

Research on TM and Mindfulness: A Comparison

Background. There are now hundreds of research studies on TM and Mindfulness.

How does the research on TM and Mindfulness Compare?

This is a complex question to answer, not only because there is so much research now on these techniques, but also because there are many different techniques that are called mindfulness meditation (MM). There are different techniques called mindfulness that refer to: open monitoring of the flow of consciousness experiences, monitoring the cycle of the breath, being mindful while eating, and being mindful while walking, etc. There is also “basic body scan meditation” (which is similar to our “feeling the body”) and compassion meditation, where the meditator thinks about compassion towards all beings or towards oneself. The physiological effects of being mindful of the breath while sitting with the eyes closed are undoubtedly different from the effects of being mindful while one is walking, for example, so one cannot conclude what “mindfulness” does, but must examine each technique separately.

Quite another, and somewhat opposite, use of the term by Langer at Harvard and others defines mindfulness in terms of actively using the mind, such as various creativity games and mental exercises. A Sudoku game would be an example of this kind of mindfulness exercise. The principle here is to use it or lose it. Keep the mind (like the body) active and challenged and it will stay healthier. A critical randomized controlled study at Harvard comparing TM with this kind of mindfulness in the elderly did find that it was superior to passive relaxation and no treatments control groups. But the study also showed that TM was even more effective in accomplishing the same thing. The study found that TM was significantly superior to mindfulness in increasing mental flexibility, lowering blood pressure, producing feelings of being “less old”, and, most importantly, increasing the life span, by an average of over 2 years after 15 years.

However, most of the research these days on mindfulness involves the open monitoring type of mindfulness. The common goal of these different techniques is to try to use conscious control of one’s reactions to things to disallow automatic emotional response that may arise from anger or fear or from other conditioned reactions that cause the person to perceive and react to the world in a dysfunctional way. The idea of monitoring experience in a non judgmental way is try to disallow automatic judgments of the experience or event as “good” and “bad”. One tries to maintain a neutral attitude and to see life on a neutral ground. One wants to gain control over one’s conditioning history, to have a “moratorium” over one’s usual negative reactions.

During sitting in mindfulness meditation one practices maintaining a neutral non judgmental attitude during the flow of thoughts and sensations that come and go in the mind. The hope is that this practice during meditation will train the mind to maintain a non-judgmental attitude during activity, and one will be able to learn new patterns of thought and behavior. Negative thoughts and conditioning come from past experiences, or agitation about the outcome of future events. The hope of mindfulness is to overcome the pushes and pulls of the past and future conditioning history and to be *mindful* of the present, to *live in the present, not in the past or the future*.

So in summary, mindfulness techniques are waking state cognitive technique whereby one uses one’s active volitional thinking mind to try to control one’s attitudes and how one reacts to experience. That is, to control the mind not to react in the usual way, so that fresher new ways can be found.

Difference in the Mechanism of TM and Mindfulness

The TM technique also eliminates negative reactions and allows one to live more in the present, but it does so by a completely different mechanism than mindfulness. Whereas with mindfulness, we use our volitional control of our mind to try to change our attitudes and reactions to life. The TM technique is an effortless technique for allowing the mind to settle down into a state of coherent rest that dissolves deep rooted stresses that are at the basis of our negative conditioned reactions. There is no concentration of contemplation during TM. No attempt to maintain a non-judgmental attitude. In TM the mind automatically settles into quieter and subtler levels, until transcending all thought, it becomes unbounded awareness. This is a very blissful state, which is why the mind is automatically drawn there. Outside of TM, in activity, there is no attempt to control or modify how one thinks or behaves. One is only advised to act naturally and spontaneously. On the basis of a more stress free and coherent physiology, one will naturally behave in a more harmonious, creative, adaptive, joyful way.

Show PowerPoint of Bubble diagram contrasting TM with mindfulness and other techniques.

Differences in Research Outcomes.

The difference between the TM and mindfulness techniques gives us an insight into the differences in the kinds of studies that have been done and into the research findings for the two techniques.

Physiological effects during meditation. There is much more research on the physiology of the TM technique per se than for mindfulness, because the hypotheses motivating TM research predict a unique state of coherent rest. TM has been taught in a standardized way for 50 years, which has allowed the development of a large body of physiological research on it. Because mindfulness techniques are many, and not a single technique, there is not so much research on what happens physiologically during the techniques, although there is some. What open monitoring shows is that it is similar to other active waking state cognitive behaviors. The EEG, for example, shows gamma (30-50 Hz), which is what is seen when one is focusing the mind on a task. Mindfulness also shows theta (4-7 Hz), which is what is seen when one is trying to think and is blocking out incoming information, for example, as when focusing on a mental arithmetic problem. The picture is that one is concentrating on the task and blocking out distracting incoming information during mindfulness, which corresponds with what one does during open monitoring mindfulness meditation.

The TM technique, on the other hand, produces a state of frontal coherent and synchronous (zero phase lag coherence) alpha wave globally across the brain. This pattern has been found to have the functional significance of organizing different brain areas to carry out their functions in a coordinated and coherent way. The analogy of alpha coherence is like a conductor timing all the activities of the orchestra.

Whereas the TM technique has been shown to produce an integrated pattern of decreased stress markers and none of the mindfulness techniques have been shown to produce this pattern. Basic body scan MM does produce increase greater cardiac respiratory sinus arrhythmia compared to PMR, but has no consistent effect on heart rate or blood pressure. One study found that monitoring the breath reduced blood pressure in adolescence.

[Alpha EEG power, coherence, and synchrony is part of the integrated pattern of deep rest observed during the Transcendental Meditation technique (Jevning, Wallace, & Biedebach, 1992). Studies have found that the Transcendental Meditation technique increases alpha coherence and synchrony as a state and trait, indicating increased stability of the phase relationship between the collective neural activity in the left and right hemispheres and frontal and posterior brain areas Dillbeck, Orme-Johnson, & Wallace,

1981 (Dillbeck & Bronson, 1981; Gaylord, Orme-Johnson, & Travis, 1989; Hebert, Lehmann, Tan, Travis, & Arenander, 2005; Travis, 2001; Travis & Arenander, 2006; Travis et al., 2009).

Basic EEG Research. Over the last decade, basic research has found that alpha coherence and synchrony functionally bind distributed cortical neuronal assemblies needed to carry out a wide range of cognitive tasks—attentional, semantic, memory, and learning—as well as basic sensory and motor tasks (Palva & Palva, 2007; Sauseng & Klimesch, 2008). Whereas beta and gamma EEG coherence have a role of coordinating local, proximal cortical areas during cognitive processing, alpha coherence is essential for large-scale neural communication and integration between distant cortical areas that are necessary for conscious awareness and the meaningful interpretation of experience (Palva & Palva, 2007). EEG coherence during the Transcendental Meditation technique is positively correlated with intelligence, creativity, concept learning, and moral reasoning, as well as with reduced anxiety, emotional stability, and mental health (Dillbeck, Orme-Johnson, & Wallace, 1981; Nidich, Ryncarz, & Abrams, 1983; Orme-Johnson & Haynes; Travis & Arenander, 2006).

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Physiological effects outside of meditation

The main physiological effects of Mindfulness outside of meditation that have been reported is increased thickening of the cerebral cortex. It should be noted that other repetitive learned behaviors, such as juggling, also produce cortical thickening. But it appears to be a good thing. The cortex thins with aging, so thickening could be construed as having anti aging effects. However, it has not yet been demonstrated that mindfulness techniques actually have life extending effects, but TM has. Nor has this effect been demonstrated to be functionally significant for cognitive processes, whereas the TM research has been shown to increase creativity, intelligence, field independence, and actual school performance. Cortical thickening, however, has been associated with reduced pain sensitivity. Results generally suggest that pain sensitivity is related to cortical thickness in pain-related brain regions and that the lower sensitivity observed in Zen meditators may be the product of alterations to brain morphometry from long-term practice (Grant, et al, 2010).

Reversal of the effects of stress. There is a large body of research showing that TM reverses the effects of stress, and little research on the effects of mindfulness on physiological measures of stress, including reduction of blood pressure, left ventricular hypertrophy, metabolic syndrome, angina pectoris, carotid atherosclerosis or cardiovascular events.

Cardiovascular Disease

A review of the effects of meditation on cardiovascular disease reported only the TM studies and found no studies on mindfulness [Olivio, E.L. 2004 Meditation and cardiovascular disease. In R.A. Stein and M.C. Oz, eds. *Complementary and Alternative Cardiovascular Medicine*, 2004 Humana Press Totowa, New Jersey.]

A search of a comprehensive data base on mindfulness from 1960 to May 2010 found *no papers* on left ventricular hypertrophy, metabolic syndrome, angina pectoris, or carotid atherosclerosis, whereas there have been randomized controlled trials on these conditions showing that TM has beneficial effects.

The search of the data base found only two papers on the cardiovascular system. [The first study was on many techniques, including mindfulness, and was not MBSR, so it cannot be concluded what, if any part, mindfulness played. [Edelman, D., Oddone, E. Z., Liebowitz, R. S., Yancy, W. S., Jr., Olsen, M. K., Jeffreys, A. S., et al. (2006). A multidimensional integrative medicine intervention to improve cardiovascular risk. *Journal of General Internal Medicine*, 21(7), 728-734.]

The second study compared the short term (immediate) effects basic body scan meditation to progressive muscle relaxation (PMR) and found greater cardiac respiratory sinus arrhythmia during MM. No difference between groups in heart rate. Conflicting results for DBP, men increased, women decreased. "Conclusions: The results indicate both similarities and differences in the physiological responses to body scan meditation and other relaxing activities." Ditto, B., Eclache, M., & Goldman, N. (2006, December). Short-term autonomic and cardiovascular effects of mindfulness body scan meditation. *Annals of Behavioral Medicine*, 32(3), 227-234. Studied short term effects of basic body scan meditation on blood pressure. No clinically relevant effects reported.

Blood pressure. A search of a comprehensive data base on mindfulness research and meta-analyses found only two studies on blood pressure, whereas there have been 9 randomized controlled trials on the TM technique and numerous earlier studies. (MINDFULNESS RESEARCH GUIDE, 1960 to May 2010, <http://www.mindfulexperience.org/>). The first was an uncontrolled study on Mindfulness Based Stress Reduction (MBSR), which is a standardized 8-week program that includes the various meditation techniques mentioned above (monitoring the breath, the flow of thought, walking, eating, as well as yoga exercises, classes on mindfulness, and a weekend in residence course. Note that one can't tell from MBSR what any of the meditation or other components per se do). There was no change in blood pressure. [The paper reported a 2 point reduction, from 19 pretest to 17 mm Hg SBP average over a year period posttest, with no change in DBP. This is less than half the change produced by TM. However, there were two pre test measures, one a week before and the other right before learning, which were 20 and 16 mm HG SBP, which were averaged. So SBP went from 16 right before the intervention to an average of 17 after, a slight increase]

A meta-analysis of the effects of sitting meditation not involving physical exertion (TM and Mindfulness) on youth did find a study showing that mindfulness (in this case, meditating on the breath cycle) did decrease blood pressure (Black et al. 2009). The meta-analysis also showed that TM reduced blood pressure, cardiovascular reactivity to stress, and endothelial function in youth. This meta-analysis also found studies showing that both TM and MM reduce behavioral problems in youth. (Black DS, Milam J, Sussman S. Sitting-Meditation among youth: A review of treatment efficacy. *Pediatrics* 2009; 124(3) e532-e541.)

TM has been shown to produce fundamental changes in how the body reacts to stress. The following studies detail what has been found for TM.

[The Sympathetic Nervous System (SNS). Stress-provoking challenges generally engage two types of neural systems mediating CVD, the autonomic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis. Chronic SNS arousal and inappropriate SNS activation to stressors is a prevalent and potent

risk factor for adverse cardiovascular events, including mortality (Curtis & O'Keefe, 2002). Pioneering studies by Wallace (1970) and others found that the Transcendental Meditation technique produces an integrated pattern of autonomic and central nervous system changes characterized by reduced SNS arousal and increased EEG alpha power (Jevning, Wallace, & Biedebach, 1992). Orme-Johnson (1973) found significantly lower levels of spontaneous skin resistance responses (considered a pure measure of SNS activity) during and outside of meditation compared to non-meditating controls. This study and subsequent research also found fewer multiple responses and more rapid autonomic recovery from stressors in Transcendental Meditation subjects compared to controls (Brooks & Scarano, 1985; Goleman & Schwartz, 1976; Travis et al., 2009; Barnes, et al., 2001). Mills et al. (1990) found reduced beta-adrenergic receptor sensitivity during the Transcendental Meditation technique, associated with reduced baseline epinephrine levels. A meta-analysis of 32 studies measuring SNS indices found that TM significantly reduces respiratory rate and plasma lactate and increases basal skin resistance during the practice compared to controls sitting with eyes closed. This study also found that Transcendental Meditation subjects have lower baseline levels outside of meditation of heart rate, respiratory rate, plasma lactate, and spontaneous skin resistance responses compared to controls (Dillbeck & Orme-Johnson, 1987). A review by Curtis & O'Keefe found that any factor that reduces SNS tone and improves SNS reactivity to stressors tends to improve outcomes for myocardial infarction (MI), coronary heart disease (CHD) and congestive heart failure (CHF) (Curtis & O'Keefe, 2002).

The Hypothalamic-Pituitary-Adrenal (HPA) Axis. Cortisol is a major adrenocortical steroid of the HPA axis that regulates the body's metabolic, immune, inflammatory, and blood pressure responses to stress. When chronically elicited, the stress response may have a damaging effect on cardiovascular health (McEwen, 1998). For example, elevated baseline plasma cortisol is associated with a greater prevalence of ischemic heart disease, independent of conventional risk factors (Reynolds et al., 2010). Jevning et al. (1978) found that the Transcendental Meditation technique acutely reduces cortisol in long-term meditators (3 to 5 years practice) compared to non-meditating controls relaxing with eyes closed, and that cortisol levels remained somewhat low after meditation. Restudied controls showed a trend towards decreased cortisol during meditation after 3 -4 months of practice. The authors concluded that the Transcendental Meditation technique appears to inhibit pituitary-adrenal activity, which has been supported by a prospective, random assignment study by MacLean et al. (1997). Changes in baseline levels and acute responses to laboratory stressors were examined for cortisol before and after 4 months of either the Transcendental Meditation technique or a stress education control condition. In the Transcendental Meditation group, but not in the controls, basal cortisol level and average cortisol across the stress sessions decreased from pre- to post-test (MacLean et al., 1997). Walton et al. (1995) also found that compared to controls, the Transcendental Meditation technique reduces 24-hour levels of cortisol, aldosterone, and norepinephrine metabolite, vanillylmandelic acid (VMA) and increased dehydroepiandrosterone sulfate (DHEA-S), an androgen hormone produced in the adrenal glands. It also reduced mood disturbance and anxiety (Walton, Pugh, Gelderloos, & Macrea, 1995). In addition, Glaser et al. (1992) found elevated levels of DHEA-S in elderly Transcendental Meditation subjects compared to controls, controlling for diet, body mass index, and exercise (Glaser et al., 1992). Low DHEA-S in elders is a strong predictor of CVD and ischemic heart disease, controlling for other risk factors (Barrett-Connor, Khaw, & Yen, 1986). The effects of the Transcendental Meditation technique on the HPA axis, along with its effects on SNS tone and reactivity and DHEAS levels, suggest that it reverses the effects of prior chronic stress and improves the ability to respond effectively to challenges (Dillbeck & Orme-Johnson, 1987).]

[CV Reactivity. Exaggerated CV reactivity due to exposure to both chronic and acute psychosocial and environmental stress appears to play a significant role in the development of essential hypertension

(Snieder et al., 2002; Treiber, Davis, & Turner, 2001) and coronary heart disease (Folkow, 1990; Pickering, 2001). A random assignment study examining the impact of the Transcendental Meditation technique on BP reactivity in adolescents with high normal resting systolic blood found that the Transcendental Meditation group exhibited a statistically significant 4.8 mm Hg decrease in resting SBP from pre- to 2-month post-intervention, compared to an increase of 2.6 mm Hg in the control group. The Transcendental Meditation group also exhibited significantly greater decreases from pre- to post-intervention in SBP, heart rate and cardiac output reactivity to a car driving stressor, and in SBP reactivity to a social stressor interview compared to the CTL group (Barnes, Treiber, & Davis, 2001). These findings have implications for the Transcendental Meditation technique's effects on hypertension because exaggerated cardiovascular reactivity to chronic stress may detrimentally impact on cardiovascular structure and function, contributing to hypertension and coronary heart disease (Folkow, 1990; Pickering, 2001).

Blood Pressure. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII) identified hypertension as the number 1 risk factor for cardiovascular disease (Chobanian et al., 2003). 45% of ischemic heart disease deaths and 51% of stroke deaths are attributable to high systolic blood pressure (Stevens, Mascarenhas, & Mathers, 2009). Randomized clinical trials have suggested that the Transcendental Meditation technique lowers blood pressure in both normotensive (Alexander, Langer, Newman, Chandler, & Davies, 1989) and hypertensive patients (Schneider, Alexander, Staggers, Orme-Johnson et al., 2005; Schneider et al., 1995). A meta-analysis by Rainforth et al. (2007) found that biofeedback, progressive muscle relaxation and stress management training did not show statistically significant reductions in blood pressure. However, six RCTs involving the Transcendental Meditation technique showed clinically meaningful blood pressure changes – 5.0/–2.8 mm Hg (Rainforth et al., 2007). Anderson et al. (2008) conducted a further meta-analysis of nine randomized controlled trials with the Transcendental Meditation technique, which indicated a similar pattern of clinically meaningful changes of –4.7/–3.2 mm Hg blood pressure responses to the Transcendental Meditation technique compared with controls. Blood pressure reductions of this magnitude are suggested to result in significant decreases in CVD risk (Staessen et al., 2004).

In a risk-subgroup analysis of Schneider et al.'s study in older hypertensive African Americans, Alexander et al. (1996) classified the subjects by five hypertension risk factors: psychosocial stress, obesity, alcohol use, physical inactivity, and dietary sodium-potassium ratio. Transcendental Meditation subjects in both the high and low risk groups for all factors declined significantly in blood pressures compared with control subjects, indicating that the Transcendental Meditation technique's effects generalize across risk categories (Alexander et al., 1996).

Metabolic Syndrome and Insulin Resistance. Metabolic syndrome, a cluster of factors including hypertension, dyslipidemia, obesity and insulin resistance, is a demonstrated risk factor for cardiovascular morbidity, especially stroke, CHD, and mortality (Denys, Cankurtaran, Janssens, & Petrovic, 2009). A randomized clinical trial of 16 weeks of Transcendental Meditation practice was conducted with 103 stable coronary heart disease patients. Results indicated statistically significant decreases in adjusted systolic blood pressure, insulin resistance and increases in heart rate variability in the Transcendental Meditation group compared with health education controls (Paul-Labrador et al., 2006). Improvements in components of the metabolic syndrome and cardiac autonomic nervous system tone were accomplished without changes in body weight, exercise, or medication. The results suggest that neurohumoral pathways may be mechanistically involved in the metabolic syndrome and that techniques, such as the Transcendental Meditation program, that target neurohumoral pathways may be beneficial for CHD reduction.

Left Ventricular Mass Regression. Increased left ventricular mass index (LVMI) is a key indicator of hypertensive heart disease (HHD) and is present disproportionately higher in African Americans. A randomized clinical controlled trial investigated the effect of the Transcendental Meditation program (N = 19) and health education (HE) (N = 15) on LVMI in hypertensive African Americans. Both groups showed significant reductions in LVMI after one year. TM compared to HE showed additional side benefits of

increased energy, positive affect, and behavioral/emotional control, as well as decreased sleep dysfunction, physical symptoms of distress, anxiety, and depression (Kandwani et al., 2005).

Angina Pectoris. A controlled longitudinal study of angina pectoris re–ported that the Transcendental Meditation program improved exercise tolerance, increased maximum workload, and delayed appearance of electrocar–diographic abnormalities during exercise (delayed onset of ST segment depression) in heart patients after 1 year of practice (Zamarra, et al., 1996). Improved ability to cope with pain is further suggested by a study using functional magnetic resonance (fMRI), which found that the Transcendental Meditation technique reduced the brain response to pain by 40 to 50% at the level of the thalamus, which gates sensory input (Orme-Johnson, Schneider, Son, Nidich, & Cho, 2006).

Carotid Atherosclerosis. As part of a larger randomized clinical trial on hypertension, Castillo-Richmond et al. (2000) compared the effects of the Transcendental Meditation technique and a heart disease education group on carotid intima-media thickness in 60 African Americans subjects. The results indicated a statistically significant decrease in carotid intima-media thickness compared with an increase in the control group, suggesting that the Transcendental Meditation program may reduce carotid atherosclerosis in high-risk hypertensive African Americans and reduce subsequent risk for myocardial infarction by 11% and stroke by 7.7 to 15%.

Cardiovascular Events. Research conducted at the Medical College of Wisconsin in Milwaukee in collaboration with the Institute for Natural Medicine and Prevention at Maharishi University of Management in Iowa found that coronary heart disease patients who practiced the Transcendental Meditation technique have lower rates of heart attack, stroke, and death (Schneider et al., 2009). Subjects were 201 men and women with coronary artery disease documented by angiography. Subjects were randomly assigned to either practice the Transcendental Meditation technique or to participate in a control group, which received health education classes in traditional risk factors, including dietary modification and exercises. Subjects were matched for expectation, contact time and attention. Medical personnel attending the patients and staff collecting the data were all blind to the subjects' group allocations, further controlling for possible bias from those sources. All participants continued standard medications and other usual medical care. The findings at five-years follow-up included a 47% reduction in the primary composite endpoint of death, myocardial infarction, and stroke in the participants, 5 mm Hg average reduction in blood pressure associated with a decrease in clinical events and significant reductions in psychological stress in the high-stress subgroup (see Figure 1 for event rates).

Figure 1: Effects of Treatment on Time to Primary Endpoint Event: MI, Stroke, or Death]

[CV Mortality. Secondary prevention studies in primarily middle-aged white men have suggested that psychological stress reduction approaches were associated with lower mortality or combined mortality-morbidity rates in patients with coronary heart disease (Blumenthal et al., 1997; Linden, et al, 2007). A controlled trial on the Transcendental Meditation technique with prehypertensive elderly whites subjects (mean age 81 years) who resided in Boston, Massachusetts suggested that the Transcendental Meditation technique program substantially reduced mortality rates after 3 years (Alexander, Langer, Newman, Chandler, & Davies, 1989) and 15 years (Alexander et al., 1996) of follow-up compared to relaxation and other behavioral controls. In a trial of older African-Americans who had stage I or II hypertension, during the 8-year follow-up, significantly fewer patients died in the Transcendental Meditation group compared with the progressive muscle relaxation, and health education groups. CVD mortality relative risk was significantly lower for the Transcendental Meditation group compared to the health education control group (Barnes et al., 2005).

Results of a pooled average retrospective long-term follow-up of the above two randomized controlled trials (N = 202) reported significantly lower mortality rates compared with other behavioral interventions and usual care in Transcendental Meditation subjects. The decreased risks were 23% for all-cause mortality and 30% for cardiovascular mortality over the 7.6-year mean, 18.8-year maximum follow-up period (Schneider, Alexander, Staggars, Rainforth et al., 2005). These findings suggest that the Transcendental Meditation technique program, in addition to usual care, may be associated with long-term decreases in mortality in older populations that have high blood pressure.]

Psychological effects of meditation in normal and clinical groups.

Because mindfulness techniques are aimed at modifying how one reacts to experiences, the majority of research on it is on that. A meta-analysis by Grossman (2004) looked at the effects of Mindfulness Based Stress Reduction on a number of clinical populations, pain, cancer, heart disease, depression and anxiety. He found only 20 studies, 13 controlled and 7 observational. The measures were emotional processing and coping with chronic stress. There were 9 studies on physical health, 19 on mental health. Overall both controlled and uncontrolled studies showed effect sizes of approximately .5. This compares with effect sizes of from .7 to .8 for TM for similar types of variables, and an effect size of .4 for placebos (source, Eppley). These results suggest that MBSR may help a broad range of individuals to cope with their clinical and nonclinical problems. The conclusion is that mindfulness training helps subjects cope with stress and emotionally process various clinical conditions, but that it does not actually benefit the clinical condition, whereas TM actually changes the functioning of the physiology, not just ones ability to deal with the stress of different conditions, for example, reducing emotional distress from pain and giving the person a sense of being in control of their lives.

Grossman P, Niemann L, Schmidt S, Walach H. Mindfulness-based stress reduction and health benefits. A meta-analysis. J Psychosom Res. 2004;57:35-43.

A review by Bishop (2002) concluded the following:

Pain: Only temporary mitigation of pain, but longer reduction of emotional distress from pain.

Anxiety and panic disorder: Not conclusive because patients were also receiving meds and other treatment.

Binge eating: inconclusive because no control group.

“There has been a paucity of research and what has been published has been rife with methodological problems. At present, we know very little about the effectiveness of this approach.”

Bishop SR. What do we really know about mindfulness-based stress reduction? *Psychosom Med.* 2002;64:71-83.

Pain.

Chiesa & Serreti (2010) conducted a systematic narrative review of MBSR on chronic pain, locating 10 studies. “The primary outcomes were: 1) the reduction of pain and 2) the reduction of depressive symptoms. Secondary outcome measures were the improvement of: 1) coping with pain, 2) physical function, 3) stress reduction and quality of life and 5) miscellaneous psychological changes. Available studies suggested that mindfulness based interventions could have non-specific effects related, for instance, to the expectation of a benefit for pain reduction in patients suffering from fibromyalgia or rheumatoid arthritis. There is only limited evidence suggesting specific effects of such interventions on the pain for these populations patients. A second important finding was that mindfulness based interventions could be useful for reducing depressive symptoms associated with chronic pain. However the magnitude of such benefits appeared comparable to that of other non specific interventions and did not suggest a possible advantage for MBIs in comparison to such interventions as educational support groups. Third, MBIs could be useful to improve specific psychological features associated with chronic pain even without modifying pain itself. Interestingly, reviewed findings showed that patients assigned to MBIs showed an increased pain acceptance and tolerance as well as significant improvements in their stress levels and quality of life, though the frequent use of a waiting list as a comparator does not allow to draw definitive conclusions. Only a single study showed improved physical function. (Chiesa A. Vipassana meditation: systematic review of current evidence.” University of Bologna, Department of Psychiatry. *Journal of Alternative and Complementary Medicine.* 2009 in review.)

As noted above, MM is associated with cortical thickening, and cortical thickening in structures in the pain pathways is associated with lower sensitivity to pain (Grant et al. 2010). An fMRI study has shown that TM also reduces the brain’s response to pain stimuli outside of meditation after 5 months of practice. (Orme-Johnson DW, Schneider RH, Son YD, Nidich S, Cho Z-H. *Neuroimaging of meditation’s effect on brain reactivity to pain.* *NeuroReport* 2006 17(12):1359-1363)

Self actualization and ego development.

One of the main motivating hypotheses of the TM research is that it promotes the development of higher states of consciousness, which is best quantified in the West by measures of self actualization and ego development.

Self actualization. A search of a comprehensive bibliography of research on mindfulness meditation from 1960 to 2010 found no studies on mindfulness and self actualization. (MINDFULNESS RESEARCH GUIDE, 1960 to May 2010, <http://www.mindfulexperience.org/>) In contrast, a meta analysis has found that the TM technique improves self actualization more than other meditation and relaxation techniques studies.

[Increased Self Actualization Compared to Mindfulness Training, Zen, Relaxation Response Techniques, Yoga, Mantra Meditation, Progressive Relaxation, or Other Relaxation techniques. A meta-analysis of 40 studies found that the Transcendental Meditation program was significantly more effective in increasing self-actualization than other meditation and relaxation techniques. Alexander, Rainforth, & Gelderloos, *Journal of Social Behavior and Personality*, 6, 189-247, 1991.]

Ego development. A search of a comprehensive bibliography of research on mindfulness meditation from 1960 to 2010 found no studies on mindfulness and ego development. (MINDFULNESS RESEARCH GUIDE, 1960 to May 2010, <http://www.mindfulexperience.org/>) In contrast, studies show dramatic increases in overall personality development (ego development) in incarcerated inmates through TM, and unprecedented increases in Ego Development and moral reasoning in post graduate MUM students compared to graduates from other universities. (Alexander CN, Orme-Johnson DW. Walpole study of the Transcendental Meditation program in maximum security prisoners II: longitudinal study of development and psychopathology. *Journal of Offender Rehabilitation* 2003 36(1-4):127-160; Chandler HM, Alexander CN, Heaton DP, Grant J. Transcendental Meditation and postconventional self-development: a 10-year longitudinal study. *Journal of Social Behavior and Personality* 2005 17(1):93-122

Conclusion. Although the Buddhist roots of mindfulness meditation are certainly concerned with gaining enlightenment, this interest has been downplayed in contemporary Western uses of the techniques, which pride themselves on being non-spiritual and non-religious. Thus, there is little research on the effects of these techniques on these variables. On the other hand, the TM program hypothesizes holistic development, and gives the key technique for attaining it, transcending, which research has shown to be highly practical, for example, for prison rehabilitation.

Prison Rehabilitation.

A recent review of Vipassana and MBSR reviewed half a dozen studies on inmates (Himelstein, 2010). The review also covered six of the 17 studies on TM in corrections. The MM studies were mostly on psychological and attitude measures (e.g., anomie, attitude towards the police, hostility, self esteem, psychiatric scales). They were also mostly short term (before and after a 10 day retreat) and without a control group. There were some studies on drug and alcohol use, one of which followed up for 3 months, and had encouraging results. But there were no studies with hard measures of rule infractions, participation in educational program, recidivism, or reversal of neural chemical abnormalities, as are found in the TM research.

Himelstein, S. (2010). Meditation research: The state of the art in correctional settings. *International Journal of Offender Therapy and Comparative Criminology*, XX(X), 1–16.

A critique of this review pointed out that it did not cover some of the most important studies on TM in corrections, including four randomized controlled trials, studies showing that TM reverses the neuroendocrine abnormalities associated with crime, and that it unfreezes the development of the inmate.

Orme-Johnson DW. The use of meditation in corrections. *International Journal of Offender Therapy and Comparative Criminology* 2010. OnlineFirst, published on May 27, 2010 as doi:10.1177/0306624X10371803 Available at <http://ijo.sagepub.com/cgi/rapidpdf/0306624X10371803v1>.

[Studies Not Reviewed. The review covered only six of the 17 studies on the TM technique in corrections (35% of the evidence) (Hawkins, Orme-Johnson, and Durchholz, 2005). Among the omissions were four randomized longitudinal studies with a total of 226 subjects and 25 studies on substance use. The four randomized trials ranged in length from 2 weeks to 10 months and found significant decreases in TM subjects compared to controls on self-report psychological measures of depression, neuroticism, sleep disturbance, suspicion, hostility, aggression, and assault (Hawkins, et al., 2005). Noteworthy is that the randomized studies also found significant improvements on “hard” archival behavioral measures, such as reduced prison rule infractions and increased participation in educational and recreational programs over 10 months of practicing the TM technique, as well as reduced neurochemical stress markers after 4.5 months. Himmelstein did review the three studies showing that TM practice reduces recidivism, by up to 43.5% fewer new convictions 15 years after release from prison compared to matched controls.

Neuroendocrine Mechanism: Also missing from the review was mention of a seminal paper by Walton & Levitsky (2003) on neuroendocrine mechanisms. Briefly, whereas reduced serotonin levels have been associated with impulsive (unpremeditated) aggression and attempted suicide, TM practice has been shown to increase serotonin metabolites. A wide range of evidence indicates that regular practice of the TM technique balances the autonomic nervous system, reducing chronic baseline activation levels of the sympathetic nervous system and improving reactivity to stress. States or behaviors associated with aggression, such as hostility and alcohol consumption, have also been correlated with elevated cortisol secretion, and TM practice has acute and long-term effects of reducing cortisol and increasing the ratio of dehydroepiandrosterone sulfate (DHEA-S) to cortisol, a sensitive measure of balance in the system.

Psychological Mechanism. Another important area of meditation research missed by the review includes studies testing the hypothesis that offenders are as if “frozen” in an immature state of ego development and that practice of the TM technique unfreezes development (Alexander & Orme-Johnson, 2003). To test this hypothesis, 271 maximum-security prisoners were studied over a 15.7-month period for longitudinal changes in self-development and psychopathology due to the TM technique and other prison programs (counseling, drug rehabilitation, or participation in Muslim or Christian groups). Controlling for pretest scores, overlap of membership, and 19 demographic and criminal history factors, TM members compared to controls increased significantly in Loewinger’s ego development scale, an objective test of global personality development. The results indicate the development of a more mature, responsible, self-monitoring, self-respecting, and communicative personality. TM subjects also showed reductions in aggression, schizophrenic symptoms, and trait-anxiety (Alexander & Orme-Johnson, 2003).]

Intelligence, Creativity, Academic Performance.

Numerous studies support the hypothesis that the TM technique increases cognitive performance, due to normalization of stress and increased coherence of brain functioning. Most important, the Maharishi Schools, which have implemented this program have an amazing academic record.

In contrast, a search of the data base of mindfulness research papers from 1960 to 2010 found no entries for intelligence, and only one for creativity and one on academic performance. Neither of these to papers showed that mindfulness actually improved academic performance. Citations, with abstracts below.

Fisher, R. (2006). Still thinking: The case for meditation with children. *Thinking Skills and Creativity*, 1(2), 146-151.

This is a conceptual paper with no data.

“Abstract

This paper argues the case for meditation with children. It seeks to define what meditation is, why it is important and how it can be practised with children. Meditation provides a good starting point for learning and creativity. It builds upon a long tradition of meditative practice in religious and humanistic settings and research gives evidence of its practical benefits. We need to help children find natural ways for body and mind to combat the pressures of modern living and to find better ways to help focus their minds on matters of importance. There are strong pedagogical reasons for including meditation as part of the daily experience of pupils of all ages and abilities. Meditation is a proven means for stilling the mind, encouraging mindfulness, and providing optimum conditions for generative thinking and reflection. This paper aims to encourage more experimentation and research into meditative practice with children.”

Radel, R., Sarrazin, P., Legrain, P., & Gobancé, L. (2009). Subliminal priming of motivational orientation in educational settings: Effect on academic performance moderated by mindfulness. *Journal of Research in Personality*, 43(4), 695-698.

This paper is about mindful students being more immune to manipulation by subliminal priming.

“Abstract

Recent literature indicates that a motivational orientation can be unconsciously primed. This study examined whether motivational priming influences students' academic performance within an educational setting and whether this effect is moderated by students' degree of mindfulness. Two randomly assigned groups of students received an identical lesson. However, the teacher's slideshow contained different subliminal words according to the condition (autonomous vs. controlled motivation). Results demonstrated an interaction between students' dispositional mindfulness and priming conditions. The more mindful students were immune to the manipulation whereas the less mindful students were affected by the priming: those primed with autonomous motivation obtained better results than those primed with controlled motivation. These findings contribute to priming research specifying individual differences of priming responsiveness.”

