioral approaches. This may include modeling of effective communication techniques that are likely to result in lower levels of interpersonal conflict and stress. Mindfulness-based interventions focus on lowering reactivity to challenging experiences through nonjudgmental self-awareness, particularly of physical sensations, cognitions, and emotions.

Four of the controlled studies addressing stress used a combination of cognitive, behavioral, and meditation techniques including psychoeducational elements, relaxation training, cognitive restructuring, and refocusing of attention on nonstressful thoughts. Saadat et al. (2012) examined an intervention entitled "Coping With Work and Family Stress," designed by one of the investigators for use in a variety of workplaces (Snow et al., 2002); this intervention has four components as follows: a) identification of stressful situations and effective problem-solving and communication strategies for reducing stress, b) modification of stress appraisal and cognitive processes, c) behavioral stress management techniques, and d) development of a personal stress management plan. McCue and Sachs (1991) used an intervention simply referred to as "Stress Management Workshop" that incorporated a) personal management skills (including elements such as goal prioritization); b) relationship building and assertiveness training; c) "outlook" skills, which, as described, are similar to cognitive reframing; and d) "stamina skills" or behavioral stress management techniques. Sood et al. (2011) examined the Stress Management and Resiliency Training (SMART) program, which involved awareness of intentional biases, training on refocusing attention from stressful to neutral content (Ellenbogen and Schwartzman, 2009), and relaxation training. Finally, Finkelstein et al. (2007) offered a mind-body medicine course for preclinical medical students. This course included elements of didactic teaching on stress response, meditation, imagery, and exercise as well as practicing meditation and physical exercise. Thus, although these interventions differed, they contained a large number of overlapping elements.

Four controlled studies examined the effectiveness of mindfulness-based stress reduction (MBSR) in reducing stress for physicians (Justo, 2010) and medical students (Rosenzweig et al., 2003; Shapiro et al., 1998; Warnecke et al., 2011). Developed by Kabat-Zinn (1982), MBSR incorporates a) body awareness, b) mind-fulness of breath, and c) hatha-yoga postures. Weekly sessions address mindfulness in stressful situations and social interactions and acceptance of self and others. Sessions are augmented by audiocassettes that lead practice at home. Originally designed as a behavioral medicine technique for patients with chronic pain, the model has

subsequently been tested on people with a broad spectrum of issues including anxiety disorders (Kabat-Zinn et al., 1991).

Two of the interventions (Finkelstein et al., 2007; Sood et al., 2011) described above incorporated meditation techniques, although they were not specifically described as mindfulness-based approaches. Thus, given the intersecting elements in all the approaches used in the studies aimed at reducing stress, they were included in one metaanalysis. Nevertheless, the differences in the models were expected to result in a large degree of statistical heterogeneity.

### **Description of Interventions Targeting Burnout**

One study (Goodman and Schorling, 2012) examined the use of MBSR to reduce burnout in physicians. Krasner et al. (2009) offered an educational program in mindful communications. This intervention included a) didactic presentations on perceptual biases as well as managing conflict and burnout, b) mindfulness meditation training and yoga-type exercises, c) self-awareness and positive selfreinforcement training, and d) group discussion. Martins et al. (2011) describe their intervention as workshops involving education on burnout syndrome, coping behaviors, and tools for prevention and self-care. Finally, Ro et al. (2010) offered two interventions, a singleday intensive individual counseling session and a 5-day course that integrated psychodynamic, cognitive, and educational theories. The structured counseling session integrated an analysis of the current work situation, sources of identity, and self-esteem and self-reliance and identified and challenged coping skills (listed as Ro, 2010a, in the meta-analysis). The week-long course consisted of lectures on restraints in work life, individual resources and personality, communication, teamwork, and prevention of burnout (identified as Ro, 2010b, in the meta-analysis). This was followed by group discussions and physical activity (Ro et al., 2008). Thus, although there was some overlap in burnout programs examined in terms of psychoeducation, interpersonal communications, and mindfulness meditation, there also seemed to be considerable divergence. Again, this was expected to be reflected in statistical heterogeneity.

## Data Analysis

Meta-analyses were conducted to pool change in the primary outcome (self-reported stress or anxiety) and secondary outcome (selfreported burnout) from baseline to postintervention using Comprehensive Meta-analysis software version 2.0. All data were continuous and analyzed by calculating the Hedges' g (Hedges, 1982). Standard differences in means (SDM) allowed for comparisons to be made across studies when scales measured the same outcomes using different standardized instruments, such as administering the STAI or the PSS to measure stress and anxiety. The Hedges' g is preferable

# **Stress in Physicians**



#### Meta-Analysis of Controlled Studies

FIGURE 1. Meta-analysis of interventions addressing stress in physicians.

356 www.jonmd.com

© 2014 Lippincott Williams & Wilkins



## **Stress in Medical Students**

#### Meta-Analysis of Controlled Studies

FIGURE 2. Meta-analysis of interventions addressing stress in medical students.

to Cohen's *d*, in this instance, because it includes an adjustment for small-sample bias. SDM point estimates and 95% confidence intervals (CIs) were computed using a random effects model because of the likelihood of heterogeneity. Three possible sources of heterogeneity were anticipated as follows: baseline severity of stress and burnout symptoms, the nature of the intervention, and different outcome measures for stress and burnout. Heterogeneity between studies was calculated using  $I^2$  (Higgins et al., 2003). This statistic provides an estimate of the percentage of variability in results across studies that are likely due to treatment effect rather than chance (Guyatt et al., 2008).

#### RESULTS

A total of 12 studies with 1034 participants were included in the three meta-analyses. Of the total number of participants in these studies, 30.4% were men and 37.3% were women, and in 31.9% of the cases, sex was not reported. The study participants included physicians in Spain (Justo, 2010), Argentina (Martins et al., 2011), Norway (Ro et al., 2010), and the United States (Goodman and Schorling, 2012; Krasner et al., 2009; McCue and Sachs, 1991; Saadat et al., 2012; Sood et al., 2011) and medical students in Tasmania (Warnecke et al., 2011) and the United States (Finkelstein et al., 2007; Rosenzweig et al., 2003; Shapiro et al., 1998).

Four cognitive-, behavioral-, and mindfulness-based studies contributed data to a pooled analysis for the primary outcome of self-reported stress and anxiety in physicians. The results are significant for treatment against the control group with a large effect size (SDM point estimate, -1.07; 95% CI, -1.39 to -0.74). Heterogeneity as assessed by the  $I^2$  is low (0%) (see Figure 1). Four additional studies assessed the impact of cognitive, behavioral, and mindfulness on stress and anxiety in medical students. The pooled results for interventions (SDM, -0.55; 95% CI, -0.74 to -0.36;  $I^2 = 0\%$ ) showed significant improvement over control groups with a moderate effect size (see Figure 2). Despite the differences in approaches, the low heterogeneity may suggest a considerable degree of similarity. It should be noted, however, that given the small number of samples included in the analysis, the low  $I^2$  score may reflect the fact that variability could not be detected.

Finally, a meta-analysis was conducted for the secondary outcome of burnout. Four studies involving five independently assessed interventions contributed to a pooled analysis for burnout. The results demonstrate a significant change from pretest to posttest with a moderate effect size (SDM, -0.38; 95% CI, -0.49 to -0.26). Heterogeneity as assessed by the  $I^2$  is 0% in this analysis, which speaks to the consistency in the outcomes of the approaches used across trials despite apparent differences (see Figure 3).

#### DISCUSSION

The findings of this meta-analysis suggest that cognitive-, behavioral-, and mindfulness-based interventions focused on stress reduction significantly reduce symptoms of anxiety in physicians. Further, despite variations in approaches in terms of length of intervention and specific components of the intervention (including

# **Burnout in Physicians**



### Meta-Analysis of Single Group Design Studies

FIGURE 3. Meta-analysis of interventions addressing burnout in physicians.

aspects such as cognitive restructuring, relaxation, and meditation) with both medical students and physicians in different countries, the results are remarkably consistent across studies. These results add to the limited research on stress reduction interventions with health care providers. A Cochrane review of the effectiveness of person-focused and organizationally focused interventions on reducing stress and burnout in health care workers (primarily nurses) concluded that both individual and work-directed interventions can be effective in reducing stress and burnout (Marine et al., 2006). This conclusion was supported in a review by Awa et al. (2010). Conversely, however, van Wyk and Pillay-van Wyk (2010) conducted a Cochrane review of preventative staff-support interventions for health workers (primarily nurses) and concluded that there was insufficient evidence regarding the effectiveness of stress management training on preventing burnout. Indeed, as noted earlier, when randomized controlled trials alone are considered, there is insufficient evidence to support the use of any intervention to reduce burnout. However, given the paucity of studies in this area, quasi-experimental studies have been included in this present review and other previous reviews.

The findings of the present review are further supported by meta-analyses conducted with other populations. A previous metaanalysis on stress interventions for students has revealed that cognitive-, behavioral-, and mindfulness-based interventions reduce stress in a wide range of student groups (Regehr et al., 2013). Further systematic reviews have established that cognitive-behavioral approaches are effective in reducing symptoms of posttraumatic stress disorder in a variety of other populations including accident survivors, emergency responders and veterans, and survivors of sexual violence (Bisson and Andrew, 2007; Hunot et al., 2007; Regehr et al., 2012; Sherman, 1998). In addition, recent reviews have found that meditation and relaxation techniques are effective in reducing anxiety (Krisanaprakornkit et al., 2006) and a number of other mental and physical disorders (Chiesa and Serretti, 2009; Grossman et al., 2004).

#### Limitations

Studies in this review are limited to those published in peerreviewed journals. The preponderance of studies included was conducted in the United States, although studies were also conducted in Spain, Argentina, Norway, and Tasmania. Nevertheless, generalizability to other cultural contexts may be limited. As with any metaanalysis, publication bias represents a threat to the validity of the analysis because studies with negative findings are often not published. Although five of the studies investigating the effectiveness of stress interventions used random assignment to intervention and control groups, three used parallel cohort designs. The composition of the control groups in these cases may have represented a bias. Finally, single-group design studies were included in the metaanalysis for burnout interventions. As such, the possibility that improvement in burnout scores was related to other factors, including spontaneous remission, cannot be ruled out.

#### CONCLUSIONS

The results from this review and meta-analysis provide support that cognitive-, behavioral-, and mindfulness-based approaches are effective in reducing subjective stress and anxiety in medical students and practicing physicians. Further, there is emerging evidence that these models may also contribute to lower levels of burnout in physicians. Given the stressors inherent in medical practice and evidence that the outcomes of stress are associated with risks to both the physician and their patients, it is imperative that physicians have access to interventions that reduce stress, anxiety, and potentially burnout. Further, because there is evidence that stress experienced by physicians begins early in their careers, engagement in preventative interventions that increase individual control over stressful situations encountered in professional practice and training should be encouraged.

#### DISCLOSURE

The authors declare no conflict of interest.

#### REFERENCES

- Arora S, Sevdalis N, Aggarwal R, Sirimanna P, Darzi A, Kneebone R (2010) Stress impairs psychomotor performance in novice laparoscopic surgeons. *Surg Endosc.* 24:2588–2593.
- Awa W, Plaumann M, Walter U (2010) Burnout prevention: A review of intervention programs. Patient Educ Couns. 78:184–190.
- Bisson J, Andrew M (2007) Psychological treatment of post-traumatic stress disorder (PTSD). Cochrane Database Syst Rev. doi:10.1002/14651858. CD003388.pub3.
- Brown S, Goske M, Johnson C (2009) Beyond substance abuse: Stress, burnout, and depression as causes of physician impairment and disruptive behavior. *J Am Coll Radiol.* 6:479–485.
- Chambers R, Belcher J (1994) Predicting mental health problems in general practitioners. Occup Med. 44:212–216.
- Chiesa A, Serretti A (2009) Mindfulness-based stress reduction for stress management in healthy people: A review and meta-analysis. J Altern Complement Med. 15:593–600.
- Cohen S, Kamarck T, Mermelstein R (1983) A global measure of perceived stress. J Health Soc Behav. 24:385–396.
- Colliver A, Kucera K, Verhulst S (2008) Meta-analysis of quasi-experimental research: Are systematic narrative reviews indicated? *Med Educ.* 42:858–865.
- Dyrbye L, Thomas M, Huntington J, Lawson K, Novotny P, Sloan J, Shanafelt T (2006) Personal life events and medical student burnout: A multicenter study. *Acad Med.* 81:374–384.
- Dyrbye L, Thomas M, Shanafelt T (2005) Medical student distress: Causes, consequences, and proposed solutions. *Mayo Clin Proc.* 80:1613–1622.
- Ellenbogen M, Schwartzman A (2009) Selective attention and avoidance on a pictoral cueing task during stress in clinically anxious and depressed participants. *Behav Res Ther.* 47:128–138.
- Fahrenkopf A, Sectish T, Barger L, Sharek P, Lewin D, Chiang V, Landrigen C (2008) Rates of medical errors among depressed and burnt out residents: Prospective cohort study. *BMJ*. 336:488.
- Finkelstein C, Brownstein A, Scott C, Lan Y (2007) Anxiety and stress reduction in medical education: An intervention. *Med Educ.* 41:258–264.
- Goehring C, Gallacchi M, Kunzi B, Bovier P (2005) Psychosocial and professional characteristics of bournout in Swiss primary care practitioners: A cross-sectional survey. *Swiss Med Wkly.* 135:101–108.
- Goodman M, Schorling J (2012) A mindfulness course decreases burnout and improves well-being among healthcare providers. *Int J Psychiatry Med.* 43:119–128.
- Grossman P, Niemann L, Schmidt S, Walach H (2004) Mindfulness-based stress reduction and health benefits: A meta-analysis. J Psychosom Res. 57:35–43.
- Guyatt G, Rennie D, Meade M, Cook D (2008) Users' guides to the medical literature: A manual for evidence-based clinical practice. 2nd ed. New York: McGraw-Hill Companies Inc.
- Harvey A, Bandiera G, Nathens A, LeBlanc V (2012) The impact of stress on resident performance in simulated trauma scenarios. J Trauma. 72:497–503.
- Hayes S (2004) Acceptance and commitment therapy, relational frame theory and the third wave of behavioral and cognitive therapies. *Behav Ther.* 35:639–665.
- Hedges L (1982) Estimating effect sizes from a series of independent experiments. *Psychol Bull*. 92:490–499.
- Higgins J, Green S (2011) Cochrane handbook for systematic reviews of interventions (Vol 5.1). Retrieved from http://www.cochrane-handbook.org. Retrieved March 14, 2014.
- Higgins J, Thompson S, Deeks J, Altman D (2003) Measuring inconsistency in meta-analyses. BMJ. 327:557–560.
- Hoffman S, Sawyer A, Fang A (2010) The empirical status of the "new wave" of CBT. Psychiatr Clin North Am. 33:701–710.
- Holtzworth-Munroe A, Munroe M, Smith R (1985) Effects of a stress-management training program on first and second year medical students. J Med Educ. 60:417–419.

358 www.jonmd.com

© 2014 Lippincott Williams & Wilkins

- Hunot V, Churchill R, Teixeira V, Silva de Lima M (2007) Psychological therapies for generalised anxiety disorder. *Cochrane Database Syst Rev.* doi:10.1002/ 14651858.CD001848.pub4.
- Jorm A, Morgan A, Hetrick S (2008) Relaxation for depression. Cochrane Database Syst Rev. doi:10.1002/14651858.CD007142.pub2.
- Justo C (2010) Reducción de los niveles de estrés y ansiedad en médicos de Atención Primaria mediante la aplicación de un programa de entrenamiento en conciencia plena (mindfulness). Aten Primaria. 42:564–570.
- Kabat-Zinn J (1982) An outpatient program in behavioral medicine for chronic pain patients based on practice of mindfulness meditation: Theoretical considerations and preliminary results. *Gen Hosp Psychiatry*. 4:33–47.
- Kabat-Zinn J, Massion A, Kristeller J, Peterson L, Fletcher K, Pbert L, Santorelli S (1991) Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *Am J Psychiatry*. 149:936–943.
- Krasner M, Epstein R, Beckman H, Suchman A, Chapman B, Mooney C, Quill T (2009) Association of an educational program in mindful communication with burnout, empathy, and attitudes among primary care physicians. *JAMA*. 302: 1284–1293.
- Krisanaprakornkit T, Sriraj W, Piyavhatkul N, Laopaiboon M (2006) Meditation therapy for anxiety disorders. *Cochrane Database Syst Rev.* doi:0.1002/ 14651858.CD004998.pub2.
- Lee F, Brown J, Stewart M (2009) Exploring family physician stress: Helpful strategies. Can Fam Physician. 55:288–289.
- Littell J, Corcoran J, Pillai V (2008) Systematic reviews and meta-analysis. London: Oxford University Press.
- Marine A, Ruotsalainen J, Serra C, Verbeek J (2006) Preventing occupational stress and healthcare workers. *Cochrane Database Syst Rev.* CD002892. doi:10.1002/ 14651858.CD002892.pub2.
- Martins A, Davenport M, Del Valle M, Di Lalla S, Dominguez P, Ormando L, Ferrero F (2011) Impact of a brief intervention on the burnout levels of pediatric residents. J Pediatr (Rio J). 87:493–498.
- Maslach C, Jackson S (1986) Maslach's burnout inventory manual. Palo Alto, CA: Consulting Psychology Press.
- McCue J, Sachs C (1991) A stress management workshop improves residents' coping skills. Arch Intern Med. 151:2273–2277.
- McNair D, Lorr M Droppleman L (1971) Manual: Profile of Mood States. San Diego, CA: Educational & Industrial Testing Service.
- Murphy R, Gray S, Sterling G, Reeves K, DuCette J (2009) A comparative study of professional student stress. J Dent Educ. 73:328–337.
- Myers M (2003) Canadian Medical Association guide to physician health and well-being. Ottawa, Canada: Canadian Medical Association.
- Palan B, Chandwani S (1989) Coping with exam stress through hypnosis: An experimental study. Am J Clin Hypn. 31:173–180.
- Panagopoulou E, Montgomery A, Benos A (2006) Burnout in internal medicine physicians: Differences between residents and specialists. *Eur J Intern Med.* 17:195–200.
- Pottier P, Dejoie T, Hardouin J, Le Loupp A, Planchon B, Bonnaud A, Leblanc V (2013) Effect of stress on clinical reasoning during simulated ambulatory consultations. *Med Teach*. 35:472–480.
- Quill T, Williamson P (1990) Healthy approaches to physician stress. Arch Intern Med. 150:1857.
- Regehr C, Alaggia R, Dennis J, Pitts A, Saini M (2012) Interventions to reduce distress in adult victims of sexual violence and rape. Campbell Library of Systematic Reviews. Retrieved from http://campbellcollaboration.org/lib/project/97/. Retrieved March 14, 2014.
- Regehr C, Glancy D, Pitts A (2013) Interventions to reduce stress in university students: A review and meta-analysis. J Affect Disord. 148:1–11. doi:10.1016/ j.jad.2012.11.026.
- Renzi C, Tabolli S, Ianni A, Di Pietro C, Puddu P (2005) Burnout and job satisfaction comparing healthcare staff of a dermatological hospital and a general hospital. J Eur Acad Dermatol Venereol. 19:153–157.
- Ro K, Gude T, Tyssen R, Aasland O (2008) Counselling for burnout in Norwegian doctors: One year cohort study. *BMJ*. 338:a2004.
- Ro K, Tyssen R, Hoffart A, Sexton H, Aasland O, Gude T (2010) A three-year cohort student of the relationships between coping, job stress and burnout after

a counselling intervention for help-seeking physicians. *BMC Public Health*. 10:1–13.

- Rosenzweig S, Reibel D, Greenson J, Brainard G (2003) Mindfulness-based stress reduction lowers psychological distress in medical students. *Teach Learn Med.* 15:88–92.
- Rutledge T, Stucky E, Dollarhide A, Shively M, Jain S, Wolfson T, Dresselhaus T (2009) A real-time assessment of work stress in physicians and nurses. *Health Psychol.* 28:194–200.
- Saadat H, Snow D, Ottenheimer S, Dai F, Kain Z (2012) Wellness program for anesthesiology residents: A randomized, controlled trial. *Acta Anaesthesiol Scand.* 56:1130–1138.
- Shanafelt T, Balch C, Bechamps G, Russell T, Dyrbye L, Satele D, Freischlag J (2010) Burnout and medical errors among American surgeons. Ann Surg. 251:995–1000.
- Shanafelt T, Boone S, Tan L, Dyrbye L, Sotile W, Satele D, Oreskovich M (2012) Burnout and satisfaction with work-life balance among US physicians relative to the general US population. *Arch Intern Med.* 172:1377–1385.
- Shapiro S, Schwartz G, Bonner G (1998) Effects of mindfulness-based stress reduction on medical and premedical students. J Behav Med. 21:581–599.
- Shen L, Lao L, Jiang S, Yang H, Ren L, Ying D, Zhu S (2012) A survey of anxiety and depression symptoms among primary-care physicians in China. *Int J Psychiatry Med.* 44:257–270.
- Sherman J (1998) Effects of psychotherapeutic treatments for PTSD: A metaanalysis of controlled clinical trials. J Trauma Stress. 11:413–435.
- Snow D, Swan S, Wilton L (2002) A workplace coping skills intervention to prevent alcohol abuse. In Bennett J, Lehman W (Eds), Preventing workplace substance abuse: Beyond drug testing to wellness. Washington, DC: American Psychological Association Press.
- Sood A, Prasad K, Schroeder D, Varkey P (2011) Stress management and resilience training among Department of Medicine faculty: A pilot randomized clinical trial. J Gen Intern Med. 26:858–861.
- Spielberger C (1983) Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press.
- Stewart S, Betson C, Lam T, Marshall I, Lee P, Wong C (1997) Predicting stress in first year medical students: A longitudinal study. *Med Educ.* 31:163–168.
- Stroup D, Berlin J, Morton S, Olkin I, Williamson G, Rennie D, Thacker S (2000) Meta-analysis of observational studies in epidemiology. JAMA. 283:2008–2012.
- Stucky E, Dresselhaus T, Dollarhide A, Shively M, Maynard G, Jain S, Rutledge T (2009) Intern to attending: Assessing stress among physicians. Acad Med. 84:251–257.
- Thomas N (2004) Resident burnout. JAMA. 292:2880-2889.
- Van Den Hombergh P, Künzi B, Elwyn G, Van Doremalen J, Akkermans R, Grol R, Wensing M (2009) High workload and job stress are associated with lower practice performance in general practice: an observational study in 239 general practices in the Netherlands. *BMC Health Serv Res.* 9:118.
- van Wyk BE, Pillay-van Wyk V (2010) Preventative staff-support interventions for health workers. *Cochrane Database Syst Rev.* CD003541. doi:10.1002/ 14651858.CD003541.pub2.
- Wallace J, Lemaire J, Ghali W (2009) Physician wellness: A missing quality indicator. *Lancet*. 374:1714–1721.
- Warnecke E, Quinn S, Ogden K, Towle N, Nelson M (2011) A randomised controlled trial of the effects of mindfulness practice on medical student stress levels. *Med Educ.* 45:381–388.
- West C, Huschka M, Novotny P, Sloan J, Kolars J, Habermann T, Shanafelt T (2006) Association of perceived medical errors with resident distress and empathy: A prospective longitudinal study. JAMA. 296:1071–1076.
- West C, Tan A, Habermann T, Sloan J, Shanafelt T (2009) Association of resident fatigue and distress with perceived medical errors. JAMA. 302:1294–1300.
- Whitehouse W, Dinges D, Orne E, Keller S, Bates B, Bauer N, Orne M (1996) Psychosocial and immune effects of self-hypnosis training for stress management throughout first semester of medical school. *Psychosom Med.* 58:249–263.
- Zuardi A, Ishara S, Bandeira M (2011) Burden and stress among psychiatry residents and psychiatric health care providers. Acad Psychiatry. 35:404–406.