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## Sitting-Meditation Interventions Among Youth: A Review of Treatment Efficacy

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### Abstract

**OBJECTIVE**—Although the efficacy of meditation interventions has been examined among adult samples, meditation treatment effects among youth are relatively unknown. We systematically reviewed empirical studies for the health-related effects of sitting-meditative practices implemented among youth aged 6 to 18 years in school, clinic, and community settings.

**METHODS**—A systematic review of electronic databases (PubMed, Ovid, Web of Science, Cochrane Reviews Database, Google Scholar) was conducted from 1982 to 2008, obtaining a sample of 16 empirical studies related to sitting-meditation interventions among youth.

**RESULTS**—Meditation modalities included mindfulness meditation, transcendental meditation, mindfulness-based stress reduction, and mindfulness-based cognitive therapy. Study samples primarily consisted of youth with preexisting conditions such as high-normal blood pressure, attention-deficit/hyperactivity disorder, and learning disabilities. Studies that examined physiologic outcomes were composed almost entirely of African American/black participants. Median effect sizes were slightly smaller than those obtained from adult samples and ranged from 0.16 to 0.29 for physiologic outcomes and 0.27 to 0.70 for psychosocial/behavioral outcomes.

**CONCLUSIONS**—Sitting meditation seems to be an effective intervention in the treatment of physiologic, psychosocial, and behavioral conditions among youth. Because of current limitations, carefully constructed research is needed to advance our understanding of sitting meditation and its future use as an effective treatment modality among younger populations.

### Keywords

literature review; meditation; mindfulness; children; adolescents; youth; efficacy

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Persuasive arguments for meditation interventions and efficacy research among children and adolescents have been made on the basis of their diverse usefulness and beneficial effects observed in adults.<sup>1</sup> This advocacy for applying empirical attention to meditation interventions has coincided with increased public interest in, and acceptance of, these practices. For example, the Mindful Awareness Research Center at the University of California Los Angeles Semel Institute (<http://marc.ucla.edu>) currently provides workshops for teachers and other educators to develop mindfulness approaches for children as young as pre-kindergarten age. Moreover, middle and high schools are increasingly implementing meditation interventions, although few empirical studies have been conducted in this setting.<sup>2,3</sup>

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Meditation interventions are commonly implemented among youth in school-, community-, and clinic-based settings. For example, organizations such as the David Lynch Foundation have reached thousands of students in the United States by funding transcendental meditation (TM) school-based programs (eg, the David Lynch Foundation for Consciousness-Based Education and World Peace [www.davidlynchfoundation.org]). These programs serve students aged 10 years and older and use TM as a modality to treat attention-deficit/hyperactivity disorder (ADHD) and emotional problems, enhance learning, and provide stability to the nervous system. The US Committee for Stress-Free Schools (www.tmeducation.org), established in 2005, provided TM programs to students and teachers in public, charter, and probate schools throughout the United States and evaluated the effects of TM on intelligence, learning, academic performance, ADHD and learning disorders, anxiety, depression, substance use, eating disorders, and other outcomes. Moreover, the Garrison Institute, a nonprofit agency, investigated mindfulness practices among kindergarten to 12th-grade students and found nearly 20 school- and community-based organizations with established mindfulness programs, as well as others that used elements of mindfulness as part of social and educational programs. To date, none of these centers have published peer-reviewed program evaluations, although qualitative and anecdotal evidence suggest increased self-awareness, self-reflection, emotional intelligence, and social skills in response to these programs.<sup>4</sup>

## MEDITATION AND TECHNIQUE

The term “meditation” has been defined in various ways, and in Western culture can be conceptualized as a distinct psychological practice from its original religious and cultural roots and philosophies. Meditation practice can be explained as the deliberate self-regulation of attention in the present moment and typically comprises concentration, relaxation, altered states of consciousness, suspension of logical thought, and maintenance of a self-observing attitude.<sup>5</sup> Meditation has also been defined as a practice that emphasizes maintaining alertness and expanding self-awareness with an increased sense of integration and cohesiveness.<sup>6</sup>

Meditation also differs in form. Sitting-meditative practices used among youth include, but are not limited to, mindfulness meditation (MM) based on *vipassana* or “insight” meditation, and TM derived from the Vedic tradition of India. Physical movement forms of meditation used among children (ie, tai chi and Hatha yoga [see ref 7 for a systematic review of yoga interventions among youth]) are commonly based on Hatha yoga techniques, which include muscle relaxation, breath control, and mental focus on particular body movements and self-manipulated postures.<sup>8</sup> Empirical evidence supports the notion that some forms of meditation such as TM may be more effective than others (eg, mantra meditation, relaxation, etc) in reducing ailments and promoting health.<sup>9</sup>

In MM, the meditator sits comfortably and silently, “paying attention in a particular way: on purpose, in the present moment, and non-judgmentally.”<sup>10</sup> The meditator consciously scans perception entering the field of awareness, welcoming rather than avoiding thoughts, emotions, sensations, and distractions.<sup>11,12</sup> By observing thoughts and emotions from this detached perspective, clarity of mental perception can be attained. Thus, the content of thought is monitored as well as the feelings and reactions associated with them. MM was manualized and termed mindfulness-based stress reduction (MBSR) by Kabat-Zinn.<sup>13</sup> MBSR was originally aimed at mindfulness techniques to reduce chronic pain and stress but is currently used to treat a spectrum of ailments and unhealthy behaviors and is increasingly used in clinical psychology.<sup>14</sup> Therapies have followed the MBSR modality, such as mindfulness-based cognitive therapy (MBCT), which are adapted for the developmental needs of school-aged children.<sup>15</sup>

TM, developed by Maharishi Mahesh Yogi, involves techniques that require neither concentration nor contemplation and allow the body to effortlessly reach a level of deep calmness while the mind achieves a stability of attention through a 15- to 20-minute practice done twice per day while sitting comfortably.<sup>16</sup> TM practice uses the sound value of a mantra to draw attention within the mind, experience quieter levels of thinking, and draw forth a restful state of awareness referred to as “clear consciousness”<sup>17</sup> (see refs<sup>18</sup> and <sup>19</sup>). The TM course begins with 7 simple steps of instruction involving ~90 minutes per class, including an introductory and preparatory lecture, personal interview, and 4 days of instruction.<sup>16</sup> Although the description of MM and TM may differ regarding their focus of attention, overlap does exist.<sup>20</sup>

Several systematic reviews<sup>21–28</sup> and meta-analyses<sup>29–31</sup> have provided empirical support regarding the efficacy of meditative practices among adult samples for outcomes including depression, anxiety, panic disorders, binge-eating disorders, substance abuse, hypertension, other cardiovascular disorders, pain syndromes, respiratory disorders, dermatologic problems, immunologic disorders, and symptoms of breast and prostate cancer. Only 1 review of meditation interventions included adult and youth samples, and this article focused solely on TM and its effects on cardiovascular functioning.<sup>32</sup>

## THE PSYCHOPHYSIOLOGICAL PROCESS OF MEDITATION

The psychophysiological processes attributed to meditation practice have been documented in adult studies, and although it is unknown if these same processes occur in youth, similar process may exist. Among adults, the impact of meditation practice on health-related and cognitive outcomes is partially mediated through neurophysiological changes (see the review in ref 33). For example, meditation is found to help control the hypothalamic-pituitary-adreno-cortical axis and associated systems (eg, parasympathetic nervous system), which are pathways that control stress-response mechanisms and regulate various bodily processes including digestion, immunology, mood, and energy usage. Meditation can also affect neuroendocrine status, metabolic function, and related inflammatory responses<sup>29</sup> and can decrease experienced stress load.<sup>34</sup> Relaxed attention can also permit more flexible psychological and behavioral responses to internal and external cues,<sup>35</sup> possibly through a restructuring of frontal brain regions associated with self-regulation.<sup>36,37</sup> In addition, actively focusing the mind on nonmotor activities, such as meditation, is associated with dopamine release in ventral areas of the brain,<sup>38</sup> which is a process that can enhance positive mood states.

## THE PRESENT STUDY

Although more than 800 studies have investigated the therapeutic effects of meditation practices, the vast majority of these studies were among adults.<sup>25</sup> As meditation interventions become more widely implemented among youth in schools, hospitals, clinics, and community settings, empirical evidence is needed to support and guide these programming efforts. Thus, we sought to determine if similar benefits of adult meditation are found among children and adolescents by conducting a systematic literature review of meditation interventions used among these younger populations. The aim of this systematic review was to determine the state of empirical research related to the treatment efficacy of sitting-meditation interventions implemented among youth aged 18 years and younger in school, clinic, and community settings.

## LITERATURE-SEARCH METHODS

Electronic databases (PubMed, Ovid, Web of Science, Cochrane Reviews Database, and Google Scholar) were searched to identify empirical articles relevant to sitting-meditation interventions among youth. For this review, sitting-meditation techniques were defined as sitting-meditation practices that do not involve physical exertion. Key words, and various combinations of key words, used in search engines included “meditation,” “mindfulness,” “transcendental,” “adolescents,” and “children,” and searches produced more than 150 citations. Searches were refined to include articles published between January 1982 and December 2008. The year 1982 was selected as a starting point because it was the earliest date that an electronic database provided access to a full-text article relevant to this study. In addition to computer-assisted searches, bibliographies of acquired articles were scanned to acquire additional studies. Finally, leading authors in the area of empirical studies of meditation were contacted by e-mail and requested to provide additional unpublished data or articles in press. Meditation interventions were operationalized as programs using meditation techniques that involve (1) a breath, image, sound, or mantra to focus the mind and/or (2) passively observing arising thoughts and sensations to become mindful of the present moment. Inclusion criteria included (1) nonmovement meditation was the main intervention modality, (2) study participants were aged 18 years or younger, (3) there was a quantitative outcome that was health related or psychosocial in nature (outcomes such as intelligence measures were excluded), (4) interventions were delivered in schools, community facilities, or clinics, and (5) the study results were published in a peer-reviewed, English-language journal. Studies were typically excluded because of age criteria and lack of sitting meditation as a main intervention component. Single-participant case studies were also excluded. Movement forms of meditation such as progressive muscle relaxation, yoga, or tai chi were not included, because the beneficial effects of meditation could not be easily separated from those derived from physical exertion. Sixteen publications met our final criteria and comprised the final sample for this review. Effect sizes were calculated by using Cohen’s *d* formulas for all studies that provided sufficient data (see ref 39). Cohen’s *d* derives effect sizes in SD units. For studies using between-group designs, treatment effect sizes were calculated with the following formula, which accounted for relative differences between the treatment and control groups:  $d = [(M_{tx1} - M_{tx2}) - (M_{c1} - M_{c2})] / SD_{pooled}$ . The notation  $(M_{tx1} - M_{tx2})$  refers to the difference between the treatment group means on a specific outcome measure from before to after the test; the notation  $(M_{c1} - M_{c2})$  refers to the difference of the control group means from before to after the test; and  $SD_{pooled}$  is the pooled SD of the 2 groups. A similar calculation was used for studies that used within-group designs; however, because there was no control group, posttest means were subtracted from pretest means of the same group, and this difference was divided by  $SD_{pooled}$ .

## RESULTS

### Sample Characteristics

The intervention descriptions, study samples and designs, outcome measures, effect sizes, and key findings of the 16 studies containing a total of 860 participants are described in Table 1. Studies included participants from 6 to 18 years of age. Studies that examined physiologic outcomes were almost entirely composed of black participants,<sup>40–44</sup> whereas the remaining studies that examined psychosocial and behavioral outcomes were composed of a more-diverse group of participants, including white, Hispanic, black, Asian, and “other.” Among the psychosocial/behavioral study samples, 2 were mainly black,<sup>45,46</sup> 2 were mainly Hispanic,<sup>47,48</sup> 1 was completely white,<sup>49</sup> and 5 were mostly male.<sup>45,46,50–52</sup> Studies were primarily conducted in elementary,<sup>52,53</sup> middle,<sup>42,46,49</sup> and high schools,<sup>40,41,43–45,50</sup> followed by clinics<sup>48,51,54,55</sup> and community centers.<sup>47</sup> All studies that examined physiologic outcomes were conducted in school settings, whereas studies that examined

psychosocial/behavioral outcomes were conducted across all 3 settings. Study participants were most often recruited on the basis of adolescents' preexisting physiologic condition such as high-normal systolic blood pressure (SBP)<sup>40,41,43-45</sup> or psychiatric conditions such as ADHD diagnosis,<sup>45,51,52,54,55</sup> learning disability,<sup>47,48,50</sup> or conduct problems.<sup>49</sup> Only 3 studies included samples that included non-clinical volunteers.<sup>42,53,54</sup>

### Meditation Interventions

Thirty-one percent ( $n = 5$ ) of the studies examined physiologic outcomes, and 69% ( $n = 11$ ) examined psychosocial/ behavioral outcomes. The majority of studies used MM ( $n = 6$ ) and TM ( $N = n$ ), followed by MBSR ( $n = 2$ ) and MBCT ( $n = 2$ ). Studies that examined physiologic outcomes used TM and MM interventions, whereas studies that examined psychosocial/behavioral outcomes used TM, MBSR, MBCT, and MM interventions. The extent of the interventions varied across studies, ranging from 4 weeks to 4 months, with individual sessions ranging from 10 minutes to more than 2 hours. The range of studies examining physiologic outcomes provided meditation sessions that lasted 10 to 15 minutes, twice per day, from 2 to 4 months. Studies that examined psychosocial/behavioral outcomes provided sessions that ranged from 5 minutes to 2.5 hours, 1 to 2 times per day, spanning 4 weeks to 4 months.

### Study Designs

The majority of intervention designs were randomized, controlled trials (RCTs) ( $n = 11$ ), and the remaining studies ( $n = 5$ ) had a pretest/posttest no-control-group design. Of the RCTs, control groups were provided health education,<sup>40-45</sup> provided treatment as usual,<sup>53,54</sup> or given the intervention at a later time (wait-list control).<sup>47,48</sup> Only 1 study design contained 3 conditions including a TM, muscle relaxation, and wait-list control arm.<sup>51</sup> Nine of the RCTs reported equivalence of participants on key variables across treatment groups,<sup>40-45,47,48,54</sup> and 2 studies did not provide data regarding this information.<sup>51,53</sup> Sample sizes for studies ranged from 3 to 194 participants, with a mean sample size of 53.8 for all studies combined. The majority of studies that used a comparison group maintained a relatively proportionate sample size in each treatment arm. However, 1 study had more than double the participants in the control arm relative to the treatment arm.<sup>44</sup>

### Intervention Effects on Physiologic Outcomes

Primary physiologic outcomes included SBP, diastolic blood pressure (DBP), heart rate (HR), cardiac output (CO), endothelium-dependent vasodilation to reactive hyperemia (EDAD), and urinary sodium excretion rate (USER). These studies were almost entirely composed of black adolescents.<sup>40-45</sup> In addition, all of these studies had outcomes solely related to cardiovascular functioning. Of the 4 studies that examined SBP, there was consistent evidence that meditation decreased SBP relative to controls.<sup>40-42,44</sup> Decreases in DBP were not consistently found. Two studies identified marginal DBP reductions in the meditation group relative to controls,<sup>40,41</sup> and 2 studies found no significant difference between groups.<sup>42,44</sup> A single study found that meditation positively affected EDAD, which is an indicator of endothelial dysfunction,<sup>43</sup> whereas another study found meditation to improve USER (an indicator of sodium handling).<sup>44</sup> Of the 4 studies that examined differences in HR, 1 study<sup>40</sup> found significant decreases, 2 studies<sup>42,44</sup> found decreases with significance dependent on the time of measurement, and 1 study found null results.<sup>41</sup> Median effect sizes for dependent variables across studies with physiologic outcomes ranged from 0.16 to 0.29 (observed range: -0.10 to 0.72).



## Intervention Effects on Psychosocial and Behavioral Outcomes

Primary psychosocial/behavioral outcomes included anxiety (eg, State-Trait Anxiety Index, Revised Children's Manifest Anxiety Scale), social behavior (eg, Child Behavior Check List), and psychological disorders (eg, ADHD, depressive symptoms). Of the 7 studies that examined changes in anxiety,<sup>46–48,50,53–55</sup> 5 revealed significant decreases in anxiety attributed to meditation.<sup>46,48,50,53,54</sup> Of the 9 studies that measured changes in social/behavioral problems, 7 showed meditation to significantly improve absentee periods,<sup>45</sup> rule infractions,<sup>45</sup> externalizing problems,<sup>47,50–54</sup> attentional problems,<sup>48,51,53</sup> self-esteem,<sup>54</sup> and suspension days<sup>45</sup> that result from behavioral problems. Two studies with small sample sizes that ranged from 3 to 5 participants indicated trends toward improved social/behavioral functioning.<sup>49,52</sup> These improvements were noted in levels of aggression, bullying, adaptive functioning, and externalizing behavior. Of the 3 studies that examined changes in depression, 1 study<sup>54</sup> revealed significant reductions, whereas 2 studies reported nonsignificant reductions in depression scores.<sup>47,55</sup> Participants in the 2 studies that showed null results reported low baseline depression scores that did not reach clinically significant cutoff points. In a study of males diagnosed with ADHD, the meditation group increased selective attention, reduced impulsivity, and decreased distractibility relative to controls.<sup>51</sup> A second study of children with ADHD was inconclusive in that it could not determine the differential effects of the meditation intervention for the child sample because adults were included in the statistical analysis.<sup>55</sup> Median effect sizes for dependent outcomes variables across psychosocial/behavioral studies ranged from 0.27 to 0.70 (observed range: 0.03 to 1.09).

## Compliance and Retention Rates

Compliance in the reviewed studies was defined as attendance to treatment sessions at the study site and/or at home. Retention was defined as the percentage of participants who completed survey measures, follow-up visits, and procedures as specified in the study protocol. Treatment compliance percentages ranged from 68% to 90%, and study retention rates ranged from 64% to 100% for the studies providing these data. Mean compliance and retention rates for all the studies combined were 77% and 84%, respectively. Of the 3 studies with 100% retention rates,<sup>45,49,50</sup> none had total sample sizes larger than 45 participants.

## DISCUSSION

Our review of 16 studies provides initial evidence that sitting meditation can be an effective intervention for the treatment of physiologic, psychosocial, and behavioral problems among children and adolescents. Observed effect sizes ranged from null to 1.09, with median effect sizes across studies ranging from 0.16 to 0.29 for physiologic outcomes and 0.27 to 0.70 for psychosocial/behavioral outcomes. Although there have been too few studies to make strong inferences, the effects sizes are slightly smaller than findings reported among adults.<sup>29,56</sup> Baer<sup>56</sup> found MM interventions among adults to yield effect sizes ranging from 0.08 to 1.35 with a mean effect size of 0.59 (SD: 0.41). Moreover, Gross-man et al<sup>29</sup> reviewed 20 meditation-intervention studies among adults and found mental health mean effect sizes ranging from 0.30 to 0.67 and physical health mean effect sizes ranging from 0.25 to 1.01. Thus, meditation interventions among both youth and adults typically yield small-to-medium effect sizes across a variety of health outcomes.

There are several limitations to these studies. Only 16 studies among youth have been conducted, in relation to more than 800 meditation-intervention studies published among adults, indicating a great need for research among younger populations. The results of the 16 studies reviewed have limited generalizability. Seven studies contained samples with a

majority of black adolescents, and all 5 studies that examined physiologic outcomes were mainly composed of black subjects at risk for cardiovascular problems. In addition, almost all the studies reviewed were completed with clinical populations that were recruited for participation on the basis of a pre-existing condition such as high-normal blood pressure, ADHD, learning disabilities, and/or conduct problems. In addition, meditation treatments that focused on physiologic outcomes were conducted primarily in school settings. Thus, future meditation-intervention studies are needed with diverse samples of youth in a variety of treatment settings. Studies among youth are also needed to measure the impact of meditation on aspects of positive functioning including well-being, mood enhancement, social intelligence, and self-regulation, particularly in universal settings (see ref 57).

The current state of evidence is also limited by study-design factors, lack of data regarding mediating variables, and incomplete data reporting. Studies examining physiologic outcomes have all been RCTs; however, ~50% of studies that examined psychosocial/behavioral outcomes lacked a comparison group. Moreover, sample sizes in some of the studies reviewed were very small,<sup>46–49,52,55</sup> which may influence the power to detect a treatment effect. Seven of the 16 studies in this review did not demonstrate sufficient statistical power ( $1-\beta \geq .80$ ; see ref 58). Thus, more RCTs are needed to enroll an adequate number of youth. In terms of measurement, future studies need to measure possible mediators of meditation to determine how these interventions function to produce enhanced health status. Valid scales have been developed to measure possible mediators such as mindfulness.<sup>59–61</sup> In addition, because some studies did not provide complete information required for critical appraisal and interpretation, future studies should use the Consolidated Standards of Reporting Trials (CONSORT)<sup>62</sup> guidelines to report their findings.

## CONCLUSIONS

Meditation interventions have been increasingly implemented among youth despite a paucity of empirical support among younger age groups. This systematic review of the literature describes the current state of research pertaining to sitting-meditation interventions among youth and finds meditation to have beneficial effects across physiologic, psychosocial, and behavioral outcomes. Because the majority of these studies contained relatively small, clinical samples, larger-scale empirical research efforts among demographically diverse samples in various settings are needed to clarify the treatment efficacy of this approach, particularly in universal health promotion and primary prevention efforts. Although much remains to be discovered about the effects of meditation on health, carefully constructed research will advance our understanding of sitting meditation and its future use as an effective treatment modality among younger populations.

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## ABBREVIATIONS

<b>TM</b>	transcendental meditation
<b>ADHD</b>	attention-deficit/hyperactivity disorder
<b>MM</b>	mindfulness meditation
<b>MBSR</b>	mindfulness-based stress reduction

<b>MBCT</b>	mindfulness-based cognitive therapy
<b>SBP</b>	systolic blood pressure
<b>RCT</b>	randomized, controlled trial
<b>DBP</b>	diastolic blood pressure
<b>HR</b>	heart rate
<b>CO</b>	cardiac output
<b>EDAD</b>	endothelium-dependent vasodilation to reactive hyperemia

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TABLE 1

Summary of Empirical Studies of Meditation Interventions Among Youth According to Measurement Outcome

Study	N	Age Range, Mean (SD) Age (y) and Gender According to Condition	Participant Description	Treatment Length/Setting	Study Design	Baseline Equivalence	% Completion (Retention) <sup>a</sup>	Dependent Variables	Cohen's <i>d</i> , Median (Range)	General Findings
Physiological outcomes										
Bames et al <sup>40</sup>	35	15–18; Tx: 16.5 (1.1), 53% male; C: 16.6 (1.1), 66% male	97% AA with high-normal BP	15 min, 2 times per day for 2 mo/ high school	RCT: TM ( <i>n</i> = 17) vs health education control ( <i>n</i> = 18)	Yes	School: 68%; home: 77%	SBP, DBP, HR, CO, TPR	0.16 (–0.08 to 0.43)	TM group decreased from before to after test in SBP, HR, and CO during acute stress simulation, and in SBP to a social stressor compared to controls; marginal differences in DBP
Bames et al <sup>41</sup>	100	Tx: 16.0 (1.3), 64% male; C: 16.3 (1.4), 62% male	100% AA with elevated SBP	15 min, 2 times per day for 4 mo/ high school	RCT: TM ( <i>n</i> = 50) vs health education control ( <i>n</i> = 50)	Yes	School: 63%; home: 76% (64%)	SBP, DBP, HR	0.29 (0.05 to 0.35)	TM group decreased daytime SBP and marginally decreased DBP compared to controls; no significant differences in HR between Tx groups
Bames et al <sup>42</sup>	73	Tx: 12.2 (0.5), 53% male; C: 12.4 (0.6), 54% male	52% AA volunteers for a class project	10 min, 2 times per day for 3 mo/ middle school	RCT: MM ( <i>n</i> = 34) vs health education control ( <i>n</i> = 39)	Yes	School: 89%; home: 86% (79%)	SBP, DBP, ABP, HR	0.22 (–0.10 to 0.72)	MBSR group decreased resting SBP, daytime ambulatory SBP after school, and daytime ambulatory HR after school compared to controls; no differences in daytime ambulatory measure at school for SBP or HR
Bames et al <sup>43b</sup>	111	Tx: 16.2 (1.3); C: 16.3 (1.4), 68% male	100% AA with high-normal BP	15 min, 2 times per day for 4 mo/ high school	RCT: TM ( <i>n</i> = 57) vs health education control ( <i>n</i> = 54)	Yes	—	EDAD	—	TM group increased EDAD compared to controls, indicating improved endothelial function
Bames et al <sup>44</sup>	66	Tx: 15.0 (0.7), 45% male; C: 15.3 (0.9), 41% male	100% AA with high-normal BP	10 min, 2 times per day for 3 mo/ high school	RCT: MM ( <i>n</i> = 20) vs health education control ( <i>n</i> = 46)	Yes	— (85%)	SBP, DBP, HR, USER	0.26 (0.29 to 0.54)	MBSR group decreased SBP during school and nighttime, ambulatory HR during school, and overnight USER and sodium content compared to controls; no DBP differences between Tx groups; no HR differences found for nighttime or after school
Psychosocial and behavioral outcomes										
Bames et al <sup>45</sup>	45	15–18 y; Tx: 16.2 (1.3), 76% male; C: 16.0 (1.4), 65% male	100% AA with elevated SBP	15 min, 2 times per day for 4 mo/ high school	RCT: TM ( <i>n</i> = 25) vs health education control ( <i>n</i> = 20)	Yes	72% (100%)	Suspensions, tardies, absences, rule infractions	0.66 (0.09 to 0.69)	TM group decreased absentee periods, rule infractions, and suspension days resulting from behavior problems compared to controls; females performing TM decreased anger compared to control females (not found for males); no difference in tardiness, lifestyle, or stress between groups

Study	N	Age Range, Mean (SD), Age (y) and Gender According to Condition	Participant Description	Treatment Length/Setting	Study Design	Baseline Equivalence	% Completion (Retention) <sup>a</sup>	Dependent Variables	Cohen's <i>d</i> , Median (Range)	General Findings
Beauchemin et al <sup>50</sup>	34	13–18 y; Tx: 16.6, 71% male	Diagnosed with learning disabilities	5–10 min, 5 d per week for 5 wk/ high school	Pre/post, no control; MM	NA	— (100%)	SSRS, STAI	0.70 (0.49 to 0.85)	Both trait and state anxiety scores significantly reduced at posttest measure; decreases in teacher ratings of student problem behaviors after test
Biegel et al <sup>54</sup>	102	14–18 y; Tx: 15.7 (1.1), 30% male; C: 15.0 (1.2), 23% male	45% white, 28% Latino, and 27% other physician-referred patients and volunteers	2 hours, 1 time per week for 8 wk/ outpatient psychiatric clinic	RCT: MBSR plus TAU ( <i>n</i> = 50) vs TAU ( <i>n</i> = 52)	Yes	78% (73%)	DSM-IV, GAF, Axis I disorders, PSS-10, STAI, SCL-90, SES	0.60 (0.41 to 1.09)	MBSR group reduced anxiety, depressive symptoms, somatization, increased self-esteem, and sleep quality compared to those with TAU; MBSR group increased GAF and percentage of positive mental health changes compared to those with TAU
Grosswald et al <sup>46</sup>	10	11–14 y; 90% male	60% AA and 40% white with preexisting ADHD diagnosis	10 min, 2 times per day for 3 mo/ school for students with learning disability	Pre/post, no control; TM	NA	— (91%)	CBCL, RCMAS, YSR, BRIEF, CAS, D-KEFS, TOL	0.40 (0.20 to 0.80)	TM group reduced symptoms of anxiety, depression, affective problems, attention problems, and total problems after test; teachers reported student reductions in anxiety, depression, and total problems after test and improvements in behavioral regulation, meta-cognition, and executive functioning
Lee et al <sup>47</sup>	25	9–13 y; 40% male	60% Latino, 28% AA, and 12% white with reading difficulties	90 min, 1 time per week for 12 wk/ community clinic	RCT: MBCT ( <i>n</i> = 13) vs wait-list control ( <i>n</i> = 12)	Yes	78% (68%)	CBCL, MASC, STAIC, RCDS	0.27 (0.11 to 0.40)	MBCT group reduced CBCL total score and CBCL externalizing problems from before to after test; no differences in CBCL internalizing problems, anxiety, or depression from baseline
Napoli et al <sup>53</sup>	194	Tx: first-, second-, and third-graders	Student volunteers	45 min, bimonthly for 24 wk/ elementary school	RCT: MM ( <i>n</i> = 97) vs no treatment control ( <i>n</i> = 97)	—	— (85%)	ACTeRS, TAS, TEA-Ch	0.48 (0.39 to 0.60)	MM group had fewer problems noted by teacher for attention and social skills, decreased test anxiety scores, and increased selective (visual) attention scores compared to controls
Kratter and Hogan <sup>51</sup>	24	7–12 y; Tx: 10.05; 100% male	Psychologist and teacher-referred ADHD diagnosis	20 min, 2 times per week for 4 wk/ clinic	RCT: TM vs muscle relaxation vs wait-list control <sup>c</sup>	—	—	MFFT, FDT, LCS, PTQ	—	TM group increased selective attention and freedom from distractibility; both the TM and relaxation groups showed decreases in impulsivity compared to controls; parents reported improvement in behavior of children in TM and relaxation groups compared to controls; no differences in LCS score between Tx groups

Study	N	Age Range, Mean (SD), Age (y) and Gender According to Condition	Participant Description	Treatment Length/Setting	Study Design	Baseline Equivalence	Completion (%)	Dependent Variables	Cohen's d, Median (Range)	General Findings
Semple et al <sup>49</sup>	25	9–13 y; 40% male	60% Latino, 24% AA, and 16% white with academic problems	90 min, 1 time per week for 12 wk/ university clinic	RCT: MBCT (n = 13) vs wait-list control (n = 12)	Yes	90% (80%)	CBCL, MASC, STAIC	0.42 (0.27 to 0.46)	MBCT group showed fewer attentional problems than controls with effects maintained 3 mo after intervention; significant reductions in anxiety and behavior problems found in children who reported elevated levels of anxiety at before the test, but full sample did not report these reductions
Semple et al <sup>52</sup>	5	7–8 y; 60% male	Teacher-referred students displaying anxiety symptoms	45 min, 1 time per week for 6 wk/ elementary school	Pre/post, no control: MBSR + MBCT	NA	— (80%)	CBCL	—	Teacher ratings indicated gains for all 5 children in adaptive functioning and reductions in total internalizing and externalizing problems; trend indicated fewer problem behaviors reported by teachers
Singh et al <sup>49</sup>	3	13–14 y; Tx: 13.3 (0.6); 100% white	School-referred students diagnosed with conduct disorder	15 min, 3 times per week for 4 wk/ middle school	Pre/post, no control: MM	NA	— (100%)	Aggression, bullying, fire setting, cruelty, noncompliance	—	MM group decreased aggressive behavior or bullying slightly during the MM training and substantially during the 25 wk of practice that followed training
Zylowska et al <sup>55</sup>	8	15.6 (1.1); 38% male	Parent-referred ADHD-diagnosed children	2.5 h, 1 time per week for 8 wk/ university clinic	Pre/post, no control: MM	NA	— (88%)	DSM-IV, SNAP-IV, CDI, RCMAS ANT, TMT, DST	0.38 (0.03 to 1.01)	MM group showed no significant changes in depression or anxiety at follow-up compared to baseline scores; other differences for adolescents could not be extracted from the adult sample

Tx indicates treatment group; AA, African American/black; C, control group; TPR, total peripheral resistance; ABP, ambulatory blood pressure; TAU, treatment as usual; SSRS, Social Skills Rating System; STAI, State-Trait Anxiety Inventory; DSM-IV, *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; GAF, Global Assessment of Functioning; PSS-10, Perceived Stress Scale; SCL-90, Hopkins Symptom Checklist; CBCL, Child Behavior Checklist; RCMAS, Revised Children's Manifest Anxiety Scale; YSR, Youth Self-report; BRIEF, Behavior Rating Inventory of Executive Function; CAS, Cognitive Assessment System; D-KEFS, Delis-Kaplan Executive Function System; TOL, Tower of London; MASC, Multidimensional Anxiety Scale for Children; STAIC, State-Trait Anxiety Inventory for Children; RCDS, Reynolds Child Depression Scale; ACTeRS, ADD-H Comprehensive Teacher Rating Scale; TAS, Test Anxiety Scale; TEA-Ch, Test of Everyday Attention for Children; MFFT, Matching Familiar Figures Test; FDT, Fruit Distraction Test; LCS, Locus of Control Scale; PTQ, Abbreviated Parent-Teacher Questionnaire; SNAP-IV, Swanson, Nolan, and Pelham scale; ANI, Attention Network Test; TMT, Trail-Making Test; DST, Digit Span Test; —, values not presented because of insufficient data; NA, not applicable.

<sup>a</sup>Percentages are rounded to the nearest whole number.

<sup>b</sup>Peer-reviewed abstract only.

<sup>c</sup>The meditation practice used was developed by Benson,<sup>63</sup> which is almost identical to the TM method.