

Effects of Mindfulness-Based Stress Reduction on Medical and Premedical Students

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Accepted for publication: March 9, 1998

The inability to cope successfully with the enormous stress of medical education may lead to a cascade of consequences at both a personal and professional level. The present study examined the short-term effects of an 8-week meditation-based stress reduction intervention on premedical and medical students using a well-controlled statistical design. Findings indicate that participation in the intervention can effectively (1) reduce self-reported state and trait anxiety, (2) reduce reports of overall psychological distress including depression, (3) increase scores on overall empathy levels, and (4) increase scores on a measure of spiritual experiences assessed at termination of intervention. These results (5) replicated in the wait-list control group, (6) held across different experiments, and (7) were observed during the exam period. Future research should address potential long-term effects of mindfulness training for medical and premedical students.

KEY WORDS: mindfulness meditation; medical education; stress-management; anxiety; depression; empathy; spirituality.

INTRODUCTION

How can we better prepare our future doctors for the stresses of medical practice? Coping with stress appears to be one of the greatest challenges currently facing the medical profession (Lee, 1987). The inability to cope successfully with the enormous demands of medical school and medical practice may

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lead to a cascade of consequences at both a personal level—affecting doctors' intra- and interpersonal lives (emotional/spiritual health as well as their physical health); and at a professional level—influencing their effectiveness as doctors by diminishing the quality of doctor–patient relationships. This study focused on premedical and medical students in a preliminary attempt to examine a possible complement to medical education which may prevent and/or reduce the harmful effects of preparing to be a physician. The aims of the study were to assess the efficacy of a short term mindfulness-based intervention (described below) to: (1) decrease overall negative psychological symptoms including specific measures of anxiety and depression, (2) potentially enhance the doctor–patient relationship through the cultivation of empathy, and (3) foster spiritual growth and understanding. Ultimately it is hoped this intervention will help students adopt a more balanced and humanistic approach to both their own lives and their patients' lives.

Stress has been shown to have deleterious effects on one's physical and mental well-being (Seyle, 1976, McCabe and Schneiderman, 1985, Jemmott *et al.*, 1983). The extreme stress levels inherent in the medical profession (and in preparing for it), put premedical and medical students at risk for both physical and psychological problems. Potential consequences of stress on medical students' lives include alcohol/drug abuse (Johnson, Michels, and Thomas, 1990), interpersonal relationship difficulties (Gallegos, 1990), depression and anxiety (Pitts, Winokur, and Stewart, 1961; Salt, Nadelson, and Notman, 1984), and suicide (Richings, Khara, and McDowell, 1986). Many of these problems develop during medical school (Salt *et al.*, 1994). A study by Salt and colleagues (1984), reported that Harvard and Tufts medical students showed an increase in depression from 13% at the beginning of medical school, to 24.5% by the end of the second year.

Stress may affect not only medical students' personal well-being, but may also have negative consequences on their professional effectiveness by diminishing the humanistic qualities fundamental to optimal patient care. Empathy, defined by Rogers (1961) as (1) the capacity to understand, be sensitive to, and feel what another is feeling, and (2) the ability to communicate this sensitivity to the person, is arguably a crucial element of the doctor–patient relationship. Research suggests that the quality of the physician–patient relationship has an impact on general patient well-being (Smith and Thompson, 1993), medical compliance (Sbarbaro, 1990), and recovery from surgery (Anderson and Masur, 1989; Egbert, Battit, Welch, and Bartlett, 1964). However, rather than helping students cultivate empathy, medical school may play a role in decreasing it. A recent study found that empathy levels, measured by the Empathy Construct Rating Scale (La Monica, 1981), decreased significantly between entry to medical school and the end of the first year (Pastore, Gambert, Plutchik, and Plutchik,

1995). Medical school, therefore, appears an important time to focus on cultivating listening skills, an awareness of and sensitivity to patients' needs, and a compassion for their experiences.

Finally, spirituality may be a buffer to the negative effects of life stressors (Kass, in press). It has been demonstrated that spirituality can enhance physical and psychological well-being (Kass, 1995; Kass, Friedman, Lesserman, Zuttermeister, and Benson, 1991) and predicts various health outcomes (Hawks, Hull, Thalman, and Richins, 1995; Levin, 1994). Because premedical and medical students face many stressors, it appears important to address their spiritual as well their cognitive, behavioral, and emotional needs in an attempt to buffer against the effects of stress. A final goal of this intervention, therefore, is to help students cultivate a deeper understanding of and openness to spirituality.

In response to the current literature, this intervention targeted premedical and medical students in an attempt to address some of the deleterious consequences of their intense and stressful lives. The intervention was modeled the Stress Reduction and Relaxation Program (SR&RP) developed by Kabat-Zinn and colleagues at the University of Massachusetts Medical Center (Kabat-Zinn, 1982). The present intervention was presented as an 8-week "course" in which medical and premedical students underwent training in a class-like setting in the practice of mindfulness meditation (formal practice) and its applications to daily life (informal practice) (Kabat-Zinn, 1993).

Mindfulness meditation is a formal discipline that attempts to create greater awareness and consequently greater insight in the practitioner. It goes beyond a closed concentrative one-pointed meditation by introducing an openness to all experiences. Mindfulness is a conscious moment to moment awareness, cultivated by systematically paying attention on purpose (Kabat-Zinn, 1990). The key to mindfulness, however, is not simply attention. More importantly it is *how* one attends. The intention one brings to the attention (practice) is crucial (Shapiro and Schwartz, in press). The attention must embody compassion, impartiality, and acceptance of self and others. Utilizing these qualities, one can cultivate present moment attention in an objective (nonjudging), compassionate and gentle way, open to whatever enters one's field of awareness.

In the past 18 years since the Stress Reduction clinic at University of Massachusetts was founded, more than 7000 patients have gone through the Stress Reduction and Relaxation Program (Kabat-Zinn, 1996). These patients have had a wide range of medical diagnoses (AIDS, heart disease, cancer, chronic pain, gastrointestinal disorders, hypertension, sleep disorders, depression, anxiety and panic disorders), yet, "all share the desire to control stress more effectively and to utilize their inner resources to improve the quality of their lives" (Kabat-Zinn, 1993, p. 260). The SR&RP is not intended to replace traditional medical therapy, but to work adjunctly with it. Research demonstrates substantial effects

associated with practicing mindfulness meditation such as decreases in anxiety, hostility, and depression as well as decreases in medical symptoms (Kabat-Zinn *et al.*, 1992).

Those completing the SR&RP also evidence profound changes in their beliefs and attitudes regarding themselves and their relationship to the world (Kabat-Zinn, 1993, 1996). Patients show improvements in self-efficacy and motivation and enhanced ability to approach stressful events as challenges instead of threats (Kabat-Zinn, 1993). There is also evidence of a greater sense of control and the ability to let go of and accept events which are uncontrollable (Astin, 1997). Upon completion of the SR&RP, people also report feeling a sense of trust, closeness with other people and the environment (Kabat-Zinn, 1993). Mindfulness meditation may not only connect one with him/herself, it may also foster a sense of connectedness with others and with a greater *whole* (Shapiro and Schwartz, in press). All of these positive psychological changes associated with the cultivation of mindfulness have been linked to greater psychological/and or physiological well-being (Antonovsky, 1987; Bandura, 1987; Kass, 1995; McClelland, 1989; Russek and Schwartz, 1997; Schwartz, 1984; Seligman, 1975; Shapiro, Schwartz, and Astin, 1997; Williams, 1985).

Despite the promising findings regarding the effects of the SR&RP, these studies have methodological limitations such as using self-selected samples and not having adequate control groups (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, and Burney, 1985). Research is needed to test the effectiveness of a mindfulness-based intervention using well controlled, experimental designs. The present study used a matched wait-list control design in attempt to replicate findings of current literature while addressing some of its methodological limitations. This study further expanded upon previous research by examining the potential benefits of a mindfulness intervention to cultivate empathy, an outcome not previously addressed in the literature. A further unique feature of the study was its focus on medical and premedical students. It attempted to examine a possible complement to medical education which may prevent the deleterious consequences of stress as well as provide students with skills and knowledge to better prepare them for their future roles as physicians.

It was hypothesized that a mindfulness-based intervention would (1) decrease overall psychological symptomatology measured by the Hopkins Symptom Checklist Revised (SCL-90), including specific subscale measures of anxiety and depression; (2) reduce both state and trait anxiety measured by the STAI-1 form; (3) cultivate empathy and mindful listening skills assessed using an adapted version of the Empathy Construct Rating Scale; and (4) contribute to an increase in spiritual experience/feelings measured by the revised edition of the INSPIRIT assessed at termination of the intervention. Further, it was anticipated that the intervention would not be equally effective for all people depending on how greatly one was committed to the course in general and meditation

practice in particular. Thus compliance was examined to determine if this variable played a role in who benefits most from the intervention.

METHOD

Participants

Premedical and medical students were actively recruited to participate in the mindfulness-based stress reduction intervention. The intervention was offered in the form of an enrichment elective available to both medical and premedical students. Brief presentations describing the “Stress Reduction and Relaxation” elective were given to the first- and second-year medical students, the premedical honors society, and the Fostering and Achieving Cultural Equity and Sensitivity (FACES) premedical student group. Premedical students were offered one psychology credit and the medical students were offered enrichment elective credit. In addition, flyers detailing the elective were distributed throughout the Medical school and the University of Arizona campus and the prehealth student advisor office. Further, the premedical student advisors referred students to the program and sent out information concerning the program to all those students on the e-mail list.

Approximately 20 FACES students, 50 honors premedical students and 130 first- and second-year medical students were actively recruited ($N = 200$). Interested students (approximately 95) filled out forms indicating their willingness to be randomly assigned to a waiting list to take the course second session. Only those students willing to be randomly assigned to either the intervention or control group were included in the study. 78 participants met these criteria and were randomly assigned to an intervention group or a wait-list control group. Randomization was matched for gender, race, and medical vs. premedical status.

Design and Procedure

The design was a matched randomized experiment in which participants were assigned to a 7-week mindfulness-based intervention or a wait-list control group. Participants in the intervention group were then split into two classes of 18 and 19 participants. The two intervention classes were equivalent except each had a different facilitator in attempt to determine generality across experimenters. Participants in both the intervention group and control group were measured two times: (a) before intervention, and (b) shortly following the intervention which was scheduled to coincide with exam period in an attempt to rigor-

ously scrutinize the benefits of the intervention during an extremely high stress period. To control for random effects and increase consistency across groups, both intervention and control groups were assessed at the same time, date, and location. The measures were given shortly after the final SR&RP class. To avoid bias induced by the meditative state of the class, there was a 15- to 20-minute interim between class and administration of post measures. Students were asked to get up and walk outside. A final set of questionnaires was administered to the wait-list control group after receiving the equivalent intervention in an attempt to replicate the first session's results. To avoid experimenter effects, assessment measures were administered and collected by an undergraduate research assistant not involved in the design of the research or the intervention. Further, all participants were assigned a confidential identification number to which the primary investigator did not have access.

Intervention

The intervention was presented as an 8-week elective in Stress Reduction and Relaxation modeled after the program developed by Kabat-Zinn and colleagues (1982). The core of the program focused on training the students in mindfulness. Participants received training in the following meditative practices (adapted from Kabat-Zinn, 1982): (1) "Sitting Meditation" involving awareness of body sensations, thoughts, emotions while continually returning the focus of attention to the breath; (2) "Body Scan," a progressive movement of attention through the body from toes to head observing any sensations in the different regions of the body; (3) "Hatha Yoga," which consisted of stretches and postures designed to enhance greater awareness and to balance and strengthen the musculoskeletal system. Inherent in all these techniques was an emphasis on mindful breathing, continually bringing attention to the breath. In addition to these three techniques, a "lovingkindness" and a "forgiveness" meditation were introduced (the loving kindness meditation is practiced during the all day retreat in Kabat-Zinn's formal intervention, however, the forgiveness meditation is unique to the present intervention).

Further, students participated in experiential exercises designed to cultivate mindful listening skills and empathy (which are unique to the present intervention). Didactic material was presented on the psychological and physiological effects of stress and how to cope with stress. To facilitate sharing and social support, the group split into smaller subsets each week to discuss their experiences. "Mindfulness" was woven throughout all of the exercises, and was explicitly emphasized as the thread that interconnected the various components of the intervention. The course consisted of seven sessions (2.5 hours each week) and had weekly home practice assignments as well as daily journals.

Measures

Standard demographic measures were obtained (ethnicity, age, gender, education). Participants completed the following measures to assess the six principle quantitative dependent variables:

Empathy. Participants completed an adapted version (half of the original version of 84 items) of the Empathy Construct Rating Scale (ECRS) (La Monica, 1981) consisting of 42 items to provide a measure of overall level of empathy. The 42 items were reported on a 5-point scale. The alpha coefficient (.89) of this adapted instrument suggests that it is highly reliable for this specific sample.

Psychological Distress. The Hopkins Symptom Checklist 90 (Revised)—SCL-90-R (Derogatis, 1977), a 90-item Likert-scale (1–5) instrument consisting of the following nine subscales: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and an “additional items” scale comprised of seven questions, five of which relate to disturbances in sleeping and eating provided a measure of overall psychological distress, calculated as the “General Severity Index” (GSI).

Depression. Subscale 4 of the SCL-90 was used to assess depression. The symptoms of the Depression dimension reflect a range of the manifestations of clinical depression. The scale consists of 13 Likert scale (1–5) questions to assess symptoms of dysphoric mood and affect, signs of withdrawal of life interest, lack of motivation, and loss of vital energy as well as feelings of hopelessness, thoughts of suicide, and other cognitive and somatic correlates of depression.

State and Trait Anxiety. The State-Trait Anxiety Inventory (Form Y)—STAI Form 1 (Spielberger, Gorsuch, and Lushene, 1970) 40-item self-report instrument was used to measure both state and trait anxiety using a 1–4 Likert rating scale.

Spirituality. The Index of Core Spiritual Experiences—INSPIRIT developed by Kass and colleagues (1991) is a seven-item scale designed to assess two characteristic elements of core spiritual experiences: (1) “a distinct event and a cognitive appraisal of that event which resulted in a personal conviction of God’s existence (or of some form of Higher Power as defined by the person),” and (2) “the perception of a highly internalized relationship between God (Spiritual core) and the person.” Scores calculated for this measure range from 1–4 (with higher scores reflecting a greater number of spiritual experiences). This instrument demonstrates high internal reliability, Kass and colleagues (1991) report an alpha coefficient of .9.

There were two ancillary measures included. A daily journal was used to measure compliance with meditation practice. Participants recorded the length of their daily meditation practice and turned in the journal each week at the beginning of class. Also, evaluation packets were filled out by participants upon completion of class to assess the course and to gain written qualitative reports of the impact of the course.

RESULTS

The high rate of completion of the program (97%, 36 of 37) was consistent with previous studies of the SR&RP (Kabat-Zinn *et al.*, 1992, Kabat-Zinn and Chapman-Waldrop, 1988). One student did not complete the intervention due to severe medical problems for which she was hospitalized. Four of the participants in the control group did not complete the post-measures. The final count of participants was 73, consisting of 32 males and 41 females, 35 premedical students and 38 medical students. The majority of the participants were Caucasian (79%, 58), the rest of the sample were Hispanic (8%, six), Indian (5%, four), African American (3%, two), and Asian American (3%, two).

Initial analyses were conducted to ensure that the matched randomization across gender, ethnicity, and premedical/medical status was successful. Chi-square demonstrated that none of the variables differed significantly between groups: gender $\chi^2(1, N = 78) = 1.30, p > .49$; race $\chi^2(1, N = 78) = 4.62, p > .43$; premedical vs. medical $\chi^2(1, N = 78) = .20, p > .64$. A repeated measures Multivariate Analysis of Variance (MANOVA) was then run to compare the intervention and control groups along the six outcome variables (depression, state anxiety, trait anxiety, spirituality, empathy, and the GSI). Both pre- and post-scores of the six outcome variables were entered as variates; the independent variable was treatment group by time. The groups were found to differ significantly at time 2 (post-intervention) $\Lambda(6, 64) = .8005, p < .03$. Multivariate Analysis of Covariance (MANCOVA) was performed to more conservatively protect against both Type I error and the chance that covariables were influencing the outcome. The pretest scores of the outcome variables were entered as covariates and the post-scores were entered as variates. MANCOVA reported a significant multivariate main effect for group $\Lambda(6, 58) = .767, p < .02$.

Post hoc Newman-Keuls tests revealed no significant differences between groups pretest scores ($p > .05$ in all cases); however, significant differences were found between groups' posttest scores ($p < .05$ in all cases). Follow-up univariate ANOVA (uncorrected because of the directional nature of the hypotheses) further revealed that, compared with the control group, the intervention group reported less depression $F(1, 69) = 8.18, p < .006$, less state anxiety $F(1, 69) = 4.11, p < .05$, less trait anxiety $F(1, 69), p < .002$, a decrease in GSI $F(1, 69) =$

6.62, $p < .02$, and increases in empathy $F(1, 69) = 4.3$, $p < .05$, and spirituality $F(1, 69) = 5.62$, $p < .02$. ANOVAs were repeated with experimenter as a factor and no significant differences were found ($p > .05$). Figure 1a–f illustrates these respective differences. It is important to note that the post-measures were administered during exam period, thus all participants (both the treatment and

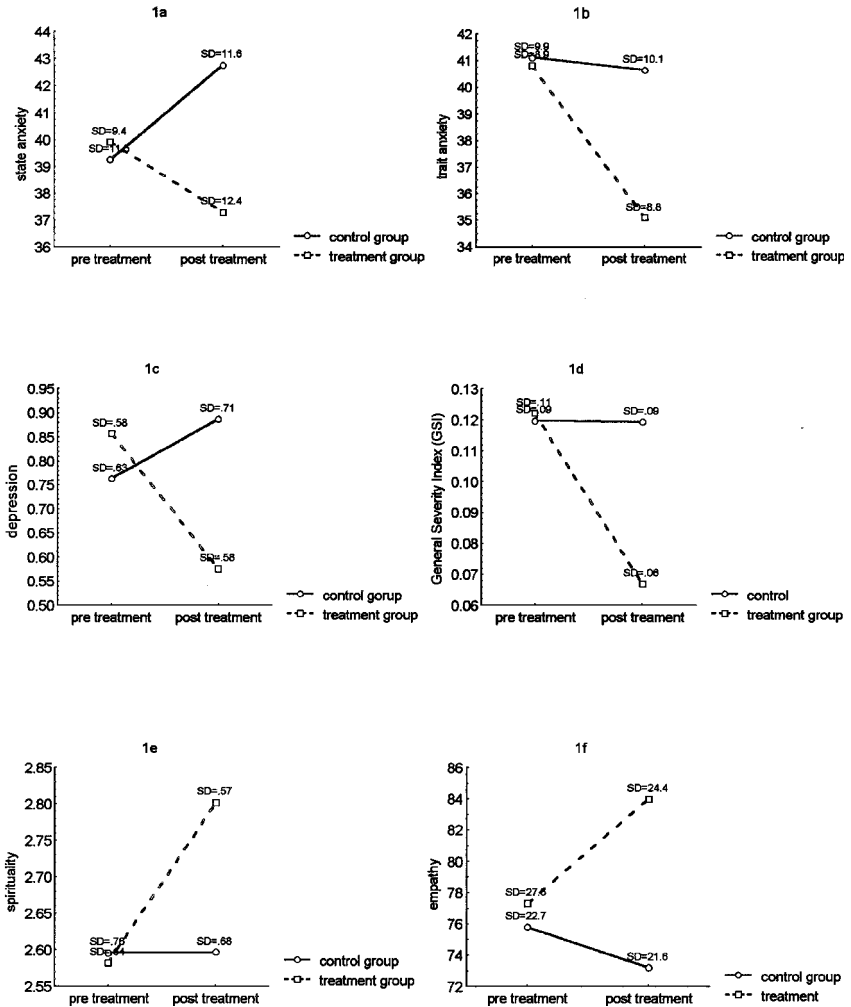


Fig. 1. Plot of means illustrating significant multivariate treatment by time interaction for both intervention and control groups. Graphs illustrate significant positive changes for the intervention: (a) state anxiety, (b) trait anxiety, (c) depression, (d) general severity index (GSI), (e) spirituality, (f) empathy.

control group) were under stress. Despite this, the intervention group demonstrated significant change in the predicted direction for all of the outcome variables.

In an attempt to examine direction and magnitude of change further, we would have preferred to use Structural Equations Modeling in order to report variance accounted for by the model and indices of fit. However, due to the relatively small sample size we were unable to do so. However, using similar data analytic strategy, we were able to construct a path diagram. Data were subjected to a series of multiple regressions using the SAS General Linear Model procedure (SAS Institute, 1985). The regressions involved both continuous and categorical variables. Change scores were constructed for the six outcome variables; and a compliance variable was created using a mean score of the total minutes plus total number of times the participants meditated during the intervention (control group was assigned a score of 0). All significance tests were performed hierarchically and regression weights were obtained through simultaneous least-squares estimation for the predictors found significant by the hierarchical tests.

The hierarchical order of the variables was as follows: treatment, compliance, change in trait anxiety, change in state anxiety, depression, GSI, empathy, spirituality. Each dependent variable became a predictor for the subsequent dependent variable. To determine the best hierarchical order, specific alternative models based on *a priori* theory were compared. Selection of the best model was based on predetermined criteria that the model reporting the least number of significant model parameters would be most parsimonious. An example of a comparison is evaluating a model where depression preceded trait anxiety against a model in which trait anxiety preceded depression. There were a few rules that were held constant across models. Trait anxiety was always entered before state anxiety to ensure that any variance accounted for by trait anxiety would not be misinterpreted as variance accounted for by state anxiety. Another constant was derived from previous analyses reporting the depression subscale to be the heart of the change in GSI. As a result, to avoid incorrect assignment of a direct effect, depression always preceded GSI.

A single best model was selected based upon principled criteria (Fig. 2). Compliance had a significant direct negative effect on trait anxiety ($\beta = -.440$, $p < .001$), indicating that as compliance increased, trait anxiety decreased. Trait anxiety appeared to be a central and integral component in the change demonstrated in the five remaining outcome variables. Trait anxiety had a significant direct positive effect on depression ($\beta = .525$, $p < .001$), state anxiety ($\beta = .541$, $p < .001$), and a significant negative effect on empathy ($\beta = -.390$, $p < .001$). Thus, a decrease in trait anxiety led to decreased depression, decreased state anxiety and an increase in empathy. Depression had a significant positive effect on change in GSI ($\beta = .695$, $p < .001$) and a significant negative effect on spir-

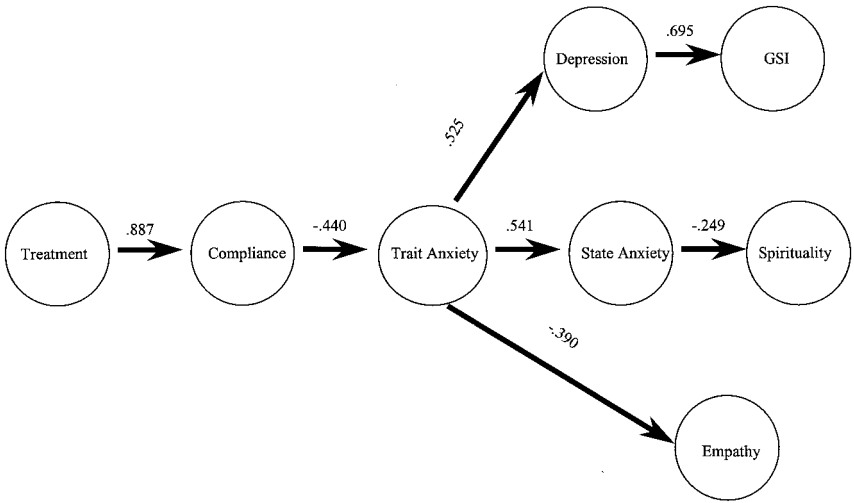


Fig. 2. Path diagram: A model of the pathways through which change occurred. Coefficients are standardized beta-weights. All pathway coefficients are significant $P < .05$.

ity ($\beta = -.308, p < .01$). State anxiety also had a significant negative effect on spirituality ($\beta = -.249, p < .033$) evidencing that a decrease in depression and state anxiety results in an increase in spirituality.

This data analytic strategy was designed to establish a path diagram estimating direct and indirect effects of the treatment in an attempt to explain the way in which change occurred. The model demonstrates both the magnitude and direction of the effects. It is important to note, however, that the path diagram is exploratory and meant to be used heuristically. The path diagram can suggest a causal theory, but it cannot prove it. Causal connections at each step, therefore, are only hypothetical. Our goal in producing this model is both to build a theory and to generate ideas for future study.

Replication

Seeking to replicate the findings of the first session intervention group, the same measures were administered to the wait-list control group after participation in the intervention. Unfortunately, due to a clerical error, the trait anxiety measure was not administered. MANOVA was conducted within groups using only control participants. Pre- and post-scores were analyzed across the three measurement times (time 1 and time 2 = pre-intervention, time 3 = post-intervention). To replicate the previous study as closely as possible, post-measures were again administered at the end of the last session during exam period. Results

replicated findings from the previous group, demonstrating significant change across the five outcome variables $\Lambda(10, 22) = .2593, p < .001$.

Post hoc Newman Keuls revealed that scores did not differ significantly at time 1 or time 2 (both pre-intervention); however, they did differ significantly with time 3 (post-intervention). Follow-up univariate ANOVA further illustrated that, compared with time 1 and time 2, at time 3 the participants reported less state anxiety at $F(2, 62) = 16.29, P < .001$, less depression $F(2, 62) = 3.37, P < .05$, a decrease in GSI $F(2, 62) = 6.33, P < .01$, as well as increases in reported empathy $F(2, 62) = 15.5, P < .001$, and spirituality $F(2, 62) = 10.83, P < .002$. Graphs plotting the means of the outcome variables at time 1, time 2, and time 3 can be seen in Fig. 3a–e.

DISCUSSION

The stress inherent in the medical profession (and in preparation for it) has numerous deleterious consequences for premedical and medical students' psychological well-being as well as their professional effectiveness. Preparation for the physician role should occur on many levels, including care of the personal well-being of students in training. There is a need for studies exploring possible complements to medical education. To contribute to the foundation of future research in this area, an intervention should first demonstrate successful short-term effects before definitive future implications can be addressed. The present study explored the short-term effects before definitive future implications can be addressed. The present study explored the short-term effects of an 8-week mindfulness-based intervention on premedical and medical students using a well-controlled statistical design.

Review of Findings

The data indicate that participation in a mindfulness-based stress reduction intervention can effectively (1) reduce self-reports of overall psychological distress including depression, (2) reduce self-reported state and trait anxiety, (3) increase scores on overall empathy levels, and (4) increase scores on a measure of spiritual experiences assessed at termination of the intervention. These results (5) replicated in the wait-list control group, (6) held across experimenters, and (7) were observed during the exam period. Further, analysis demonstrated that one's compliance with treatment played an important role in outcome. Finally, the path diagram provided a hierarchic model of the changes, making the change in (reported) trait anxiety the mechanism through which subsequent changes occur. This is consistent with Lesh's study (1970), which demonstrated that reducing

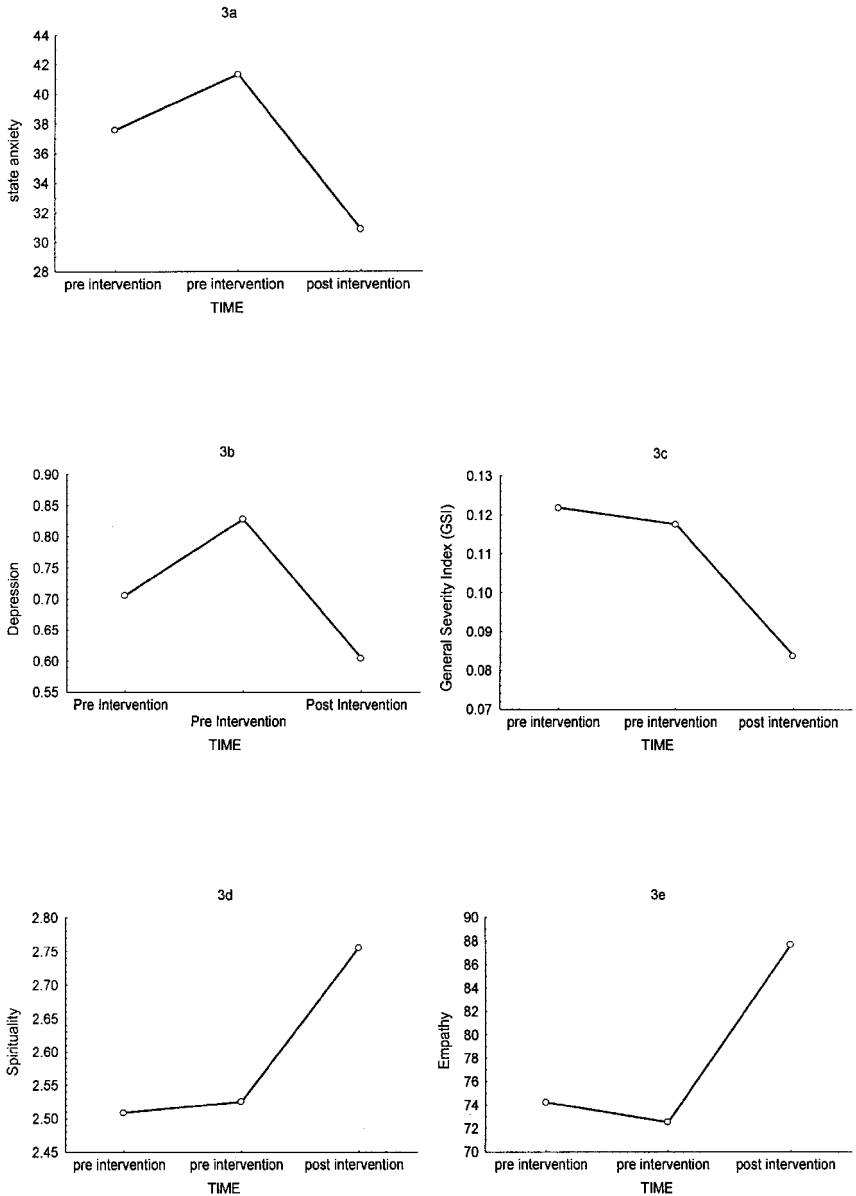


Fig. 3. Replication of findings of Fig. 1 with the control group after having received intervention. Plot of means across three time periods (time 1 and time 2 = pre-intervention, time 3 = post-intervention). Scores on the five outcome variables did not differ significantly at time 1 or time 2; however, they did differ significantly at time 3: (a) state anxiety, (b) depression, (c) GSI, (d) spirituality, (e) empathy.

stress and anxiety through meditation led to greater compassion and empathy in counselors.

The observed reductions in psychological symptomatology are consistent with the findings of previous research studying mindfulness-based interventions (Kabat-Zinn *et al.*, 1992; Astin, 1997), and provide evidence that the intervention is effective in a nonclinical population. Scores on the empathy measure increased significantly, suggesting that the intervention may have helped students cultivate listening skills and develop new, more compassionate perspectives and paradigms to approach their own lives as well as their future patients' lives. Finally, although the observed change in spirituality is statistically significant, interpreting change scores on the INSPIRIT in terms of clinical significance is difficult. However, despite the challenge of measuring and interpreting spirituality, including the spiritual dimension of an individual seems consequential given that research indicates spiritual well-being plays a role in health (Kass, 1995; Kass *et al.*, 1991; Levin, 1994).

Limitations and Future Research

Although this study found significant results consistent with the hypotheses using a well-controlled design, there are many limitations and suggestions for future research. It was not in the scope of this study to assess the long-term effects of the intervention; as a result, it cannot be concluded that the short-term changes produced will be useful in helping students deal with the future stress of being a physician or even the ongoing stressors associated with medical school. The results of this study will only have implications for health care if the effects of the intervention are enduring; this question should be answered by future research. Another limitation is the generalizability of the results. It is difficult to generalize from a population of medical and premedical students who voluntarily chose to enroll in a "Stress Relaxation and Reduction" elective. Experimenter effects and social desirability are other potential limitations. It is possible that students wanted to please the experimenter, and thus answered the self-report measures accordingly. In attempt to guard against this, all students were given confidential identification numbers, the researcher did not administer or collect any of the data, and the two groups were led by different experimenters.

The placebo effect is another potential confound; however, it can be viewed as a part of the healing process that should not be eliminated (White, Tursky, and Schwartz, 1985). The only way placebo effect can be investigated is to use placebo control groups in a prospective, randomized study. A further limitation of this study was that it included no comparison group receiving alternative treatment (i.e., progressive relaxation, biofeedback). It is suggested that future research compare different interventions to determine if effects are specific to

the mindfulness intervention or generalize across stress-management techniques. In addition, all assessment measures were self-report psychological questionnaires which are intrinsically limited and open to response bias. Future research is encouraged to explore the physiological effects of mindfulness intervention as well as the psychological effects.

Explanatory Mechanisms

A final suggestion for future research is to tease out explanatory mechanisms of how the intervention worked. The 8-week course was a multimodal intervention, including experiential exercises to cultivate mindful listening skills and empathy, didactic material on coping and stress, and provided group social support in addition to the formal meditation practice. Although at the foundation of each of these components was mindfulness, it is difficult to determine to what degree each uniquely contributed to the effects found. For example, the degree to which expression and social support individually contribute to the overall effects of mindfulness intervention is difficult to decipher. The intervention provides an empathic, safe environment where participants are encouraged to share their experiences, feelings, and difficulties. Therefore, it is possible that some of the effects are brought about through participants' expression of emotions and disclosure of personal stories. The literature confirms that both social support and disclosure enhance psychological and physical well-being (Pennebaker, Kiecolt-Glaser, and Glaser, 1988; Fawzy *et al.* 1993; Spiegel, Bloom, Kraemer, and Gottheil, 1989; Berkman, 1995). Future research should focus on more definitive designs, for example, comparing the mindfulness training to a traditional social support group.

Further, because of the complexity inherent in mindfulness practice itself, there are probably multiple pathways by which it positively affects health. One possible hypothesis is that mindfulness training provides a powerful cognitive-behavioral coping tool (Kabat-Zinn *et al.* 1992; Astin, 1997). Current theory posits that it is the cognitive-emotional appraisal of situations that determines the stress subsequently experienced (Beck, 1976; Ellis, 1962; Lazarus and Folkman, 1984). The intervention encourages alternative paradigms, and new interpretations of stress. It invites the participants to view stress as a challenge instead of a threat. However, mindfulness differs from cognitive-behavior therapy. One crucial difference is that cognitive behavior therapy places an emphasis on distinguishing thoughts as positive or negative, whereas mindfulness simply acknowledges them (Kabat-Zinn *et al.*, 1992). Another important difference is that cognitive-behavior therapy teaches coping skills to use during stressful or anxiety producing moments, whereas mindfulness is not just a coping tool but a "way of being," to be practiced in all moments (Kabat-Zinn *et al.*, 1992). Mind-

fulness involves adopting a new life perspective (Shapiro and Schwartz, in press) which one carries through all situations, continuously, moment to moment.

In addition, like other meditative practices, mindfulness meditation can facilitate physiological relaxation (Benson, 1975), which may partially contribute to reduction in psychological symptomatology. However, in contrast to other relaxation techniques, mindfulness meditation may foster "insight" (Kabat-Zinn *et al.*, 1985), providing practitioners with a deeper and clearer view of themselves and their problems. Further comparisons are needed to determine if the effects of the intervention are specific to mindfulness meditation or span across the multiple relaxation techniques (Shapiro, 1982).

Finally, a strong case can be made that self-regulation is a crucial mechanism which may contribute to the changes in psychological and physical health found in mindfulness-based stress reduction intervention. According to Schwartz's systems model of self-regulation (1984, 1989), a "system" maintains stability of functioning as well as flexibility and the capacity to change in novel circumstances through continual feedback loops that connect all subsystems to the larger whole. The model further posits that disregulation and subsequent disease stem from disconnection of feedback loops as a result of not attending to crucial messages within the system. When disregulation occurs, attention is needed to reestablish connectedness which in turn enhances health. Humans can be thought of as systems, composed of subsystems, and part of larger suprasystems (e.g., families, communities, cultures). Thus, a potential hypothesis is that mindfulness serves to increase the amount of attention and connection in the "system" thereby leading to greater psychophysiological regulation, balance, and health (Shapiro and Schwartz, in press).

SUMMARY

Although the explanatory mechanisms of the mindfulness intervention are yet unclear, the results of this study may have important implications across many levels. A number of novel features are introduced that have not been previously reported on in the context of mindfulness-based stress management. The study documents the potential effectiveness of mindfulness training to enhance premedical and medical students' psychological/spiritual well-being as well as help cultivate skills to use in their future roles as physicians. It explores the multiple pathways by which a mindfulness-based intervention may help premedical and medical students in their personal as well as professional lives. The significant findings are strengthened because data acquisition postintervention coincided with subjects' exam periods and also because these findings were replicated with the wait-list control group. The short-term results are encouraging, and suggest that this intervention may prove a useful complement to medical

and premedical education. Further, these findings give strength to the hypothesis that mindfulness can be thought of as “preventive medicine” for future doctors, helping them cultivate a “way of being” that may foster healing and growth in their own lives as well as skills to effectively help others heal and grow in the future. The present study helps provide a foundation by establishing the immediate effectiveness of mindfulness-based intervention from which future, more sophisticated studies can build to examine the long-term implications (both for the well-being of our doctors and for their sensitivity to their patients) of integrating mindfulness training into medical education.

ACKNOWLEDGMENTS

We wish to thank Drs. Dan Shapiro, Varda Shoham, and John Allen for their invaluable advice and suggestions throughout the study. We also wish to thank Dr. Lynn Nadel for facilitating the implementation of the intervention. Further, we would like to thank Drs. A. J. Figueredo and John P. Kline for their statistical input and advice. Finally, we thank all of the premedical and medical students who participated in this study.

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