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Cardiovascular Disease Prevention and Health Promotion with the Transcendental Meditation Program and Maharishi Consciousness-Based Health Care

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Abstract

This article summarizes the background, rationale, and clinical research on a traditional system of natural health care that may be useful in the prevention of cardiovascular disease (CVD) and promotion of health. Results recently reported indude reductions in blood pressure, psychosocial stress, surrogate markers for atherosclerotic CVD, and mortality. The randomized clinical trials conducted so far have involved applications to both primary and secondary prevention as well as to health promotion more generally. The results support the applicability of this approach for reducing ethnic health disparities associated with environmental and psychosocial stress. Proposed mechanisms for the effects of this traditional system include enhanced resistance to physiological and psychological stress and improvements in homeostatic and self-repair processes. This system may offer clinical and cost effectiveness advantages for health care, particularly in preventive cardiology.

Keywords

Chronic Diseases; Health Promotion; Disease Prevention; Complementary and Alternative Medicine; Meditation

Introduction

Chronic disease is the leading public health issue in the United States and other developed and developing nations. Currently, the prevalence of chronic disease in the United States is >40%, with >100 million Americans suffering from at least one chronic disorder.[1] Cardiovascular disease (CVD) carries with it the highest mortality rates and healthcare costs. In the United States, the annual death rate from heart disease and stroke is nearly one million, with an annual cost of $396 billion.[2-4] These statistics raise concerns about the performance of conventional health care in preventing and treating chronic disorders.[1,5]

In addition to limited effectiveness in preventing chronic diseases, other deficiencies also exist in modern medical care, particularly in the United States. One example is the epidemic of iatrogenic diseases—diseases produced by adverse effects of medicine and medical errors.

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Epidemiologic research estimates that 280,000 die each year from iatrogenic causes in the United States,[6-8] This rate far exceeds the total due to automobile accidents (45,000) and all other accidents combined.[9] Thus, modern medical diagnostics and therapeutics now ranks as the third leading cause of death in the United States.[8] Furthermore, in recent comparisons of health system performance in developed countries, the United States ranked near the bottom on most health indicators examined.[10]

Such observations also aid in understanding the major shift of public and professional interest toward alternatives to conventional medicine. In 1993, Eisenberg et al[5] reported that approximately one third of the US population consulted alternative providers and that the 425 million visits/year to such providers were more numerous than visits to primary care physicians. Data from a follow-up report in 1998 showed a continuing increase in alternative medicine use in the United States since the earlier report.[11] Between 1990 and 1997, the number of visits to alternative providers rose to 629 million, and most of that increase was due to a rise in the proportion of the population seeking alternative therapies (from 33.8% in 1990 to 42.1% in 1997) rather than increased visits per patient.[11]

Reinforcing the significance of this trend, a recent survey found that 89% of the American public is dissatisfied with the current status of medicine and desires fundamental change in the direction and structure of the US healthcare system.[12] This article introduces a comprehensive approach, a complete system of traditional healthcare practices, while focusing on research on one component of this system, the transcendental meditation (TM) program, for which the largest amount of research data has been accumulated.

Maharishi Consciousness-Based Health Care—Background and Theory

Maharishi Consciousness-Based Health Care is reported to be a comprehensive system of prevention-oriented natural health care.[13,14] The Maharishi Consciousness-Based Health Care system has its origin in the ancient Vedic civilization of India, the oldest continuously practiced system of knowledge in the world.[15,16]

The word “Veda” in Sanskrit means “knowledge,” and the Vedic tradition, with its classical literature, has been described as providing total knowledge of health.[17,18] One branch of the Vedic tradition, Ayur-Veda, is recognized by the World Health Organization as a sophisticated system of natural health care with a detailed scientific literature consisting of classical medical texts, an uninterrupted oral tradition of classical knowledge predating the written texts, a comprehensive *materia medica*, and a wide breadth of clinical procedures relevant to prevention and treatment of acute and chronic diseases.[15,16] The recent increased interest in Vedic health care in the West has resulted in significant part from the systematic investigation and restoration of the original texts and practical applications by Maharishi Mahesh Yogi, who collaborated with leading traditional physicians, modern scientists, and Vedic scholars.[14,17, 19,20] Over the last 30 years, hundreds of scientific studies on Maharishi Consciousness-Based Health Care treatment and prevention modalities have come from researchers in >200 research institutions and universities in three dozen countries around the world.[21-25] Recently, remarkable correlations between human neurophysiologic structures and functions and the 40 aspects of the Veda and the Vedic literature have been reported.[17] These correlations may provide a coherent framework for the contemporary understanding of Maharishi Consciousness-Based Health Care.

In the Maharishi Consciousness-Based Health Care system**,** diagnostic, preventive, and therapeutic modalities are drawn from the broad range of Vedic literature and are said to holistically enhance the body’s innate self-repair and homeostatic mechanisms, thereby preventing disease and promoting health. Diseases are reportedly addressed by treating their

ultimate cause—disruption of the body's inner intelligence.[17] According to Maharishi Consciousness-Based Health Care, this "inner intelligence" (or order) structures and governs the human body and is seen as an expression of the same natural laws that structure and govern the entire universe.[14,20]

This ancient Vedic perspective of an underlying field of intelligence or natural law is consistent with modern theories of quantum physics.[26,27] The original proposition of Einstein that a single unified field of natural law forms the basis of all the force fields and matter fields in the universe has been upheld in recent years by entirely consistent and complete unified field theories.[26] In the quantum mechanical view that forms a major part of these theories, the physical particles that structure the universe are ultimately frequencies or wave functions of the self-interacting dynamics of the unified field. Similarly, from the Vedic perspective, the universe, including the human body, is the expression of self-interacting impulses of intelligence.[17,27] The Maharishi Consciousness-Based system further identifies this unified field as being identical to the field of human consciousness in its purest form.[17,26]

The 40 approaches of Maharishi Consciousness-Based Health Care include techniques to normalize adaptive mechanisms of the body that have become distorted in their function because of psychosocial stress. For example, the Transcendental Meditation (TM) technique, pulse diagnosis, diet, herbal remedies, and herbal food supplements are consciousness-based Vedic approaches used for the systematic detection and/or correction of imbalances in adaptive systems such as the autonomic nervous system, the hypothalamic-pituitary-adrenal axis, the cardiovascular system, and the immune system. Other strategies include behavioral recommendations and a variety of approaches to physiologic purification. Still others take advantage of knowledge of effects of the near environment and distant environment on health. Finally, technologies exist for reducing social stress and enhancing collective health (eg, group practice of the TM program and the more advanced TM-Sidhi, program). These approaches are largely missing from modern medicine.[20]

Most studies on the Maharishi Consciousness-Based Health Care system have been on individual components, particularly the TM program. The remainder of this paper reviews recent CVD-related research on this program and some of the other approaches currently in use in the United States.

Empiric Findings on Key Maharishi Consciousness-Based Healthcare Approaches

The studies described below involve both primary and secondary prevention of CVD. Effects have been found in ethnic minority populations as well as in majority populations. The largest number of clinical studies conducted so far involves the use of the TM technique to prevent or treat hypertension and CVD in African Americans. Studies suggest this ethnic group is subjected to more stressful experiences than the majority population and that this stress is a major cause of the higher morbidity and mortality rates for CVD in this population.[42,44,45]

Particularly relevant to the ability of the TM program to reduce psychosocial stress or correct deleterious effects of stress are the results of studies suggesting restoration of adaptive mechanisms by this technique.[28-32] Adaptive mechanisms involving the autonomic nervous system, neuroendocrine axes, and the cardiovascular system are responsible for maintaining a stable and efficient functional state of the body. These mechanisms are altered by psychosocial stress in ways that decrease their ability to foster effective adaptation, thereby leading to physical and mental declines.[33-35] The term "allostatic load" has been applied to such alterations of adaptive mechanisms.[35] Allostatic load is an index of the wear and tear on the body caused by repeated or prolonged experiences of psychosocial stress; increased allostatic

load predicts not only declines in cognitive and physical functioning with age but also increased CVD events and CVD risk.[33,36] The possibility that a reduction of allostatic load is an underlying mechanism for effects such as those described in the following paragraphs is under investigation.

The Transcendental Meditation Program and CVD

Research on the TM program and CVD has centered on the observations that multiple risk factors predict this disease and that combinations of these risk factors are more strongly predictive than are the individual factors. The research includes psychosocial factors along with traditional risk factors and tests the hypothesis that the TM program, partly by making patients more resilient under stressful situations, will reduce many of the more concrete pathophysiologic signs or symptoms of the progression of CVD. Here we summarize some of the relevant findings on components of the proposed pathway connecting CVD risk factors to death from CVD.[37] (For a more complete review, see Walton et al.[38,39])

Reduction in Risk Factors for CVD

Empiric research on the TM program has examined effects on both traditional risk factors for CVD and psychosocial risk factors. Several populations, from generally healthy subjects to those at high risk for CVD, have been tested. A large number of individual studies have reported reductions in psychological factors such as anxiety as well as improvements in measures of overall psychological health. Quantitative systematic reviews of the effects of TM on trait anxiety (112 outcomes) and self-actualization (a comprehensive measure of psychological health; 42 outcomes), for example, have found effect sizes of .7 and .78, respectively, significantly larger than effect sizes for other forms of meditation and relaxation.[40,41] These differences in effect size were maintained when statistically controlling for strength of experimental design, duration of treatment, expectancy of benefits, and experimenter attitude.

Reductions in traditional risk factors for CVD, such as hypertension, have also been documented for the TM program. In a three-armed, randomized, controlled trial in 127 older, urban African Americans with hypertension (mean age of 66, ranging from 55–88 years), ≈50% of whom were on antihypertensive medication, Schneider et al found that the TM group decreased significantly on systolic blood pressure (−10.7 mm Hg) and diastolic blood pressure (−6.4 mm Hg) compared to the educational control group (figure 1).[42] The effect of the TM program also was statistically greater than the effect of progressive muscle relaxation, and treatment compliance was high in both groups, with 97% of the TM group and 81% of the relaxation group reporting full compliance with the recommended twice-daily regimen. The blood pressure reductions in this trial were probably clinically significant, as inferred from trials on antihypertensive drugs in which similar reductions in blood pressure produced substantial reductions in cardiovascular morbidity and mortality.[43]

The specificity and relative efficacy of the treatments in the above study were further assessed in a second study[44] that subdivided the subjects by median split into those with relatively high and those with relatively low scores on hypertension-related risk factors. For each of these factors—1) psychosocial distress (from standardized scales); 2) obesity; 3) physical inactivity; 4) alcohol use; 5) dietary sodium-to-potassium ratio; and 6) an empirically derived index of risk factor clustering—the results indicated that the TM program reduced blood pressure significantly more than did the educational control in both the low- and high-risk groups in both sexes. By comparison, progressive muscle relaxation significantly reduced blood pressure, compared to education controls, only in the high-risk men's subgroup, and only the systolic pressure. These effects of TM on hypertension are probably not limited to African Americans. Other studies of the blood pressure effects, with durations up to one year, have found similar results in African American as well as other populations.[45-48]

Conclusion Regarding Effects of Transcendental Meditation on Blood Pressure

Recently, Canter and Ernst[49] and an accompanying editorial comment by Parati and Steptoe[50] critically reviewed six randomized controlled trials evaluating the TM program for reducing blood pressure. Their critique was based on five full-length articles and one published abstract and judged that evidence is insufficient to conclude that this program decreases blood pressure. Their concerns centered mainly on methodologic issues. However, we agree with Orme-Johnson et al[51] in their subsequent rebuttal of these critiques.

In one example, the review[49] dismisses three of the trials as being irrelevant to hypertension because these trials examined prehypertensive adolescents or normotensive young adults. This claim contradicts the recommendations of JNC-7,[52] based on evidence that elevated blood pressures in youth predict hypertension later in life, that health-promoting lifestyle modifications be implemented well before blood pressures reach the hypertensive range.

Another criticism in the review[49] questioned the suitability of methods of blood pressure measurement, specifically, whether or not the measurements were performed according to the standard research method or were repeated a sufficient number of times. Authors of the rebuttal point out that most of these studies were competitively reviewed through the rigorous National Institutes of Health (NIH) peer review process and funded by various institutes of the NIH. The protocols were scrutinized during the peer review process by experts in the field before any awards were made. Moreover, a study on prehypertensive adolescents[46] used ambulatory blood pressure monitoring, which is a better predictor of hypertension than resting clinical pressure, is highly reproducible, is sensitive to small changes, and is free from assessor blinding issues and placebo effects.

We also concur with the position of Orme-Johnson et al[51] that the reviewed research provides more than suggestive evidence that reductions of blood pressure by TM are clinically significant, both in hypertensive patients and in prehypertensive adolescents. The reviewers[49] criticized one study on prehypertensive adolescents indicating its single-day baseline might exaggerate the effect due to adaptation. This procedure was not a confound in this case, however, because the controls showed no change, indicating no adaptation occurred.[53] Moreover, the critiques failed to mention that the main finding in this study of adolescents was a reduction in reactivity of systolic blood pressure, cardiac output, and heart rate to laboratory stressors. Exaggerated cardiovascular reactivity is known to contribute to hypertension and coronary heart disease.[53]

Although randomized, controlled trials are considered the strongest tests of the causal effects of interventions, data from other research designs also can be helpful in drawing conclusions regarding causality, especially when they are consistent experimental data from randomized trials. For example, observational studies have found large differences in blood pressure when comparing long-term practitioners of TM with age- and sex-matched controls practicing no systematized behavioral technique.[48,54] The most recent of those also reported a significant negative correlation (r=−.63, P=.015) between blood pressure and the number of months practicing the TM technique in a group of older women.[54] Another outcome that appears to support the conclusion of a clinically significant reduction in blood pressure due to TM is the recently reported significant reduction in CVD mortality rate (see later section “Reduction of CVD Mortality”).

Transcendental Meditation and Other CVD Risk Factors

Other traditional risk factors for CVD that may be reduced by the TM program include cholesterol, oxidized lipids, and smoking. In two prospective, random assignment studies, the TM program reduced total cholesterol over a relatively short period (three months)[55] as well

as a long period (11 months),[56] compared to matched controls. In an observational study, significantly lower levels of serum lipid peroxides were found in older, long-term TM practitioners (*n*=18; average age 67 years) compared to controls matched for age, education, and sex (*n*=23), while controlling for dietary fat and nutritional supplements.[57] This latter result suggests that oxidative stress, which has been implicated in atherosclerotic CVD, is reduced by the TM program.

Controlling for strength of experimental design, a statistical meta-analysis of treatment approaches for reducing substance abuse found an effect size of .87 for the TM program in reducing cigarette use, significantly larger than effect sizes for cessation counseling (.18), pharmacologic treatments (.29), and other approaches.[58] Although the effects of standard programs tended to drop off in the first three months after treatment, abstinence rates for the TM program continued to rise at two years, the latest time point studied.

Reduction in Pathophysiologic Mechanisms of CVD

A number of studies provide evidence that the TM program reduces or counteracts some of the pathophysiologic mechanisms thought to contribute to CVD. For example, a meta-analysis of 31 studies showed significant reductions in several indicators of autonomic activity during practice of the TM program compared to resting quietly with eyes closed.[31] Most of these indicators were lower than for controls outside the practice session as well, suggesting a cumulative effect of reduced sympathetic arousal through the TM program. Reduced sympathetic arousal due to the program is also supported by studies using lymphocyte beta-adrenergic receptors[32] or resting plasma levels of norepinephrine and epinephrine[30] as markers. In addition to the sympathetic nervous system, hyperactivity of the hypothalamic pituitary adrenal axis his also been causally linked to hypertension and CVD (see For review[29]). The TM program appears to reduce activity of this system as well.[28,29,54]

Further research suggests that the program reduces hemodynamic factors contributing to hypertension. A study by Barnes et al compared 18 long-term practitioners of the TM program with 14 healthy controls in terms of total peripheral resistance, a measure of the degree of vasoconstriction of the peripheral vasculature.[59] Resistance was lower at baseline in the TM group and further declined during a practice session of the program compared to eyes-closed rest in the controls.

Reduction in CVD Morbidity

A recent single-blind clinical trial in African Americans, at King-Drew Medical Center in Los Angeles, compared the TM program with a health education program focused on diet and exercise for the treatment of hypertensive heart disease.[60] A sample of 60 subjects from a larger study was randomly chosen for investigation of changes in carotid artery intima-media thickness (lMT), a measure of carorid atherosclerosis and surrogate measure of coronary atherosclerosis.[60] As measured by B-mode carotid ultrasound, an eight-month intervention period with TM decreased carotid IMT relative to the health education group (Figure 2). A more recent pilot clinical trial with carotid IMT as the primary outcome suggests that a one-year intervention using three other Maharishi Consciousness-Based Health Care approaches (herbal food supplements, Vedic dietary recommendations, and Vedic exercise) along with the TM program, reduced carotid IMT substantially more than was found in the above study with the TM program alone.[61]

A pilot study of effects of the TM program on myocardial ischemia[62] found after eight months of treatment that exercise-induced myocardial ischemia in 21 coronary heart disease patients was reduced in the TM group relative to a usual cardiac care group. The TM group also showed significant increases in exercise tolerance, maximum workload, and delay of onset of ST

segment depression compared to the control group. These findings suggest that the TM program reduces stress-induced myocardial ischemia in coronary heart disease (CHD) patients.

Yet another pilot study, in patients with cardiac syndrome X, a syndrome characterized by anginal chest pain and positive response to exercise stress testing but with normal coronary angiograms, found significant beneficial effects in: 1) time to ST segment depression; 2) maximum ST segment depression; 3) frequency of chest pain episodes; and 4) quality of life after subjects learned and practiced the TM program for three months.[63] A high (91%) rate of compliance with the recommended twice-daily practice of the TM technique was observed.

Reduction in CVD Mortality

The mortality data so far available on the TM program suggest a significant effect of the program on this ultimate endpoint measure. A randomized controlled trial of 73 ambulatory, non-institutionalized, elderly subjects in Massachusetts rest homes, 82% of whom were women with high-normal blood pressure or stage one hypertension, reported a preliminary finding of higher survival rate after three years for the TM group than for the usual care group and the relaxation response group.[64] A later pooled analysis[65] combined data on the 77 Caucasian American men and women who participated in this study (mean age 81 years) with data on 125 African American men and women (mean age 66 years) from another randomized trial. In each of the original studies, average baseline blood pressure was in the prehypertensive or stage 1 hypertension range. Followup of vital status and cause of death over a maximum of 18.8 years was determined from the National Death Index. Survival analyst was used to compare intervention groups on mortality rates after adjusting for study location. Mean followup was 7.6 ± 3.5 years. Compared with combined controls, the TM group showed a 30% decrease in the rate of cardiovascular mortality (relative risk .70, P=.045) and a 23% reduction in all-cause mortality (relative risk .77, P=.0399). These results suggest that the prevention and control of high blood pressure through this program may contribute to decreased mortality from CVD in older subjects who have systemic hypertension. Larger and betterr designed studies are clearly warranted.

Effect of Transcendental Meditation on Health Care Utilization and Health Care Costs

The health insurance utilization patterns of individuals with several clinical conditions and diseases, especially those that afflict older people, have been shown to improve with practice of the TM program. Investigating the health insurance records of >2000 practitioners of the program over a five-year period, Orme-Johnson found significantly less healthcare utilization for all major disease categories when compared to other groups of similar age, sex, profession, and insurance terms (Figure 3).[66] This finding included 87% lower hospitalization rates for heart disease, 55% lower for cancer, and 87% lower for nervous system disorders. When these data were analyzed by age group, older subjects (>40 years) had larger reductions in insurance use for inpatient services (68%) as well as for outpatient services (74%) compared to the younger age groups.

A later study[67] of archival data from Blue Cross/Blue Shield Iowa extended this research to persons using other Maharishi Consciousness-Based Health Care modalities in addition to the TM program. The four-year expenditures per person for total medical, for all ages and all disease categories, were 59% and 57% lower in the Maharishi Consciousness-Based Health Care group when compared to a normative group and to a demographically matched control group, respectively. The greatest savings were seen among older Maharishi Consciousness-Based Health Care users (age >45 years) who had 88% fewer inpatient days compared to controls.

The results of these two studies are dramatic and might suggest methodologic flaws or alternative explanations for the data. One possibility, for example, is that the subjects in these studies were healthier before they began these programs. All in the TM group had chosen to learn and continue the practice, and many in the second study also chose, in addition, to use other modalities of the Maharishi Consciousness-Based Health Care system. This self-selection is a potential problem.

Two studies of government payments to physicians in the Canadian province of Quebec have tested this possibly more directly.[68,69] Physicians' expenses in Canada are covered by government insurance agencies. With the subjects' permission, these agencies released physician payment data on 1418 practitioners of the TM program and 1418 matched controls. The researchers were able to calculate payments for several years before and after the subjects began the practice. These results indicated no difference in the yearly rate of payments between the TM subjects, and government-selected controls before beginning the program. In the latest and most extensive of these two studies, the government's random selection of controls involved matching, subject by subject, the age, sex, and geographic region of the TM subjects. After beginning the program, physicians' payments for the TM subjects declined 13% per year for the next six years, compared with the matched controls.[69] In a subanalysis of subjects over 65 years of age, these authors found a 69.8% cumulative reduction in physicians' payments over the five years following instruction in TM, a slightly higher average rate of decline than for the larger group.[70]

The results from these five studies on health insurance are similar and suggest major reductions in healthcare costs and chronic disease after beginning the practice of TM, and even greater effects if other modalities of Maharishi Consciousness-Based Health Care are added. True cost-effectiveness studies are much needed.

Effects of Herbal Preparations Used in Maharishi Consciousness-Based Health Care

Herbal preparations from the traditional Ayur-Vedic *materia medica* are utilized both according to clinical indications[71] and as preventive measures. The classical texts on Vedic health care describe certain herbal preparations for specific diseases, and other herbal preparations called *rasayanas*, which are proposed to promote general health by increasing resistance to disease, activating tissue repair mechanisms, and arresting or reversing deteriorative effects associated with chronic stress and aging.[72] Each herbal preparation contains various herbs or plant parts, each herb having hundreds of phytochemicals.[73] Both traditional Vedic theories and theories of modern science propose that by using the combined ingredients of the herbal preparations rather than by using only the isolated active ingredients, various chemical constituents are allowed to function synergistically, often with mitigation of adverse side effects of individual components.[73]

Most research on herbal preparation *rasayanas* has involved two compounds collectively known as 'Maharishi Amrit Kalash' (MAK). MAK-4 and MAK-5 contain distinctly different combinations of herbs. MAK-5 is available only in tablet form and consists of *Gymnema aurantiacum*, *Hypoxis orchiodes*, *Tinospora cordifolia*, *Sphaeranthus indicus*, *butterfly pea*, *licorice*, *Vanda spatulatum*, *Lettsomia nervosa*, and Indian wild pepper. MAK-4, available as a fruit paste as well as a tablet form, consists of raw sugar, ghee (clarified butter), Indian gallnut, Indian gooseberry, dried catkins, Indian pennywort, honey, nut-grass, white sandalwood, butterfly pea, shoeflower, aloewood, licorice, cardamom, cinnamon, Indian cyperus, and turmeric. Although quantitative chemical analyses have not been performed, both MAK-4 and MAK-5 have been shown qualitatively to include a mixture of substances that includes the antioxidants alpha-tocopherol, beta-carotene, ascorbate, bioflavonoids, catechin, polyphenols, riboflavin, and tannic acid.[74-77] In the classical literature, MAK has been reported to promote longevity, vitality, physiological balance, youthfulness, and resistance to disease.[72,78] The

properties of these *rasayanas* and studies on some of their effects that may be relevant to prevention and treatment of chronic disorders are reviewed below.

Antioxidant Effects of MAK—Both MAK-4 and MAK-5 scavenge oxygen free radicals in a dose-dependent manner, thereby ameliorating the deleterious effects of these free radicals. Reactive oxygen species scavenged by MAK-4 and MAK-5 include superoxide, hydroxyl, and peroxyl radicals, and hydrogen peroxide generated both in cellular (neutrophil) and noncellular (xanthine-xanthine oxidase) systems.[79,80] MAK-4 and MAK-5 also reduce levels of lipid peroxide, a marker of free radical damage, and inhibit oxidation of low-density lipoproteins (LDL), reduce platelet activation, and reduce angina pectoris and the development of atherosclerotic lesions.[81]

Analysis of MAK components identifies a large number of natural antioxidants.[80] Niwa et al found MAK-4 and MAK-5 to be efficient scavengers of common free radicals and oxidants, including superoxide anion, hydroxyl radical, and hydrogen peroxide.[79] Aqueous and alcoholic extracts of MAK-4 and MAK-5 inhibited hepatic microsomal lipid peroxidation.[82] Sharma et al round that MAK-4 and MAK-5 were ≈103 times more potent than probucol in preventing 50% oxidation of LDL.[83] Animals pretreated with MAK showed no evidence of toluene-induced free radical damage to the cerebellum, in contrast to control rats exposed to toluene.[80] Whereas some of the diseases related to aging are thought to result from or be exacerbated by the oxidative tissue damage caused by free radicals and other oxidants, the powerful antioxidant effect of MAK should reduce these aging-related diseases.

Cardiovascular Disease and MAK—Cardiovascular disease (CVD) is the leading cause of death in the United States. MAK's ability to prevent the LDL oxidation, platelet aggregation, and lipid peroxidation accompanying a high-cholesterol diet in animal studies suggests that MAK may help prevent atherosclerosis in humans.

A study by Sundaram et al found that hyperlipidemic patients whose diet was supplemented with MAK-4 for six months had a time-dependent reduction in their LDL oxidation by Cu^{+2} and endothelial cells.[81] Lee et al found significant reductions in lipid peroxides, increased glutathione peroxidase, and resistance of LDL to endothelial cell-induced and cupric ion-catalyzed oxidation in Watanabe Heritable Hyperlipidemic (WHHL) rabbits receiving MAK-4 for six months (6% diet).[84] In addition, a significantly lower percentage area of atheroma was seen in the MAK-4 group compared to controls, Lee et al also tested organ functions in WHHL rabbits on a six-month, 6% MAK-4 supplemented diet. Functional t ests for liver, kidney, pancreas, carbohydrate metabolism, immunity, inflammation, and tissue damage indicated MAK-4 significantly prevented organ damage in these hyperlipidemic rabbits.[85]

Platelet aggregation occurs abnormally under a variety of stresses and may trigger myocardial infarction, strokes, and other vascular diseases. In vitro studies showed that MAK-5 prevents platelet aggregation when platelets are exposed to any of several well-known aggregation inducers.[86]

Immune System Effect of MAK—Weakened immune function has been implicated in the detrimental effects of stress.[87] MAK appears to have anti-stress and anti-aging effects on the immune system. Dilleepan et al used animal and cell models to study the effects of MAK under a number of different conditions of immune challenge.[88] Investigators saw increases of 100% to 160% in T-lymphocyte proliferation, depending on the MAK dosage.

Nervous System Effects and MAK—In humans, many neural functions decline with age. MAK's central nervous system mechanisms may involve interactions with a variety of neurotransmitter receptors or uptake sites including opioid receptors.[89] A double-blind,

placebo controlled study was conducted to test the effect of MAK on an age-related alertness task.[90] Forty-eight men >35 years of age were randomly assigned to a group receiving MAK-5 twice daily for six weeks or to a closely matched group receiving placebo. The MAK group improved significantly more in performance of this task after three and six weeks of treatment relative to the placebo group. Performance was highly correlated with age, and because successful performance apparently requires an unrestricted flow of homogeneous attention as well as focalized concentration, MAK may enhance attentional capacity or alertness and thus reverse some of the detrimental cognitive effects of aging.

Physiologic Purification Techniques

In the area of physiologic purification, Maharishi Consciousness-Based Health Care recommends multimodality purification therapies on a seasonal basis for enhancement of physiologic homeostasis, removal of impurities (toxins) that accumulate over time, promotion of mental and emotional wellbeing, and overall physical health.[91,92] These procedures have been described in the classical Vedic texts and have been recently and collectively termed Maharishi Rejuvenation Therapy (MRT). These procedures are recommended according to the individual's physiologic imbalances, and likely physiological mechanisms of action for several of the procedures have been described.[93]

In a controlled study, Schneider and coworkers found, after a one-week treatment period, that 142 patients undergoing these physiologic purification treatments reported significantly greater improvements in well-being, energy-vitality, strength-stamina, and appetite and significantly less anxiety, depression, and fatigue compared to 60 control subjects who participated only in a didactic class on Maharishi Consciousness-Based Health Care.[94] A more recent study found that after a typical five-day purification program in middle aged adults, the speed of mental processing increased.[95]

These physiologic purification procedures may also reduce risk for CVD. In a study similar to those above, total cholesterol fell acutely and high density lipoprotein (HDL) cholesterol rose significantly three months after a five-day purification procedure.[96] Lipid peroxides and diastolic blood pressure also dropped, while measures of state anxiety improved significantly. Vasoactive intestinal peptide, a coronary vasodilator, rose significantly (80%).

In the most complete studies known testing the ability of these purification procedures to remove environmental toxins lodged in the body, Herron and Fagan[97] evaluated reductions in the serum levels of 17 serious environmental toxicants. Levels of most of the toxicants detected in the serum were lower in the group receiving the purification procedures in both a cross-sectional study (48 experimental subjects and 40 controls) and a prospective study (15 subjects measured before and after the procedures).

Vedic Sound

Few research studies on Maharishi Consciousness-Based Health Care effects have included the approach of applying special Vedic sounds, but the traditional knowledge suggests this approach is valuable for both prevention and treatment.[13] Preliminary results showing beneficial effects of a Vedic sound approach in arthritis, chronic neck or back pain, respiratory and digestive problems, anxiety and depression, insomnia, and other problems have been published recently.[98,99]

Known as Maharishi Vedic Vibration Technology (MVVT), this approach was investigated first for arthritis by using a double-blind, randomized experimental design.[98] A total of 176 subjects with painful conditions of the joints and spine were tested, alternately, with an MVVT treatment intended for another disorder and with an MVVT treatment for arthritis. After the

specific arthritis treatment, >70% of the patients experienced ≥60% relief of pain, while >50% of those who also reported joint stiffness and a limited range of motion experienced ≥60% improvement. After receiving the control treatment, only 11% experienced, ≥60% reduction in pain, one subject experienced this degree of improvement or greater in the range of motion, and two subjects reported this degree of improvement or greater in stiffness. Similar results were obtained in a simple, non-blinded, self-report study of 213 subjects with complaints ranging from neck pain to eye problems.[99]

Dietary Approaches

The traditional Vedic diet emphasizes fresh vegetables, fruits, grains, nuts, high fiber content, and dietary sources of antioxidants, vitamins and minerals; it is similar to other therapeutic diets previously associated with reduced morbidity and mortality from chronic diseases.[100-102] Within this broad context, each patient's diet is tailored to compensate for his or her specific physiologic imbalances and pathophysiologic processes.

Vedic Exercise

Maharishi Consciousness Based Health Care includes the practice of a set of classical yoga exercises for 15–20 minutes twice a day. These include physical exercises for neuromuscular integration and slow breathing exercises. Maharishi Consciousness-Based Health Care uses these exercises as one of 40 approaches for prevention of disease and promotion of health, especially for mind-body integration.[103] Research on these Vedic exercises has found significant reductions in cardiovascular risk factors and in stress-related neuroendocrine markers, as well as enhancements in psychological health.[104-106]

Environmental Health - Effects of the Near Environment

Analysis of the health effects of the patient's home and work environments is based on the classical texts of Vedic architecture called Maharishi Sthapatya-Veda.[103,107] This field includes knowledge and practices for the beneficial orientation and layout of homes and office buildings. This approach is consistent with the recently described syndrome of building-related illness or "sick building syndrome"[108] but includes a wider range of environmental considerations.

Environmental Health - Effects of the Distant Environment

The Vedic approach to the patient considers that the individual is in a dynamic state of equilibrium with the entire environment, extending to the universe as a whole, including the influences of the cycles and rhythms of the sun, moon, stars, and planets. This field of knowledge called Maharishi Jyotish may correspond in part to modern understandings in chronobiology.[109] Maharishi Consciousness-Based Health Care programs usually include assessment of risk factors, future health trends, and recommendations for prevention derived from this traditional approach.[20]

Collective Health

Research has shown that practice of the TM program and the more advanced, TM-Sidhi program in groups has beneficial effects on the health of individual participants and of the society as a whole.[24,25,110,111] Thus, group practice is recommended when participants are in a circumstance that allows it, and the formation of large groups practicing the more advanced TM-Sidhi program together appears especially advantageous for the individual and society.[112,113]

Conclusion and Future Directions

Cardiovascular and other chronic diseases affect individuals of all ages. However, these diseases reach epidemic proportions in the elderly. Both the absolute number of elderly and the percentage of elderly in the society are rapidly increasing. A growing body of evidence suggests that what has been described as “usual aging” may actually be modifiable by behavioral or other interventions that reduce the incidence of chronic disease. Such approaches appear to promote successful aging—aging without the usual diseases and disabilities.

The challenge of reducing cardiovascular and other chronic diseases is an integral part of developing programs for successful aging. Accordingly, national policy makers and gerontologic professionals have established national health objectives that call for studies of innovative health promotion strategies. Experts in behavioral medicine and healthcare policy[10,114-116] have pinpointed the following needs: 1) an optimal balance between primary care and specialized care; 2) treatment strategies that address the causes of disease, not just the symptoms; 3) a more holistic system of health care in America; 4) more emphasis on cost-effectiveness of medical care; 5) more emphasis on prevention-oriented health care; 6) more incorporation of positive lifestyle changes into medical treatments; 7) more use of treatments with high compliance rates; 8) more and better health care for minorities, including the elderly; 9) more use of natural approaches to replace or reduce conventional pharmacologic and surgical procedures.

The research reviewed here on several modalities of Maharishi Consciousness-Based Health Care suggests that this traditional preventive approach may fulfill many of the above recommendations. Especially important is its prevention-oriented, holistic nature—one that addresses the underlying causes of disease. Our research in African Americans has found not only promising preventive effects but also a high compliance with this intervention compared to conventional approaches. This is another major advantage of this natural approach. Our studies in this population show that quality of life tends to improve, and thus far no negative side effects have been detected. This improvement in quality of life undoubtedly contributes to the high rate of compliance. Our results are compatible with the larger body of research on other high-risk populations and normal subjects, suggesting this natural approach to health care is appropriate for use on a much wider scale.

Although >40% of the general public has used some form of natural or alternative medical approaches, these approaches are often applied in an unsystematic framework that has not been subjected to empiric verification. The growing body of research on the TM program and Maharishi Consciousness-Based Health Care has major public health and healthcare policy implications for prevention and treatment of cardiovascular disease and other chronic diseases in the United States and internationally.

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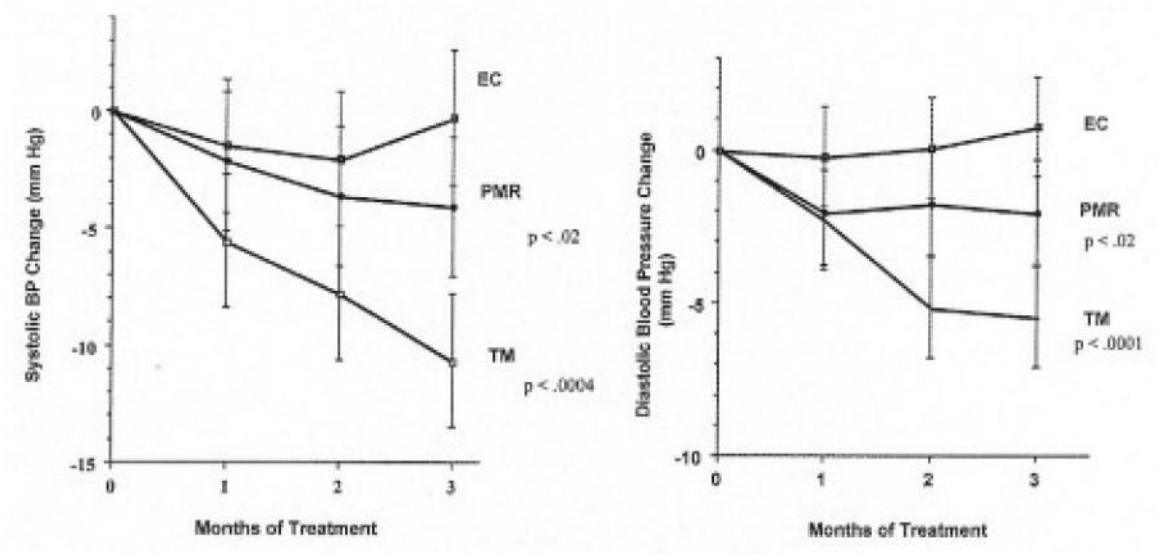

Fig 1.

Mean changes in clinic systolic blood pressure (SBP, left) and diastolic blood pressure (DBP, right) with standard errors of means. The *P* values are for repeated measures ANCOVA comparing each experimental group (TM or PMR) to control (EC). TM, Transcendental Meditation group (*n*=36); PMR, progressive muscle relaxation group (*n*=33); EC, lifestyle education control group (*n*=35). (Source: Schneider et al[42] reprinted with permission.)

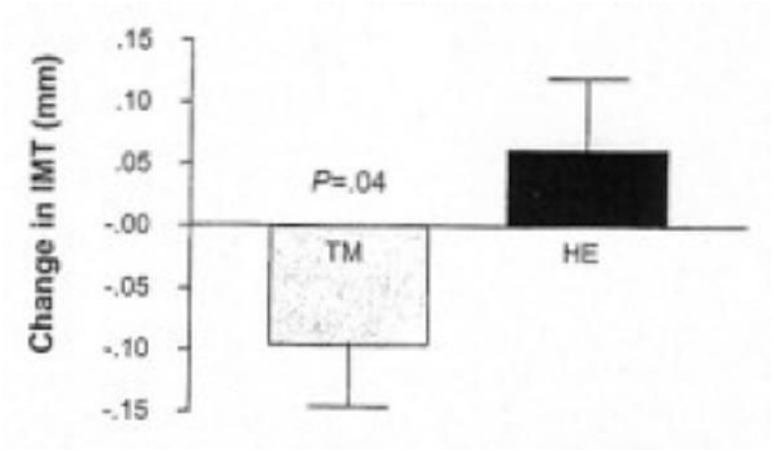

Fig 2.

Effects of the Transcendental Meditation program on carotid atherosclerosis (indicated by intima media thickness [IMT]) in hypertensive African Americans randomized to a Transcendental Meditation group (TM) and a health education (HE) group. Graph shows mean changes in IMT scores, and the 95% confidence intervals, (Source: Castillo-Richmond et al[60] reprinted with permission.)

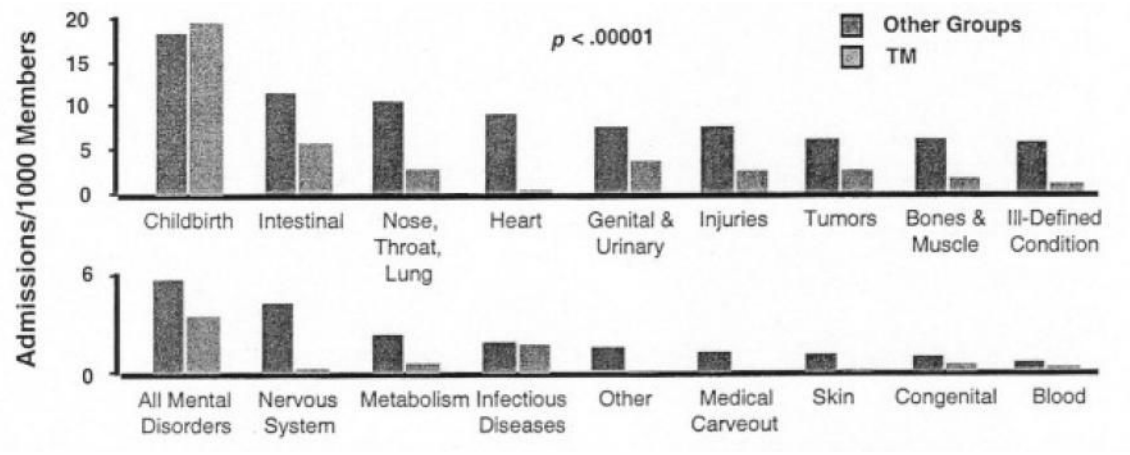

Fig 3.

Hospital admissions rate in 18 categories of care for the 2,000-member Transcendental Meditation (TM) group and the 600,000-member normative control group (Other Groups) over a five-year period. (Source: Orme-Johnson[66] reprinted with permission).