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# A pilot intervention to reduce burnout and enhance resilience through transcendental meditation among Georgetown University medical students

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## Abstract

**Background** Rates of burnout, depression, and anxiety among healthcare workers are at historically high levels and have remained high in the aftermath of the COVID-19 pandemic. As aspiring physicians, medical students are the future of the healthcare profession. The practice of Transcendental Meditation (TM) has been shown to reduce burnout and stress in diverse populations, including healthcare professionals. To date, no data have been published on the benefits of TM for medical students. Our objective was to assess the efficacy of TM practice in reducing burnout and increasing resilience among medical students at Georgetown University School of Medicine (GUSoM) over three months between October 2022 and May 2023.

**Methods** Forty-two GUSoM medical students qualified for and enrolled in the study. Thirty-nine students completed three months of TM training and practice, with the recommended regimen of meditating for 20 min twice a day. The students were assessed at baseline, one month, and three months using measures of burnout, depression, anxiety, insomnia, well-being, and resilience, of which burnout (emotional exhaustion) and resilience were the primary outcomes. Two-tailed paired-sample t-tests were used to determine the significance of changes in outcome measures over time.

**Results** In the three-month post-test, significant changes were found for both primary outcomes, emotional exhaustion ($p = 0.001$, Cohen's $d$ effect size = -0.61) and resilience ($p = 0.002$, $d = 0.53$), as well as for anxiety ($p < 0.001$, $d = -0.71$), insomnia ($p = 0.002$, $d = -0.53$), depersonalization ($p = 0.017$, $d = -0.40$), depression ($p = 0.006$, $d = -0.47$), and mental well-being ($p = 0.031$, $d = 0.36$). TM practice compliance was high at 85%. Additionally, there were significant relationships between frequency of TM home practice and improvements in emotional exhaustion ($p = 0.005$), anxiety ($p = 0.008$), and insomnia ($p < 0.001$), and a marginally significant relationship with depression ($p = 0.088$).

**Conclusions** These findings suggest that TM practice is an accessible, achievable, and effective intervention to decrease burnout and increase resilience for medical students. This study paves the way for future initiatives to evaluate a broad range of benefits of TM for medical students.

**Keywords** Transcendental Meditation (TM), Medical students, Burnout and emotional exhaustion, Anxiety and depression, Resilience and wellbeing, Academic stress

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## Background

Healthcare workers are at high risk of developing psychological distress. During the COVID-19 pandemic, healthcare workers showed alarming rates of anxiety, depression, and sleep disturbances. In the latest National Physician Burnout & Depression Report (2024), 49% of physicians reported that they are burned out–an increase from 42% in January 2021–with 1 in 5 reporting that they are clinically depressed. This report indicates a major increase of burnout among frontline physicians, e.g., from 43 to 63% among emergency physicians. In addition, 42% of physicians reported that their burnout has lasted for more than two years (compared to 30% in the preceding year), and 86% said that burnout harmed their personal relationships (compared to 65% in the preceding year) [1]. In another study published in Mayo Clinic Proceedings surveying 2,440 US physicians at the end of 2021 and the beginning of 2022, 63% of physicians reported at least one symptom of burnout [2].

According to Maslach and colleagues (1996), burnout is defined as a "work-related syndrome involving emotional exhaustion, depersonalization and a sense of reduced personal accomplishment" [3]. Burnout was already a national crisis in the healthcare workforce before COVID-19, with rates exceeding 40% among physicians, negatively affecting patient care and contributing to provider shortages at a cost estimated to be 4.5 billion dollars annually [4, 5]. Each year over 300–400 physicians and medical students die by suicide in the United States; this is equal to the loss of two average-sized medical school classes per year [6, 7]. Female physicians have a 200% higher suicide risk and male physicians have a 40% higher suicide risk compared to other professions [6, 8]. Medical students' rates of depression are 15–30% higher than those of peers of similar age and education [9]. A meta-analysis of 50,000 medical residents spanning 50 years found that 28% of residents experienced significant depressive symptoms during training that may have met the criteria for major depression [10]. Data comparing matriculating medical students to similar-age college graduates indicate that medical students had lower rates of burnout before entering medical school [11]. These findings support concerns that the training process and environment contribute to the deterioration of mental health.

The stigma attached to mental health difficulties among medical students, interns, and residents may lead medical trainees to avoid mental health treatment as their medical careers advance. This issue thus threatens not only the medical trainee population but potentially the integrity and resilience of the entire healthcare system. New models to promote mental well-being and reduce barriers to mental healthcare for medical students and healthcare workers are urgently needed.

Resilience has been defined as "the ability of an individual to respond to stress in a healthy, adaptive way, such that personal and professional goals are achieved at minimal psychological and physical cost" [12]. Transcendental Meditation (TM) has been widely studied as a technique for reducing stress and increasing resilience in at-risk populations. TM is described as a mind–body program that allows the practitioner to experience progressively quieter, less excitatory states of mental activity, with the growing experience of restful alertness in the mind and body [13]. TM has been found to be effective in reducing adverse mental health outcomes, including burnout, emotional exhaustion, depression, anxiety, insomnia, and trauma symptom severity, and in increasing resilience [14–18].

A randomized controlled trial with 40 academic physicians at the Loyola University Chicago Stritch School of Medicine found that the practice of TM over a four-month intervention period significantly decreased burnout, depression, and sleep problems relative to controls [19]. Another randomized controlled trial with 80 frontline healthcare workers performed at Duke University School of Medicine over three months during the COVID-19 pandemic found significant improvements in the TM group compared to controls in burnout, anxiety, and insomnia [20]. Similarly, Nestor et al. showed improvement in depression, anxiety, emotional exhaustion, insomnia, and mental well-being beginning as early as 2 weeks after starting TM practice in healthcare workers in three Miami Hospitals [21]. Single-arm pilot studies on various frontline healthcare workers at Brigham and Women's Hospital and the University of Michigan also showed significant reductions in burnout, depression, anxiety, and insomnia [22, 23]. These studies also highlighted the feasibility of the TM technique for busy healthcare workers as demonstrated by the high levels of reported TM practice throughout the study period.

Overall, the available evidence suggests that TM can provide an effective self-care practice for healthcare workers, capable of complementing traditional mental healthcare approaches for treating and preventing burnout, anxiety, and depression as well as enhancing mental well-being and resilience. This pilot study is the first to investigate the levels of engagement and feasibility of a TM intervention with medical students. It offers a first look into the effectiveness of the TM intervention in reducing burnout, depression, anxiety, and sleep disturbance, and improving resilience and mental well-being in this population. We hypothesized that after three months of practicing TM, students would have increased levels of resilience, well-being, and personal

accomplishment, along with decreased levels of anxiety, insomnia, depression, emotional exhaustion, and depersonalization.

## Methods

### Design

This study was a single-arm pilot trial with baseline, one-month, and three-month post-training evaluation of a TM intervention. The study period was three months from the time of a student's first instruction session with a certified TM instructor to the time of their last follow-up session and completion of the three-month post-instruction evaluation surveys.

### Sample

The participants ($n=42$) were medical students studying at Georgetown University School of Medicine (GUSoM), recruited from all four medical class years. We sent an email announcement to the entire student body, 754 students, and posted fliers on the GUSoM campus describing the opportunity to learn TM. The study was designed and approved by the Institutional Review Board for fewer than 50 participants. We assessed those who responded ($n=53$) for eligibility, and of those, 42 students met inclusion criteria, responded to scheduling their first learning sessions, and consented to participate. They either attended an introductory session in real time or watched an introductory recording before beginning the intervention. To be included, participants needed to be 18 years of age or older and full-time students. Participants also agreed to complete the eight-session TM training program (a 4-session course of instruction presented on 4 consecutive days and 4 subsequent follow-up sessions at intervals over the following 3 months), to practice the TM technique twice daily for approximately 20 min each time, to complete a daily log for self-monitoring, and to complete self-reported outcome surveys at baseline, one month, and three months following TM instruction. Participants who were being treated with psychoactive medications had to have maintained a stable regimen for at least two months before enrollment.

All students who attended at least the first session of TM training and completed at least one session of post-testing (either 1-month or 3-month post-testing) were included in the final data analysis. Three students withdrew from the study before their one-month post-testing, due to not being able to continue with the time commitment required for the study; these students were excluded from data analysis as they did not complete any outcome measures. This left 39 students included in the final data analysis (Fig. 1).

### Intervention

The intervention consisted of four TM instructional sessions of 60 min duration, taken in person on four consecutive days at a TM training site or on the GUSoM campus; four follow-up sessions at 10 days, one month, two months, and three months post-instruction; and twice daily individual practice of the TM technique. Certified instructors of the program delivered TM instruction and follow-up to participants in a standardized format over three months. All certified TM teachers have been extensively trained in the teaching of the TM program [13, 18]. Groups of students started at different time points between early October 2022 and January 2023, so each cohort started and finished TM training at different times. The first cohort started in October 2022 and the final cohort completed their three-month study period in May 2023. Instructors advised participants to engage in their individual, daily home practice of two 20-min TM sessions, morning and evening.

### Measures

#### *Feasibility and acceptability*

At baseline, we collected demographic status data (Table 1). Attendance at TM instruction and follow-up sessions was tracked throughout the three-month study period. Adherence to home TM practice was tracked through a self-report form at one month and three months in which participants reported frequency of home practice over the preceding month. Participants completed a questionnaire at the end of the three-month study period on the feasibility and acceptability of TM practice.

#### *Well-being outcomes*

We gathered mental health and well-being measures using the following instruments at baseline, one-month, and three-month follow-up. We collected data from the participants using secure survey links to REDCap.

- *The Maslach Burnout Inventory (MBI)-General Survey for Students* measured participant burnout. It is a 16-item inventory with a seven-point response scale, measuring emotional exhaustion (5 items), depersonalization (5 items), and personal accomplishment (6 items). The score is calculated using a 7-point Likert scale rating from 0 (never) to 6 (every day). Each of the three subscales is scored separately and an average score is then determined for each subscale. Higher scores for the emotional exhaustion and depersonalization subscales, ranging from 0–30, indicate higher burnout and higher scores for the personal accomplishment subscale,

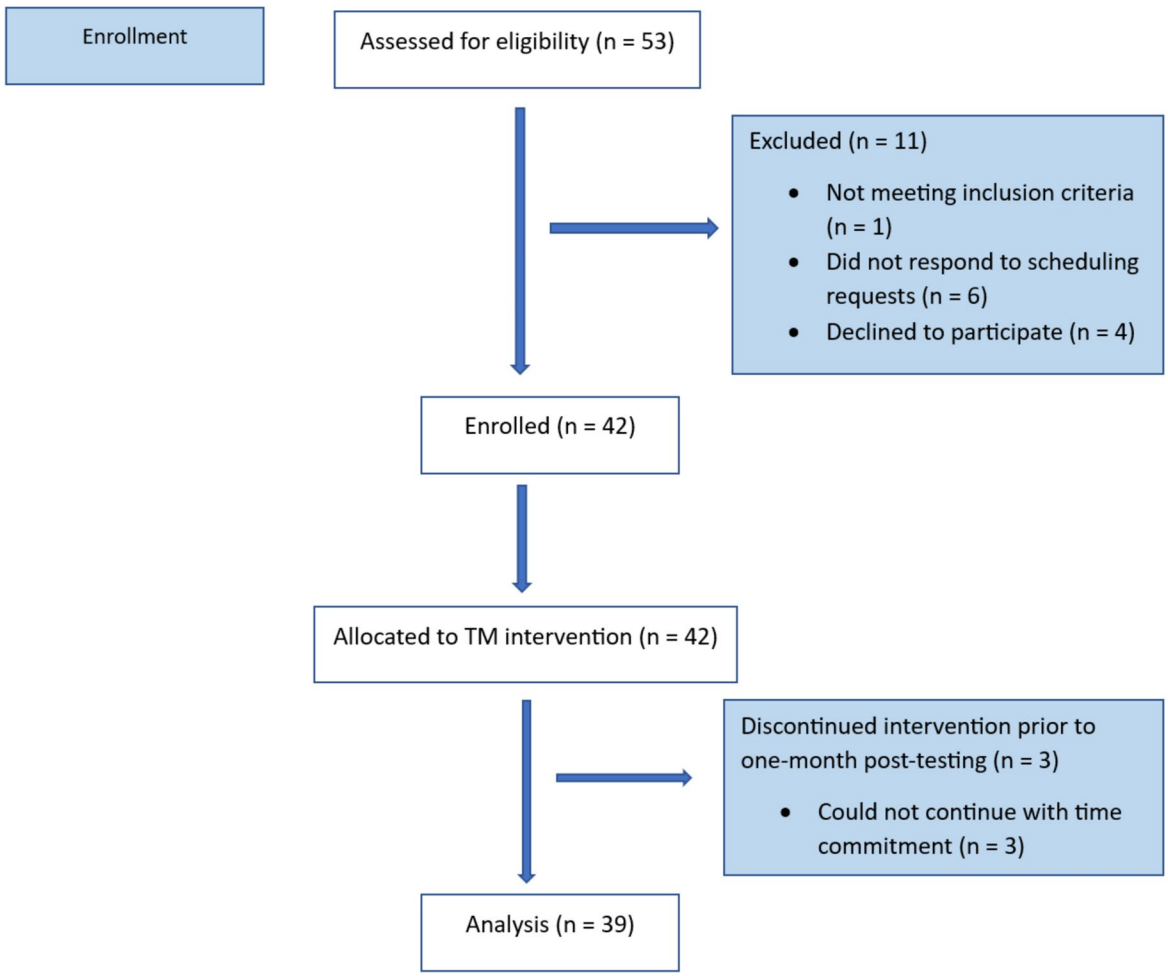


**Fig. 1** CONSORT diagram. CONSORT flow chart summarizing the study steps from enrollment of subjects to analysis of data

**Table 1** Demographic and background data ($n = 39$)

| | n (%) |
|---|---|
| Gender | |
| Males | 17 (44) |
| Females | 22 (56) |
| Year of Medical School | |
| Preclinical | 25 (64) |
| 1st-year | 14 (36) |
| 2nd-year | 11 (28) |
| Clinical | 14 (36) |
| 3rd-year | 4 (10) |
| 4th-year | 10 (26) |

ranging from 0–36, indicate lower burnout. Sample question for the emotional exhaustion subscale is, "I feel emotionally drained from my studies." Sample question for the depersonalization subscale is, "I doubt the significance of my studies." Sample question for the personal accomplishment subscale is, "I have accomplished many worthwhile things in my studies." Cronbach's α ranges from 0.71 to 0.78 [24].

- *NIH Promis Emotional Distress-Depression Short Form 6a* assessed depression severity. The score is calculated using a 5-point Likert scale rating from 1 (never) to 5 (always). The cumulative score ranges from 6–30, where higher scores indicate a higher level of depression. Sample question is, "In the past 7 days, I felt worthless." Cronbach's α ranges from 0.89 to 0.95 [25].
- *Generalized Anxiety Disorder 7-Item (GAD-7) Scale* measured anxiety symptom severity. The score is calculated on a 4-point Likert scale from 0 (not at all sure) to 3 (nearly every day), with scores ranging from 0–21. Higher total scores indicate higher levels of anxiety and lower total scores indicate lower levels of anxiety. Sample question is, "Over the last two

weeks, how often have I been feeling nervous, anxious or on edge?" Cronbach's α = 0.92 [26].

- *The Insomnia Severity Index* assessed insomnia. The first three questions ask participants to rate the current severity of a listed insomnia problem on a 5-point Likert scale from 0 (none) to 4 (very severe) and the next four questions ask participants how satisfied, worried, etc. they are about their current sleep pattern from 0 (not at all) to 4 (very much). Scores from 0–7 indicate no clinically significant insomnia, scores from 8–14 indicate subthreshold insomnia, scores from 15–21 indicate moderately severe clinical insomnia, and scores from 22–28 indicate severe clinical insomnia. Sample question is, "Please rate the current severity of your difficulty falling asleep." Cronbach's α ranges from 0.90 to 0.91 [27].
- *The Warwick-Edinburgh Mental Well-being Scale (WEMWBS)* measured mental well-being and focused on positive aspects of mental health. The score is calculated using a 5-point Likert scale rating from 1 (none of the time) to 5 (all of the time). The cumulative score ranges from 14–70 and a higher score indicates a higher level of well-being. Sample question is, "Over the last 2 weeks, I've been feeling good about myself." The Cronbach's α ranges from 0.89 to 0.91 [28].
- *The Brief Resilience Scale* (BRS) evaluates the ability to recover from stress. The score is calculated using a 5-point Likert scale rating from 1 (strongly disagree) to 5 (strongly agree) where half of the questions are reverse scored. The cumulative score ranges from 6–30, where higher scores indicate a higher level of resilience. The total score is divided by the total number of questions answered. Scores from 1.00 to 2.99 indicate low resilience, from 3.00 to 4.30 indicate normal resilience and from 4.31 to 5.00 indicate high resilience. Sample of a normally scored question, "I tend to bounce back quickly after hard times." Sample of a reverse scored question, "I have a hard time making it through stressful events." Cronbach's α ranges from 0.80 to 0.91 [29].

Our primary outcomes were measures of emotional exhaustion as a subscale of the MBI and resilience using the BRS. All other well-being outcomes were secondary.

### Statistical analysis

We conducted statistical analyses using IBM SPSS Statistics version 28.0.1.1.14 (Armonk, NY) for the 39 subjects who qualified for data analysis. We calculated mean scores and standard errors for each well-being outcome. We calculated frequencies for compliance, feasibility, and acceptance. We used two-tailed paired t-tests to determine whether there were statistically significant changes between the mean scores at baseline and one-month and three-months post-instruction. We conducted these tests with $\alpha < 0.05$ and reported 95% confidence intervals (CIs) corresponding to all estimates. Effect sizes were calculated using Cohen's *d* test. Based on prior research with TM frequency of practice [30], a post hoc analysis was done comparing participants who meditated twice a day to those who meditated less than twice a day, on change in outcome measure scores from baseline to three-month post-testing, using independent t-tests.

### Sample size and statistical power

Previous studies on the practice of the TM technique among health-care workers reported effect sizes of −0.60 and −0.74 for reductions in the MBI Emotional Burnout scores [21, 23] and 0.95 for increased resilience as measured by the CD-RISC scale [31]. Statistical power analysis using G*Power software [32] showed that an effect size of at least 0.46 would provide 80% statistical power, given the sample size of 39 in the present study, based upon performing paired *t*-tests to analyze change from baseline to posttest, using two-tailed tests and $\alpha = 0.05$. Therefore, the present study had adequate statistical power to reliably detect improvements in the primary outcomes of emotional exhaustion and resilience.

## Results

Forty-two participants were enrolled in the study between October 2022 and January 2023. Enrolled was defined as students who attended at least the first session of TM training. Of the enrolled participants, three voluntarily withdrew from the study prior to one-month post-testing due to personal time constraints and were therefore excluded from data analysis (Fig. 1). Analysis was conducted on the remaining 39 students (93% of the original sample).

Participants were recruited from all medical school class years, with 14 first-year medical students, 11 second-year medical students, 4 third-year medical students, and 10 fourth-year medical students. This came out to be 25 preclinical students (first and second-year students) and 14 clinical students (third and fourth-year students). The average age of the sample was 26.5 years and the cohort included 17 males and 22 females (Table 1).

### TM compliance, feasibility and acceptability

Compliance was evaluated in terms of attendance at TM training sessions and frequency of home TM practice. In terms of TM training sessions, compliance was defined as attending at least 75% of these sessions, or 6 out of 8 sessions [18]. All 39 subjects in the analysis met the criterion

for compliance, as all of them attended all 8 training sessions. Compliance with TM home practice was defined as meditating at least once a day on average during the preceding month [18]; according to this criterion, 85% of the 39 subjects in the analysis were compliant with meditation at home at the three-month follow-up. Specifically, 6 students (15%) reported meditating rarely or not at all, 16 students (41%) reported meditating once a day, and 17 students (44%) reported meditating twice a day.

Self-reported feasibility and acceptability were high at the three-month follow-up, with 34 students (87%) reporting that TM training was feasible, 35 students (90%) stating that TM added to their overall well-being, and 36 (92%) stating that they would continue with TM when they completed the program (Table 2).

**Table 2** TM compliance, feasibility and acceptability outcomes for Transcendental Meditation training for Georgetown University medical students

| Compliance, feasibility and acceptability measures | n (%) |
|---|---|
| Session completion rate ($n=39$) | |
| ≥ 6/8 sessions | 39 (100) |
| Self-reported meditation practice ($n=39$) | |
| Times per day on average in the last month | |
| rarely or not at all | 6 (15) |
| once/day | 16 (41) |
| twice/day | 17 (44) |
| Self-reported feasibility ($n=39$) | |
| Do you feel meditation has been feasible for you? | |
| Yes | 34 (87) |
| No | 5 (13) |
| Self-reported acceptability ($n=39$) | |
| Do you feel TM adds to your overall well-being? | |
| Yes | 35 (90) |
| No | 4 (10) |
| Do you think you will continue with TM when the study is complete? | |
| Yes | 36 (92) |
| No | 3 (8) |

All feasibility and acceptability ratings, including rates of self-reported meditation frequency, were reported at the three-month follow-up. Compliance was prespecified as meditating at least once per day on average in the last month

*Abbreviations*: *TM* Transcendental Meditation

### Intervention effects

Medical students reported baseline scores on scales of emotional exhaustion, depersonalization, depression, anxiety, insomnia, personal accomplishment, well-being, and resilience. All scores at one month and three months following TM instruction were in the predicted direction, with scores for emotional exhaustion, depersonalization, depression, anxiety, and insomnia progressively decreasing and scores for personal accomplishment, well-being, and resilience progressively increasing. The trends for the primary outcomes of emotional exhaustion and resilience are presented in Fig. 2. Insomnia scores showed statistically significant reductions at both one month and three months. Reductions in emotional exhaustion scores were marginally significant at one month and significant at three months. Reductions in scores for depersonalization, depression, and anxiety were significant at the three-month but not at the one-month mark. Increases in scores for well-being and resilience were statistically significant at three months but not at one month. Increases in scores for personal accomplishment, while in the hypothesized direction, were not significant. TM practice led to reductions with effect sizes (ES) at least in the moderate range for emotional exhaustion (Cohen's $d=-0.61$), anxiety (Cohen's $d=-0.71$), and

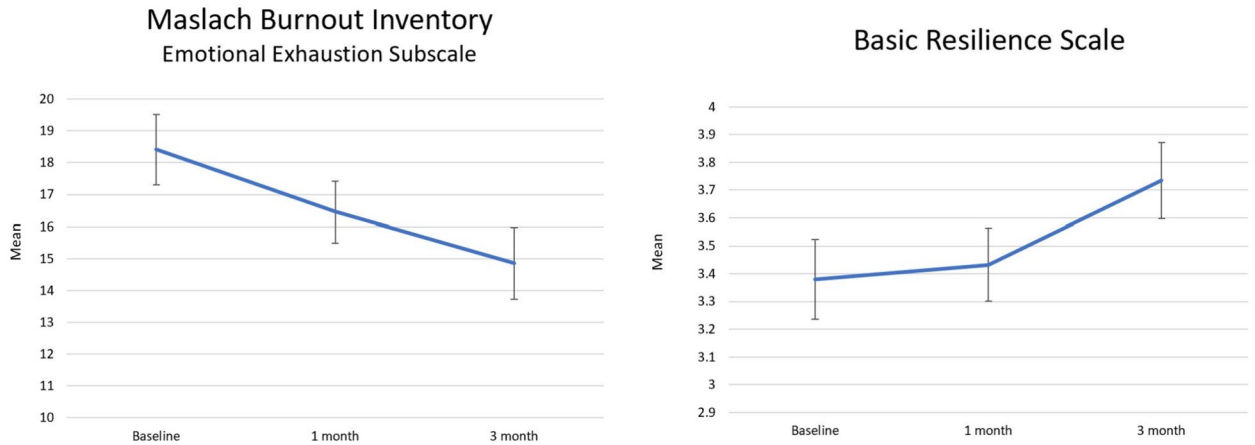


**Fig. 2** Change in burnout and resilience outcomes for medical students. Note: Error bars indicate standard error of the mean (SEM). The number of observations for each point is 39

**Table 3** Means, *p*-values, and effect sizes for all study outcome measures

| Outcome[a] | Mean at baseline (SEM) $n=39$ | Mean at 1 month (SEM) $n=39$ | Mean at 3 months (SEM) $n=39$ | Mean change, baseline to 1 month (95% CI) | Mean change baseline to 3 months (95% CI) | *P*-value for 1-month change[b] (Effect size[c]) | *P*-value for 3-month change[b] (Effect size[c]) |
|---|---|---|---|---|---|---|---|
| MBI-GSS | | | | | | | |
| Emotional exhaustion subscale | 18.41 (1.11) | 16.46 (0.97) | 14.85 (1.13) | 1.95 (−0.04, 3.93) | 3.56 (1.67, 5.46) | $P=0.054$ ($d=-0.32$) | $P=0.001$ ($d=-0.61$) |
| Depersonalization subscale | 13.03 (1.14) | 11.59 (1.08) | 10.21 (1.16) | 1.14 (−0.44, 3.32) | 2.82 (0.54, 5.10) | $P=0.130$ ($d=-0.25$) | $P=0.017$ ($d=-0.40$) |
| Personal accomplishment subscale | 24.79 (1.05) | 25.69 (1.11) | 26.44 (1.10) | 0.90 (−0.92, 2.72) | 1.65 (−0.43, 3.72) | $P=0.324$ ($d=-0.16$) | $P=0.117$ ($d=-0.26$) |
| Depression: NIH PEDD | 14.08 (0.86) | 13.13 (0.95) | 12.10 (0.88) | 0.95 (−0.15, 2.05) | 1.98 (0.60, 3.35) | $P=0.088$ ($d=-0.28$) | $P=0.006$ ($d=-0.47$) |
| Anxiety: GAD-7 | 7.49 (0.84) | 6.36 (0.88) | 4.51 (0.65) | 1.13 (−0.16, 2.42) | 2.98 (1.62, 4.33) | $P=0.084$ ($d=-0.28$) | $P<0.001$ ($d=-0.71$) |
| Insomnia: ISI | 9.74 (0.98) | 7.51 (0.89) | 6.72 (0.98) | 2.23 (0.916, 3.55) | 3.02 (1.17, 4.89) | $P=0.001$ ($d=-0.55$) | $P=0.002$ ($d=-0.53$) |
| Well-being: WEMWS | 45.79 (1.42) | 46.64 (1.53) | 48.87 (1.57) | 0.85 (−1.67, 3.36) | 3.08 (0.30, 5.86) | $P=0.500$ ($d=-0.11$) | $P=0.031$ ($d=0.36$) |
| Resilience: BRS | 3.38 (0.14) | 3.43 (0.13) | 3.73 (0.14) | 0.05 (−0.13, 0.23) | 0.35 (0.14, 0.57) | $P=0.563$ ($d=-0.09$) | $P=0.002$ ($d=0.53$) |

*Abbreviations*: *MBI-GSS* Maslach Burnout Inventory-General Survey for Students, *NIH PEDD* NIH Promis Emotional Distress-Depression Short Form 6a, *GAD-7* 7-item Generalized Anxiety Disorder scale, *ISI* Insomnia Severity Index, *WEMWS* Warwick-Edinburgh Mental Well-being Scale, *BRS* Brief Resilience Scale, *SEM* Standard error of the mean, *CI* 95% Confidence interval

[a] The primary outcomes were MBI-GSS emotional exhaustion subscore and BRS score. All other scores were secondary outcomes

[b] The significance threshold was $p<0.05$, two-tailed

[c] Effect sizes were calculated using Cohen's *d*, differences in mean scores divided by pooled standard deviation. A negative effect size indicates lower scores for participants at one or three months after completing TM instruction compared with baseline. Positive effect size indicates higher scores in the participants at one or three months after completing TM instruction compared with baseline

insomnia (Cohen's $d=-0.53$), as well as increased resilience (Cohen's $d=0.53$), at three months (Table 3). Additionally, for clinical students versus pre-clinical students, there were no significant differences in change for any of the 8 outcome variables from baseline to 3-months. There was a significantly greater improvement among females compared to males on change in MBI personal accomplishment scores ($p=0.024$), even though there was no significant overall improvement over 3 months in the whole sample. The average change over 3-months in personal accomplishment scores among females was an increase of 3.86 points, versus an average decrease of 1.24 points among males. On the other 7 outcome variables there was no significant difference between males and females on change from baseline to 3-months.

The results of paired *t*-tests did not depend upon the assumption of a normal distribution or the presence of outliers. Q-Q plots for the change scores on all outcome variables were consistent with normally distributed data, although there were outliers on changes in anxiety scores to one month and three months and on changes in personal accomplishment to three-months. However, we compared *p*-values for the paired *t*-test obtained using bootstrap resampling (with outliers retained in the data) to the *p*-values reported in Table 3. For the analyses of change in each outcome, the findings of statistical significance were the same; the *p*-values were very similar and were not affected by the presence of outliers.

Based on prior research with TM frequency of practice [30], a post hoc analysis was done to compare participants who meditated twice a day (2x, $n=17$), to those who meditated less than twice a day (< 2x, $n=22$), on all study outcomes using independent *t*-tests. A significant difference was found between these two groups for MBI emotional exhaustion (2x: mean change $=-6.47\pm1.53$ (SEM); < 2x: mean change $=-1.32\pm0.948$, $p=0.005$, Cohen's *d* effect size $=0.97$); anxiety (2x: mean change $=-4.94\pm1.08$; < 2x: mean change $=-0.145\pm0.70$, $p=0.008$, $d=0.91$); and insomnia (2x: mean change $=-6.59\pm1.17$; < 2x: mean change $=-0.027\pm1.04$, $p<0.001$, $d=1.30$); with a marginally significant change for depression (2x: mean change $=-3.29\pm0.76$; < 2x: mean change $=-0.95\pm1.02$, $p=0.088$, $d=0.57$). No significant differences between the two TM practice groups were found for MBI personal accomplishment, MBI depersonalization, mental well-being, and resilience.

## Discussion

Our findings show changes in the hypothesized direction, which were significant on all scales at three months except for the MBI personal accomplishment subscale. Participants reported significantly lower levels of anxiety,

depression, insomnia, depersonalization, and, most importantly, emotional exhaustion at the three-month post-test when compared to their baseline. They also reported significantly higher levels of well-being and resilience at three months when compared to baseline. These results are consistent with those from earlier studies on TM in healthcare workers.

This pilot study conducted at GUSoM expands on the current literature as the first study to assess the effects of Transcendental Meditation on medical students. Six previously published studies on physicians, nurses, and other healthcare workers have demonstrated significant improvements in a range of outcomes similar to those used in the current study, including burnout, anxiety, depression, and resilience [19–23, 31]. Studies have been done on other populations, including both healthy adults and chronically ill patient populations. In a randomized controlled study with heart failure patients conducted at the Perelman School of Medicine at the University of Pennsylvania, patients practicing TM showed a significant decrease in depression compared to a control group participating in a health education intervention over six months [33]. In another randomized controlled trial TM practice also showed beneficial effects on reducing stress in the secondary prevention of cardiovascular disease when compared to health education [34]. Additionally, HIV and breast cancer patients showed improved mental health and quality of life by practicing TM [35, 36].

While there are abundant data on the effects of TM on healthcare professionals and patient populations, the literature has lacked data on the effects of this practice on medical students. Medical students have higher rates of depression than those of peers of similar age and education [9]. These students also have lower rates of burnout before entering medical school [11], suggesting that going through the strenuous medical school environment contributes to their deteriorating mental health. This study highlights an opportunity to intervene early on, at the beginning of medical training, to impact the epidemic of burnout currently afflicting the medical profession.

We found statistically significant improvements, with effect sizes (ES) at least in the moderate range for both our primary outcomes, the emotional exhaustion subscale of the Maslach Burnout Inventory (ES −0.61), and resilience measured by the Brief Resilience Scale (ES 0.53). The effect sizes for anxiety and insomnia were −0.71 and −0.53 respectively, indicating at least moderate effectiveness of the TM intervention for these outcomes. These results are consistent with previously published results in healthcare workers. A significant decrease in emotional exhaustion and an increase in resilience are promising results for medical students, whose stability and well-being are critical to the future of medicine.

One of the additional goals of the study was to evaluate the feasibility and acceptability of TM training and practice for this population. We found that 85% of students were compliant with meditation at the three-month mark, practicing at least once a day. 87% reported that they were able to fit their meditation practice into their busy medical student schedules and 92% reported that they would continue to meditate once the study was completed. In addition, a post hoc analysis indicated significant relationships between frequency of TM home practice and change at 3 months in burnout/emotional exhaustion, anxiety, and insomnia, with a marginally significant change for depression, suggesting a possible dose–effect for TM practice.

The study shows promising results with possible major implications for medical education and aspiring young physicians. TM fits in with the current emphasis on "creating a learning environment of wellness" in medical school education, as it helps foster an environment conducive to the well-being of students. The data suggest that this intervention can be helpful for medical students by reducing stress and burnout and enhancing mental well-being and resilience. Based on these findings, larger-scale studies over a longer period should be performed.

### Limitations

This was a single-arm pilot study and we were thus unable to compare the effects these students experienced with students who were not meditating. The 39 students who completed the study also elected to participate, which may have led to selection bias. Convenience sampling was carried out on a specific population of medical students, namely those at Georgetown University, so we should be cautious when generalizing results to all medical students. Future randomized trials with an appropriate control group should be done to more accurately evaluate the effects of TM on medical students. The number of medical students participating in our pilot study was also limited; future trials should include a larger sample size. Additional university-led support and endorsement as well as communications through presentations during class time and email contact may increase medical student enrollment in future studies.

## Conclusion

Medical students are critical participants in the future of healthcare. Reducing their burnout, depression, and anxiety, and increasing their well-being and resilience are vital to ensuring their success, happiness, and fulfillment as practicing physicians. Our results suggest that practicing TM may significantly reduce medical students' emotional exhaustion, depersonalization, depression, anxiety, and insomnia and increase

their well-being and resilience. They also suggest that medical students, despite their busy, highly challenging schedules, can make the time to meditate at least once a day to improve their day-to-day lives. This study lays the groundwork for further research using the TM technique to alleviate medical student burnout. We recommend future research be pursued with larger numbers of subjects for a longer duration in a randomized controlled environment.

**Abbreviations**

| | |
|---|---|
| TM | Transcendental Meditation |
| GUSoM | Georgetown University School of Medicine |
| MBI | Maslach Burnout Inventory |
| GAD-7 | Generalized Anxiety Disorder 7-Item |
| WEMWBS | Warwick-Edinburgh Mental Well-being Scale |
| BRS | Brief Resilience Scale |
| CI | Confidence interval |
| ES | Effect size |

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**Authors' contributions**
CJ and IH coordinated the study which included the scheduling of TM instructional sessions and correspondence with participants regarding data collection and other study logistics. CJ and IH performed the initial data analysis, and CJ contributed significantly in writing the original drafts of the manuscript. HA contributed in the design of the study, implementation of the IRB-approved protocol, data analysis, editing, finalizing, and submitting the final manuscript. All authors read and approved the final manuscript.

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**Data availability**
The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

## Declarations

**Ethics approval and consent to participate**
The Georgetown University Institutional Review Board approved this study (IRB # MOD00011827) on September 29, 2022. Each participant electronically signed an informed consent form before participation in the study.

**Consent for publication**
Not applicable.

**Competing interests**
The authors declare no competing interests.

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## Publisher's Note



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