

# Health Benefits of Meditation

## What the Newest Research Shows

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Meditation is among the complementary and alternative medicine (CAM) therapies that is used by Americans, according to CAM-utilization surveys. A national survey on the use of this mind-body form of medicine showed increased usage between 2002 and 2007.<sup>1</sup> This article presents a review of recent research on the efficacy of the major types of meditation that have been studied for treating a wide range of conditions, as well as for promoting stress reduction and overall wellness. Current evidence-based theories on the mechanisms of action underlying the beneficial effects of meditation on health are also examined.

### Types of Meditation and Related Practices

“Meditation” refers to a group of techniques, most of which originated in Eastern religious or spiritual traditions and are also practiced today for stress reduction and other health-related purposes. Common elements of most types of meditation include: a space with minimal distractions; a specific comfortable position; a particular focus of attention; and an open attitude.

Transcendental Meditation™ (TM; from the Vedic tradition of India) and mindfulness meditation (with roots in Buddhism) have received the most scientific attention. Meditation is either practiced on its own or as a component of yoga, *t'ai chi*, *qigong*, and other practices.<sup>2</sup> Vipassana (insight meditation), Zen meditation, and breathing meditation are other types of meditation with applications that have been studied in clinical trials, some sponsored by the U.S. National Institutes of Health's (NIH) National Center for Complementary and Alternative Medicine (NCCAM). As of Spring 2010, the NIH website listed 58 open (recruiting) studies on meditation.<sup>3</sup>

In 1979, Jon Kabat-Zinn, Ph.D., now professor emeritus of medicine and founding director of the Stress Reduction Clinic and the Center for Mindfulness in Medicine, Health Care, and Society (see Resources) at the University of Massachusetts Medical School, developed the Mindfulness-Based Stress Reduction (MBSR) program at the University of Massachusetts Medical Center, in Worcester. The MBSR

program, an 8-week standardized intensive training in mindfulness meditation, is now offered at many medical facilities. A related modality is Mindfulness-Based Cognitive Therapy (MBCT), a form of MBSR that involves cognitive exercises to overcome negative thought patterns that affect emotions and pain perception.<sup>4</sup>

*T'ai chi* and *qigong* have been conceptualized as forms of meditative exercise because they involve some kind of movement or body positioning, a focus on breathing, and a cleared or calm state of mind, with a goal to achieve a deep state of relaxation.<sup>5</sup> Some theorists recommend that these commonalities be taken into account by therapists and practitioners when prescribing and engaging in these practices.<sup>6</sup>

### Recent Clinical Trials

#### *Cardiovascular Health*

Clinical studies have suggested that TM may reduce the blood pressure (BP) of persons with normal BP or hypertension. A meta-analysis of 9 randomized, controlled trials evaluated BP responses to TM, compared with control procedures. The reviewers concluded that TM can produce clinically meaningful reductions in BP by approximately 4.7 and 3.2 mm Hg, in systolic and diastolic pressure, respectively.<sup>7</sup>

African Americans are disproportionately represented in rates of cardiovascular disease (CVD). In a randomized, controlled study, breathing awareness meditation was found to affect ambulatory BP and sodium handling in African American adolescents at high risk of developing hypertension. A meditation group ( $n = 20$ ) engaged in 10-minute sessions in addition to taking standard ninth-grade health-education classes at school and at home daily for 3 months; the control group ( $n = 46$ ) attended health-education classes only. Ambulatory systolic BP at night, overnight urinary sodium excretion rate, and heart rate (HR), recorded periodically over 24 hours, decreased in the intervention group but increased in the control group.<sup>8</sup>

In another randomized controlled trial, 201 high-risk subjects (mean age 58) were randomly assigned to either a TM program (active group) or a health-education (control)

group; all subjects continued usual care. At 5 years' follow-up, stress reduction in the TM group was associated with a 43% reduction in risk for all-cause mortality, myocardial infarction, and stroke.<sup>9</sup>

A study of the effect of a sitting breathing meditation on 50 patients with type 2 diabetes (mean age, 63) in a primary health center involved 3 weekly visits, a patient self-care education session after breakfast, followed by 2 sessions of meditation. The meditation sessions resulted in a postprandial hypoglycemic effect and slightly reduced systolic and diastolic BP.<sup>10</sup> Zen meditation has also been found to reduce blood pressure.<sup>11</sup> A phenomenologic study of a small sample of patients with CVD suggested that meditation focusing on ecospirituality can also be integrated into patient care.<sup>12</sup>

### Cancer

A meta-analysis of 10 randomized controlled trials and observational studies examined the effects of MBSR on the physical and mental health of patients with different types of cancer. The investigators concluded that MBSR may improve the psychosocial adjustment of patients with cancer, but further research is needed to show evidence of MBSR's effects on physical health.<sup>13</sup>

A nonrandomized controlled trial evaluated the effect of a MBSR program on the immune functioning, coping, and quality of life (QoL) of women newly diagnosed with early stage breast cancer who had not had chemotherapy (*N* unspecified). The patients self-selected into an 8-week MBSR program or an assessment-only control group. Assessments were made prior to the program, at midpoint, at program completion, and at a 4-week follow-up. Prior to either program or assessment-only participation, both groups had reductions in peripheral blood mononuclear natural-killer (NK) cell activity and interferon (IFN)- $\gamma$  production with increases in plasma cortisol levels and interleukin (IL)-4, IL-6, and IL-10 production. Women enrolled in the MBSR program had reduced plasma cortisol levels and improved QoL and coping ability, compared with the non-MBSR group. Women in the non-MBSR program had continued reductions in NK cell activity and increased cytokine production levels.<sup>14</sup>

In the post-treatment period, survivors of breast cancer often experience high levels of anxiety, depression, fear of recurrence, pain, fatigue, and sleep disturbances. In a randomized, controlled study of 84 female patients with stages 0–III breast cancer who were within 18 months of standard treatment, patients were randomized to a 6-week MBSR program or to usual care. Compared with usual care, MBSR treatment produced significant improvements in psychologic status and QoL.<sup>15</sup>

A single-blinded, randomized controlled trial evaluated the impact of TM plus standard care (*n* = 64), compared with standard care alone (*n* = 66), on the QoL of 130 women 55 years or older with stages II–IV breast cancer over an average 18-month intervention period. As measured every 6 months by the Functional Assessment of Cancer Therapy–Breast (FACT-B), Functional Assessment of Chronic Illness Therapy–Spiritual Well-

Being (FACIT-SP), and Short-Form (SF)–36 mental health and vitality scales, significant improvements were noted in the TM group in overall QoL, emotional well-being, and mental health.<sup>16</sup>

In a study of the psychologic effects of MBCT on patients diagnosed with various stages of cancer (*n* = 115), patients were randomly assigned to 8 weeks of 2-hour sessions of MBCT (1-hour of which was spent in meditation), plus an additional full-day session during the course, or to a wait-list control. Patients were assessed at pretreatment and at 10 weeks and 3 months post-training. Compared with the controls, patients who had received mindfulness training had significant improvements on measures of mindfulness, depression, distress, and QoL.<sup>17</sup>

### Chronic Pain Disorders

A 6-year longitudinal study conducted at an integrative medicine center examined the effects of a MBSR program on a cohort of 133 patients with heterogeneous chronic pain disorders. Outcomes in pain perception and health-related QoL differed across conditions. Treatment outcomes were most significant in subgroups of patients with arthritis, back/neck pain, and comorbid conditions. Patients with chronic headache/migraine experienced the smallest reduction in pain intensity and smallest improvement in QoL, and patients with fibromyalgia (FM) reported the least reduction in psychologic distress. Home practice affected all measures positively except pain intensity.<sup>18</sup>

A review of the literature indicated that meditation, like exercise and cognitive behavioral therapy (CBT), enables patients with rheumatoid arthritis (RA) to manage the psychologic distress comorbid with their chronic illness better.<sup>19</sup> A pilot study examined the effect of a program of instruction in TM, plus an individually tailored Ayurvedic diet for 31 female patients diagnosed with FM. At a 6-month follow-up, compared with a nonmeditating control group, the 28 patients who completed the follow-up had significant improvement on six of the seven outcome measures on the Fibromyalgia Questionnaire: generalized pain; fatigue; stiffness; tiredness on rising; anxiety; and working ability. Depression was the only measure on which results did not reach significance.<sup>20</sup>

### Menopausal Symptoms

A recent review of the peer-reviewed literature on studies of the effects of self-administered mind–body therapies, including meditation, on menopausal symptoms yielded 12 randomized clinical trials (*n* = 719), 1 nonrandomized controlled trial (*n* = 58), and 5 uncontrolled trials (*n* = 105). The collective findings of these studies suggest that meditation-based and other relaxation therapies may help alleviate vasomotor and other menopausal symptoms.<sup>21</sup>

### HIV/AIDS

Spirituality, which may include meditation, is one of the resources drawn upon by patients with HIV or AIDS. A nonrandom sample of 129 predominantly African Ameri-

can HIV-positive women found a positive relationship between spiritual/religious well-being and CD4 cell counts, and an inverse relationship between spiritual well-being and depression.<sup>22</sup>

A group meditation intervention that involved repeating a mantra, a spiritual word or phrase, was found to decrease anger in distressed HIV-positive persons ( $n = 46$ ) compared with controls ( $n = 47$ ) in a community-based sample. The intervention worked by enhancing positive reappraisal coping skills.<sup>23</sup>

A small randomized controlled study examined the effects of 8 weeks of mindfulness meditation training on the immune status of HIV-1 infected adults. Compared with participants in a 1-day control stress-reduction education seminar, whose circulating CD4+ T lymphocytes declined, those counts remained unchanged during the intervention period in the meditation-program participants.<sup>24</sup>

#### *Substance Abuse*

A critical review of the literature indicates that the most widely-studied types of meditation have a helpful emerging role to play in treating substance-abuse disorders.<sup>25</sup> A systematic review of 3 clinical studies suggested that Vipassana meditation could reduce alcohol and other substance abuse in incarcerated populations.<sup>26</sup> Because mindfulness was positively associated with a sense of control among 158 enrollees in a smoking-cessation program, it was concluded that mindfulness-based interventions may enhance smoking cessation.<sup>27</sup>

#### *Memory Loss*

A recent preliminary study indicates that patients with memory loss may potentially be helped by meditation, if the results are borne out in future trials. This 8-week meditation program with 14 subjects with memory loss produced improvements in cerebral blood flow and memory.<sup>28</sup>

#### *Youth Populations*

Although most meditation studies have focused on adults, a systematic review conducted of studies from 1982 to 2008 reviewed a sample of 16 empirical trials related to sitting-meditation interventions (i.e., TM, mindfulness meditation, MBSR, and MBCT) among youth.

Most of the studies examined young people with preexisting conditions, including high-normal BP, attention-deficit/hyperactivity disorder (ADHD), and learning disabilities. Despite methodologic limitations, the reviewers concluded that: “[s]itting meditation seems to be an effective intervention in the treatment of physiologic, psychosocial, and behavioral conditions among youth.”<sup>29</sup>

A randomized controlled trial on the effects of TM on 298 young adult college students (53% of whom were at risk for developing hypertension) found that a TM intervention decreased systolic/diastolic BP by reducing stress and anger/hostility and increasing coping at baseline and at a 3-month follow-up. The overall sample BP reduction was  $-2.0/-1.2$

mm Hg, whereas the BP reduction in the hypertension-risk subgroup was  $-5.0/-2.8$  mm Hg; BP increased slightly in the control groups.<sup>30</sup>

#### *Incarcerated Populations*

Studies suggest that TM, mindfulness-based, and insight forms of meditation support rehabilitation programs for incarcerated populations. This is achieved by reducing substance abuse, enhancing psychologic well-being, and decreasing recidivism.<sup>31</sup>

#### *Psychologic Trauma*

Twenty-seven adult survivors of childhood sexual abuse participated in a pilot study of a MBSR program and daily home practice of mindfulness skills. Assessments at baseline, 4, 8, and 24 weeks found statistically significant reductions in depressive symptoms, post-traumatic stress disorder (PTSD) and anxiety, and improvements in mindfulness. Compliance with class attendance and home practice was high.<sup>32</sup>

## Stress Management

Meditation is not only for ill people. Although forms of meditation, including MBSR, have been efficacious for helping patients with a wide range of disorders, less attention has been paid to the potential benefits of MBSR for healthy individuals. A literature search yielded 10 studies for a review and meta-analysis of MBSR in healthy subjects in English-language articles published up to September 2008. While of varying methodologic quality, the studies showed a nonspecific effect of meditation programs on stress reduction compared with interventions designed to be structurally equivalent. MBSR reduced trait anxiety and ruminative thinking and increased self-compassion. Both MBSR and standard relaxation training were equally able to reduce stress.<sup>33</sup> A clinical trial of assana meditation suggested that this form of meditation practice could enhance more-mature coping styles.<sup>26</sup>

Similarly, a community-based randomized study comparing a 5-week mindfulness meditation course ( $n = 19$ ) with one on progressive muscle relaxation ( $n = 24$ ) found comparable post-treatment levels of stress-reduction.<sup>34</sup> A 6-week work-site MBSR intervention also significantly reduced perceived stress in members of the active intervention group, compared with those who served as wait-list controls.<sup>35</sup>

#### *College Students*

A randomized, controlled study investigated the effects of TM practice on stress reactivity and brain functioning in 50 college students who were randomly assigned to learn TM immediately following a pretest or after a 10-week post-test. Posthoc analyses revealed significant increases in brain-integration scale scores (on frontal coherence, power ratios, and preparatory brain responses) for immediate-start students (assigned to learn TM immediately following a pretest) but

## Resources

### Organization

#### Center for Mindfulness in Medicine, Health Care, and Society (CFM)

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55 Lake Avenue North  
Worcester, MA 01655  
Phone: (508) 856-2656  
E-mail: [mindfulness@umassmed.edu](mailto:mindfulness@umassmed.edu)  
Website: [www.umassmed.edu/content.aspx?id=41252](http://www.umassmed.edu/content.aspx?id=41252)

Founded in 1995 by Jon Kabat-Zinn, PhD, the CFM pioneered integration of mindfulness meditation in mainstream medicine. The Center—an outgrowth of the Stress Reduction Clinic at the University of Massachusetts Medical Center, in Worcester—focuses on patient care, research, medical and professional education, and public outreach.

### Website

#### [www.tm.org](http://www.tm.org)

The official website of the Transcendental Meditation™ (TM) Program provides information on the benefits of meditation, courses for learning meditation, and answers to commonly asked questions about TM.

### Book

#### *Heal Thy Self:*

*Lessons on Mindfulness in Medicine* (8th printing)  
By Saki Santorelli, EdD (executive director of the CFM)  
Ithaca, NY: Random House/Bell Tower, 2008

### Recording

*Mindfulness Meditation for Pain Relief*  
*Guided Practices for Reclaiming Your Body and Your Life*  
By Jon Kabat-Zinn, PhD  
Louisville, CO: Sounds True, 2010

In this double compact disc-package, the developer of the Mindfulness-Based Stress Reduction (MBSR) methodology, presents practices for finding relief from chronic pain, acute pain, everyday stress, and emotional challenges.

decreases in delayed-start students (assigned to learn TM following the other group's 10-week post-test). On measures of electrodermal habituation to tones, sleepiness, HR, respiratory sinus arrhythmia, and P300 [a positive wave that appears 300 milliseconds following the start of a stimulus] latencies, there were significant reductions in sleepiness in immediate-start students but no change in the delayed-start students, and significant increases occurred in the delayed-start students only.<sup>36</sup>

#### *Health Care Professionals*

To combat the stress, psychologic distress, and job burnout that health care professionals frequently experience, a prospective, randomized, controlled pilot study examined the effects of an 8-week MBSR intervention. The results suggest that this intervention was promising for relieving these problems.<sup>37</sup> Other studies show similar stress-reducing effects of mindfulness meditation in primary care physicians<sup>38</sup> and in nursing students.<sup>39</sup>

## Pending Clinical Trials

Clinical trials currently recruiting subjects for studies on the effects of meditation focus on patients with PTSD, congestive heart failure with implantable cardioverter defibrillators (ICDs), ADHD, migraine, schizophrenia, interstitial cystitis/painful bladder syndrome, insomnia, and chronic pain disorders; smokers; and caregivers of individuals with Alzheimer's disease.<sup>3</sup>

## Mechanisms of Action

Practicing meditation was formerly thought to induce passive relaxation states primarily by producing changes in the autonomic nervous system. However, recent findings from electroencephalogram (EEG) and neuroimaging studies suggest that meditation is associated with active states of consciousness that involve cognitive restructuring, learning, and changes in the structure of the brain itself. While even brief training in meditation can affect processing of affective stimuli so that emotions are no longer overwhelming, long-term practitioners also have changes in brain structure and reactions to pain.<sup>40</sup>

In structural magnetic resonance imaging (MRI) scans of 17 practitioners of Zen meditation, compared with 18 controls, subjected to heat stimuli capable of evoking moderate pain, long-term meditation practice was associated with reduced pain sensitivity and greater cortical thickness in pain-related brain regions, including the anterior cingulate cortex and anterior insula.<sup>41</sup>

In a comparison of advanced and novice meditators, there was a significant reduction in self-reported unpleasantness but not in intensity of pain, suggesting that nonjudgmental awareness can mitigate against the negative affects of the sensory experience of pain.<sup>42</sup> A study of the analgesic effects of mindful states in 13 experienced Zen meditators suggested that pain modulation could be explained, in part by, changes in respiratory rates.<sup>43</sup> Compared with baseline testing and a distraction task, even brief training (3 sessions of 20 minutes per day) in mindfulness meditation was effective for reducing pain and anxiety scores in subjects who participated in experiments involving painful electrical stimulation.<sup>44</sup>

Electrophysiologic states observed in advanced versus novice meditators correspond to states that appear to be unique (e.g., synchronized  $\gamma$  oscillations). Such altered EEG patterns provide further evidence for the concept of neuronal plasticity.<sup>45</sup> While EEG studies on Zen meditation practice found increase  $\alpha$  and  $\theta$  activity generally related to relaxation in brain regions including the frontal cortex,  $\theta$  activity was associated with a greater degree of experience in meditation.<sup>46</sup> However, even a brief course of 4 sessions of mindfulness meditation was sufficient to enhance the ability to sustain attention by improving visual-spatial processing, working memory, and executive functioning.<sup>47</sup>

Neuroimaging studies have shown neurobiologic correlates of meditation, highlighting brain regions that regulate attention control and affect—a major aim of meditation instruction and practice.<sup>48</sup> Meditation and MBCT are thought to promote synaptic links more effectively between the amygdala (the brain structure mainly responsible for processing emotion and anxiety) and the higher thought-processing cortex.<sup>49</sup> Such studies suggest that Vipassana meditation practice is associated with activation of the prefrontal and anterior cingulate cortex, as well as with increased thickness in cortical areas related to attention and increased subcortical gray matter in the hippocampus and right insula in long-time meditators.<sup>26</sup>

From a study of how meditation affects parameters of the cardiovascular system, based mainly on assessment of BP waveforms, it was inferred that Zen meditation may improve characteristics of the cardiovascular system.<sup>50</sup> Likewise, cerebral blood flow changes have been observed during chanting meditation.<sup>51</sup>

It has been proposed that mindfulness meditation may have salutary effects on the length of telomeres (protective caps at the ends of chromosomes) and, therefore, on cellular

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### *Zen meditation may improve characteristics of the cardiovascular system.*

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aging, by counteracting chronic states of stress arousal. According to this model, mindfulness meditation shifts cognitive appraisals from “threat” to “challenge,” thereby increasing positive states of mind and hormonal factors that appear to promote telomere maintenance.<sup>52</sup> Functional magnetic resonance imaging (fMRI) studies suggest that a neural-switch mechanism is used in the shift from normal consciousness to meditation and in a threshold regulation mechanism that sustains the meditative state.<sup>53</sup> Different meditation traditions may differ in terms of their foundational state of cerebral functioning.<sup>54</sup>

### Conclusion

Meditation is now widely accepted as a mind–body technique for maintaining holistic health and wellness. In medical and rehabilitation settings, meditation has proven to be a safe and effective adjunctive therapy for treating a variety of conditions and the psychologic effects of chronic illness and pain—effects often not addressed in conventional treatments. Evidence suggesting that meditation has neuroprotective properties has implications for enhancing cognition and preventing dementia.<sup>55</sup>

Further efforts are needed to apply meditation practices in clinical settings in ways that are practical, effective, and meaningful.<sup>56</sup> Comparison of different types of meditation and of

meditation with other therapies, evaluation of long-term effects, and further elucidation of the neurobiologic and clinical correlates of this nonpharmacologic modality are warranted. ■

### References

1. Barnes PM, Bloom B, Nahin RL. Complementary and alternative medicine use among adults and children: United States, 2007. *Natl Health Stat Report* 2008;10:1–23.
2. National Center for Complementary and Alternative Medicine. Meditation: An Introduction (Background). Online document at: <http://nccam.nih.gov/health/meditation/overview.htm> Accessed April 8, 2010.
3. U.S. National Institutes of Health. Meditation: Open Studies. Online document at: <http://clinicaltrials.gov/ct2/results?term=meditation&crec=Open> Accessed April 7, 2010.
4. What is Mindfulness-Based Stress Reduction? Online document at: [www.mindfullivingprograms.com/whatMBSR.php](http://www.mindfullivingprograms.com/whatMBSR.php) Accessed April 8, 2010.
5. Larkey L, Jahnke R, Etnier J, Gonzales J. Meditative movement as a category of exercise: Implications for research. *J Phys Act Health* 2009;6:230–236.
6. Posadzki P, Jacques S. *Tai chi* and meditation: A conceptual (re)synthesis? *J Holist Nurs* 2009;27:103–114.
7. Anderson JW, Liu C, Kryscio RJ. Blood pressure response to transcendental meditation: A meta-analysis. *Am J Hypertens* 2008;21:310–316.
8. Barnes VA, Pendergrast RA, Harshfield GA, Treiber FA. Impact of breathing awareness meditation on ambulatory blood pressure and sodium handling in pre-hypertensive African American adolescents. *Eth Dis* 2008;18:1–5.
9. Schneider R, Nidich S, Kotchen JM, et al. Effects of stress reduction on clinical events in African Americans with coronary heart disease: A randomized controlled study [abstr 1177]. *Circulation* 2009;120(18suppl):S461; presented at American Heart Association Scientific Sessions 2009, Orlando, FL, November 14–18, 2009.
10. Chaiponant S. Hypoglycemic effect of sitting breathing meditation exercise on type 2 diabetes at Wat Khae Nol Primary Health Center in Nonthaburi province. *J Med Assoc Thai* 2008;91:93–98.
11. Chiesa A, Serretti A. A systematic review of neurobiological and clinical features of mindfulness meditations. *Psychol Med* 2009;November 27:e-pub ahead of print.
12. Delaney C, Barrere C. Ecospirituality: The experience of environmental meditation in patients with cardiovascular disease. *Holist Nurs Practice* 2009;23:361–369.
13. Ledesma D, Kumano H. Mindfulness-based stress reduction and cancer: A meta-analysis. *Psycho-oncology* 2009;18:571–579.
14. Witek-Janusek L, Albuquerque K, Chroniak KR, et al. Effect of mindfulness based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. *Brain Behav Immun* 2008;22:969–981.
15. Lengacher CA, Johnson-Mallard V, Post-White J, et al. Randomized controlled trial of mindfulness-based stress reduction (MBSR) for survivors of breast cancer. *Psycho-oncology* 2009;18:1261–1272.
16. Nidich SI, Fields JZ, Rainforth MV, et al. A randomized controlled trial of the effects of Transcendental Meditation on quality of life in older breast cancer patients. *Integr Cancer Ther* 2009;8:228–234.
17. Foley E, Baillie A, Huxter M, et al. Mindfulness-based cognitive therapy for individuals whose lives have been affected by cancer: A randomized controlled trial. *J Consult Clin Psychol* 2010;78:72–79.
18. Rosenzweig S, Gresson JM, Reibel DK, et al. Mindfulness-based stress reduction for chronic pain conditions: Variation in treatment outcomes and role of home meditation practice. *J Psychosom Res* 2010;68:29–36.

19. Gettings L. Psychological well-being in rheumatoid arthritis: A review of the literature. *Musculoskeletal Care* 2010;8:99–106.
20. Rasmussen LB, Mikkelsen K, Haugen M, et al. Treatment of fibromyalgia at the Maharishi Ayurveda Health Centre in Norway: A six-month follow-up study. *Clin Exp Rheumatol* 2009;27(suppl):S46–S50.
21. Innes KE, Selfe TK, Vishnu A. Mind-body therapies for menopausal symptoms: A systematic review. *Maturitas* 2010;66:135–149.
22. Dalmida SG, Holstaf MM, Diiorio C, Laderman G. Spiritual well-being, depressive symptoms, and immune status among women living with HIV/AIDS. *Women Health* 2009;49:119–143.
23. Bormann JE, Carrico AW. Increases in positive reappraisal coping during a group-based mainstream intervention mediate sustained reductions in anger in HIV-positive persons. *Int J Behav Med* 2009;16:74–80.
24. Creswell JD, Myers HF, Cole SW, Irwin MR. Mindfulness meditation training effects on CD4+ T lymphocytes in HIV-1 infected adults: A small randomized controlled trial. *Brain Behav Immun* 2009;23:184–188.
25. Dakwar E, Levin FR. The emerging role of meditation in addressing psychiatric illness, with a focus on substance abuse disorders. *Harv Rev Psychiatry* 2009;17:254–267.
26. Chiesa A. Vipassana meditation: A systematic review of current evidence. *J Altern Complement Med* 2010;16:37–46.
27. Vidrine JI, Businelle MS, Cinciripini P, et al. Associations of mindfulness with nicotine dependence, withdrawal, and agency. *Subst Abuse* 2009;30:318–327.
28. Newberg AB, Wintering N, Khalsa DS, et al. Meditation effects on cognitive function and cerebral blood flow in subjects with memory loss: A preliminary study. *J Alzheimers Dis* 2010;20:517–526.
29. Black DS, Milam J, Sussman S. Sitting meditation interventions among youth: A review of treatment efficacy. *Pediatrics* 2009;August 24:e-pub ahead of print.
30. Nidich SI, Rainforth MV, Haaga DA, et al. A randomized controlled trial on effects of Transcendental Meditation program on blood pressure, psychological distress, and coping in young adults. *Am J Hypertens* 2009;22:1326–1331.
31. Himelstein S. Meditation research: The state of the art in correctional settings. *Int J Offender Ther Comp Criminol* 2010 March 23:e-pub ahead of print.
32. Kimbrough E, Magyari T, Langenberg P, et al. Mindfulness intervention for child abuse survivors. *J Clin Psychol* 2010;66:17–33.
33. Chiesa A, Serretti A. Mindfulness-based stress reduction for stress management in healthy people: A review and meta-analysis. *J Altern Complement Med* 2009;15:593–600.
34. Agee JD, Danoff-Burg S, Grant CA. Comparing brief stress management courses in a community sample: Mindfulness skills and progressive muscle relaxation. *Explore (N Y)* 2009;5:104–109.
35. Klatt MD, Buckworth J, Malarkey WB. Effects of low-dose mindfulness-based stress reduction (MBSR-ld) on working adults. *Health Educ Behav* 2009;36:601–614.
36. Travis F, Haaga DA, Hagelin J, et al. Effects of Transcendental Meditation practice on brain functioning and stress reactivity in college students. *Int J Psychophysiol* 2009;71:170–176.
37. Shapiro SL, Astin JA, Bishop SR, Cordova M. Mindfulness-based stress reduction for health care professionals: Results from a randomized trial. *Int J Stress Manage* 2005;12:164–176.
38. Franco JC. Reducing stress levels and anxiety in primary-care physicians through training and practice of a mindfulness meditation technique [in Spanish]. *Aten Primaria* 2010;February 1:e-pub ahead of print.
39. Kang YS, Choi SY, Ryu E. The effectiveness of a stress coping program based on mindfulness meditation on the stress, anxiety, and depression experienced by nursing students in Korea. *Nurs Educ Today* 2009;29:538–543.
40. Williams JM. Mindfulness and psychological process. *Emotion* 2010;10:1–7.
41. Grant JA, Courtemanche J, Duerden EG, et al. Cortical thickness and pain sensitivity in Zen meditators. *Emotion* 2010;10:43–53.
42. Perlman DM, Salomons TV, Davidson RJ, Lutz A. Differential effects on pain intensity and unpleasantness of two meditation practices. *Emotion* 2010;10:65–71.
43. Grant JA, Rainville P. Pain sensitivity and analgesic effects of mindful states in Zen meditators: A cross-sectional study. *Psychosom Med* 2009;71:106–114.
44. Zeidan F, Gordon NS, Merchant J, Goolkasian P. The effects of brief mindfulness training on experimentally induced pain. *J Pain* 2010;11:199–209.
45. Fell J, Axmacher N, Haupt S. From alpha to gamma: Electrophysiological correlates of meditation-related states of consciousness. *Med Hypotheses* 2010;March 11:e-pub ahead of print.
46. Chiesa A. Zen meditation: An integration of current evidence. *J Altern Complement Med* 2009;15:585–592.
47. Zeidan F, Johnson SK, Diamond BJ, et al. Mindfulness meditation improves cognition: Evidence of brief mental training. *Conscious Cogn* 2010;19:597–605.
48. Rubia K. The neurobiology of meditation and its clinical effectiveness in psychiatric disorders. *Biol Psychol* 2009;82:1–11.
49. Mayo KR. Support from neurobiology for spiritual techniques for anxiety: A brief review. *J Health Care Chaplain* 2009;16:53–57.
50. Liu CY, Wei CC, Lo PC. Variation analysis of sphygmogram to assess cardiovascular system under meditation. *Evid Based Complement Alternat Med* 2009;6:107–112.
51. Khalsa DS, Amen D, Hanks C, et al. Cerebral blood flow changes during chanting meditation. *Nucl Med Commun* 2009;30:956–961.
52. Epel E, Daubenmier J, Moskowitz JT. Can mindfulness slow rate of cellular aging? Cognitive stress, mindfulness, and telomeres. *Ann N Y Acad Sci* 2009;1172:34–53.
53. Baerentsen KB, Stodkilde-Jorgensen H, Sommerfund B, et al. An investigation of brain processes supporting meditation. *Cogn Process* 2010;11:57–84.
54. Travis F, Shear J. Focused attention, open monitoring and automatic self-transcending: Categories to organize meditations from Vedic, Buddhist and Chinese traditions. *Conscious Cogn* 2010;February 16:e-pub ahead of print.
55. Xiong GL, Doraiswamy PM. Does meditation enhance cognition and brain plasticity? *Ann N Y Acad Sci* 2009;1172:63–69.
56. Fortney L, Taylor M. Meditation in medical practice: A review of the evidence and practice. *Prim Care* 2010;37:81–90.

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