COHORT STUDY

COHERENCE AND HEALTH CARE COST—RCA ACTUARIAL STUDY: A COST-EFFECTIVENESS COHORT STUDY

Woody Bedell; Marietta Kaszkin-Bettag, PhD

Chronic stress is among the most costly health problems in terms of direct health costs, absenteeism, disability, and performance standards. The Reformed Church in America (RCA) identified stress among its clergy as a major cause of higher-than-average health claims and implemented HeartMath (HM) to help its participants manage stress and increase physiological resilience. The 6-week HM program Revitalize You! was selected for the intervention including the emWave Personal Stress Reliever technology.

From 2006 to 2007, completion of a health risk assessment (HRA) provided eligible clergy with the opportunity to participate in the HM program or a lifestyle management program (LSM). Outcomes for that year were assessed with the Stress and Well-being Survey. Of 313 participants who completed the survey, 149 completed the Revitalize You! Program, and 164 completed the LSM. Well-being, stress management, resilience, and emotional vitality were significantly improved in the HM group as compared to the LSM group.

In an analysis of the claims costs data for 2007 and 2008, 144 pastors who had participated in the HM program were compared to 343 non-participants (control group). Adjusted medical costs were reduced by 3.8% for HM participants in comparison with an increase of 9.0% for the control group. For the adjusted pharmacy costs, an increase of 7.9% was found compared with an increase of 13.3% for the control group. Total 2008 savings as a result of the HM program are estimated at $585 per participant, yielding a return on investment of 1.95:1. These findings show that HM stress-reduction and coherence-building techniques can reduce health care costs.

Woody Bedell is the former director of benefits at the Reformed Church in America, New York, New York. Marietta Kaszkin-Bettag, PhD, is senior manager of regulatory affairs and scientific expert at PharmaLex GmbH, Mannheim, Germany. (*Altern Ther Health Med*. 2010;16(4):26-31.)

Corresponding author: Woody Bedell
E-mail address: lwbedell@sbcglobal.net

It has become common knowledge that stress is a major factor in many chronic illnesses. Stress is a physiological response to the primary emotions of fear and anxiety (and associated emotions of frustration, anger, worry, resentment, etc), whether real or imagined.[1] When such physiological responses become chronic, they can lead to lasting modifications in the hormonal system (eg, increased cortisol) and changes in autonomic nervous system activity. Elevated cortisol is associated with increased blood pressure, blood glucose, triglycerides, and increased waist circumference. The elevation of these biometric factors, when bundled, is known as metabolic syndrome and is a major contributor to hypertension, cardiovascular disease, autoimmune disorders, depression, type 2 diabetes, and others.[2] It has been shown that people with metabolic syndrome have more than double the actual health-related claims cost as those who do not have the syndrome.[3]

In particular, work-related stress has an adverse impact on health and well-being, leading to an increased incidence of coronary heart disease, cortisol levels, and metabolic syndrome.[4,5] Stress is identified as an important health-economic risk factor for different professional categories.[6] Cost of lost productivity from absenteeism and disability alone associated with the conditions mentioned above can contribute to more than 50% of the total health-related costs. Based on Towers Watson's *Staying@ Work Report* (2009/2010), employers recognize stress as a major issue related to employees' health and productivity.[7] Excessive work hours (75%), lack of work/life balance (65%), and fears about job loss (64%) are the foremost sources of stress affecting employees in most organizations, and significant gaps exist in companies' actions to reduce these stressors.

In 2005, Woody Bedell, director of the Reformed Church of America's (RCA) benefit program recognized that the medical costs had been increasing at rates significantly higher than the national average. Bedell had been the chief strategic relations officer for the United Methodist Church and found, through claims analysis and focus group feedback, that stress had become a major factor on the health costs of the pastoral profession,

which had shifted from one of the healthiest occupations to one of the least healthy over a 35-year period. Clergy/pastor medical insurance costs are approximately 60% higher than the costs in the average US preferred provider organization (PPO) program (in 2007, clergy per capita cost were $10 400 compared to $6500 per capita PPO cost). This difference cannot be fully accounted for by the fact that the average age of mainline clergy is 51 years, whereas the average age of a participant in a corporate US PPO program is 42. This difference may account for about a 25% higher cost but certainly not the 60% differential. A review of one the largest denomination's claims for 2007 with emphasis on the impact that chronic stress has on a participant may provide a reasonable explanation for this discrepancy:

- 75% of claims attributable to lifestyle factors,
- 54% of disability diagnosis attributable to psychosocial issues,
- 96% higher incidence of type 2 diabetes,
- 83% higher incidence of depression,
- 87% higher incidence of hypertension, and
- 250% higher incidence of obesity.

As the director, Woody Bedell with board approval initiated two important changes to help reduce denominational health care costs. First, they changed from a third-party administrator to a major insurance carrier, thereby gaining the benefits of deeper discounts from the provider. This resulted in an immediate 20% reduction in costs, but it was critical to address the overall higher annual rate of claims (trend) that were exceeding national averages. Knowing chronic stress was a major factor contributing to the utilization of medical and pharmaceutical services, and after vetting a number of programs, they implemented a stress-reduction and coherence-building program from the Institute of HeartMath (IHM) to counteract the negative effects of stress on RCA clergy. To increase health awareness, they also initiated a health risk assessment (HRA) from Health Fitness Corporation (HFC) that included biometric screening and questionnaire data. This included a personal call from an HFC advisor to review the results of the HRA and direct the participants to programs best suited to their needed lifestyle change. HFC offered programs for exercise, weight reduction, cholesterol reduction, and blood pressure reduction. HeartMath (HM) provided the program for stress reduction and resiliency.

INTERVENTION

The stress-reduction program from HM provides a series of tools and techniques designed to help people better self-regulate stress, increase resiliency, and improve performance, hallmarks of increased coherence.[8-10] The term *coherence* is used to describe the degree of order, harmony, and stability in and among the various rhythmic activities in the body such as the heart's rhythm, respiration, blood pressure rhythms, etc. Many of these techniques include the intentional generation of a heartfelt positive emotional state combined with a shift in attentional focus to the area of the heart (where many people subjectively experience positive emotions). Research shows that when shifting into a positive emotional state, heart rhythms change to a more coherent and ordered pattern. Negative emotions such as anxiety and frustration lead to a disordered heart rate variability (HRV) pattern.[11] Amplitude and frequency characteristics of the heart rhythm have been shown to be indicative of both the physiological and psychological status as well as predicting health risk.[12,13] A harmonious order signifies a coherent system whose efficient or optimal function is directly related to the ease and flow in life processes.[11] Physiological coherence is measured by HRV analysis, which reflects heart-brain interactions and autonomous nervous system (ANS) dynamics and is reflected in a heart rhythm pattern that is more ordered and sine wave–like at a frequency of around 0.1 Hz (10-second rhythm). Specifically, coherence is assessed by identifying the maximum peak in the 0.04- to 0.26-Hz range of the HRV power spectrum, calculating the integral in a window 0.030 Hz wide centered on the highest peak in that region, then calculating the total power of the entire spectrum. The coherence ratio is formulated as (Peak Power/(Total Power—Peak Power)).[11]

Learning and integration of the HM self-regulation skills were facilitated with a heart rhythm coherence feedback monitor (ewWave PSR). This monitor assesses the user's level of heart rhythm coherence as he or she practices the self-regulation techniques. HRV coherence feedback has been shown to significantly improve outcomes in a number of clinical conditions such as posttraumatic stress disorder (PTSD),[14,15] depression,[16,17] asthma,[18-20] congestive heart failure,[21,22] hypertension,[23] anxiety, fibromyalgia,[24] and insomnia.[25]

APPROACH AND METRICS

The RCA has made stress and resiliency management a priority and a fundamental component of its medical program. In 2006, the RCA began offering the HM coherence training to pastors with three or more health risk factors. Each participant was also provided with the handheld emWave device. Due to the distribution of the pastors throughout the United States, it was not cost-effective for them to travel to a single location to attend an HM program in a workshop format. Therefore, a telephone-based program called Revitalize You! was selected for the intervention. The program was delivered by certified HM health coaches over a 6-week period and consisted of six 30- to 45-minute coaching sessions.

From the fall of 2006 to the fall of 2007, the RCA wanted to gain an understanding of the overall health of the population and to address the issue of stress and its negative impact. To ensure participation in the HRA, they tied eligibility to the $500 deductible medical program. If a participant did not complete the HRA, he or she would be placed in the $1500 deductible plan. They achieved 96% participation for the completion of the HRA. To combat stress, they offered a $50 incentive for participants to complete an online version of the Stress and Well-being Survey (SWS, IHM). Approximately a third of the denomination completed the survey. The RCA collected valid pre- and post-intervention SWS

surveys, the primary assessment metric, from 313 participants. Of these 313 participants, 149 completed the Revitalize You! program, and 164 who had fewer than three risk factors participated in the phone-based lifestyle management program. The lifestyle management group will be referred to as the control group, although it should be appreciated that it was not a placebo control due to the fact that this group participated in an intervention, which was expected to significantly benefit the pastors. As this group did not receive instruction on stress management but did have ongoing contact with a risk management coach, it served as a control for the HM cohort, which also used a phone coaching model for the delivery of the intervention.

For the calendar year of 2007 the same HM program was offered to all members of the health plan (not just those with three risk factors). An additional cohort of 86 pastors participated in the HM program, which meant that about a third of eligible RCA pastors had participated in the program by the end of 2008. To determine any potential impact the HM stress-reduction program had on the RCA's medical costs, the RCA retained McCarthy Actuarial Consulting, LLC, Glen Allen, Virginia, to conduct an independent analysis of the actual health care utilization and costs during the 2007 to 2008 year period. This was the only time span for which they had valid cost data due to switching to a new plan administrator for the 2007 calendar year.

Two cohorts of pastors were defined: those who completed the Revitalize You! program prior to December 31, 2007, and those who, as of the end of 2008, had not yet participated in the HM program. Only pastors who had continuous coverage from January 1, 2007, through December 31, 2008, were included in either cohort. One hundred forty-four pastors were identified who had participated in the HM program, and 343 pastors who had not participated served as the control group. The cohorts were demographically similar: 80.3% of the HM participants were male with an average age of 49.5 years compared to 79.9% of the control group with an average age of 50.2 years. The age of the two groups was also similar, with 73.2% of the HM participants and 67% of the control participants in the 45- to 60-year range.

The claims and cost data were analyzed by diagnoses (medical) and treatment (pharmaceutical) categories. The key metric used in the analysis was charges per pastor per year. Costs were calculated as the total charges incurred during a year divided by the number of pastors included in the respective cohort. Other metrics calculated to aid the analyses included incidence rates and cost per utilization unit.

RESULTS

For the Stress and Well-being Survey data collected during the 2006 to 2007 year, the 149 participants who participated in the HM program were compared to the 164 who participated in the phone-based coaching lifestyle modification program. The results of a single-factor ANOVA on the Stress and Well-being Survey pre-post change scores are shown in Table 1 and Figure 1.

There were significant differences between the groups in total stress ($P < .05$), total well-being ($P < .05$), work stress ($P <$

TABLE 1 RCA Stress and Well-being Survey (SWS) Score Changes*

	Treatment Group (N=149)			Control Group (N=164)			Between-group Differences		
	Mean	SD	SEM	Mean	SD	SEM	Mean Sq	F	*P* value†
Total stress	-0.22	0.41	0.03	-0.12	0.33	0.03	0.82	5.95	<.05
Total well-being	0.25	0.50	0.04	0.08	0.67	0.05	2.19	6.17	<.05
Work	-0.30	0.68	0.06	-0.14	0.59	0.05	1.97	4.92	<.05
Relationships	-0.23	0.56	0.05	-0.10	0.61	0.05	1.10	3.17	ns
Finances	-0.22	0.64	0.05	-0.17	0.62	0.05	0.20	0.49	ns
Lack of social support	-0.31	0.78	0.06	-0.12	0.63	0.05	2.78	5.57	<.05
Other sources of stress	-0.19	0.40	0.03	-0.14	0.43	0.03	0.20	1.11	ns
Response to stress	-0.16	0.60	0.05	-0.08	0.48	0.04	0.51	1.75	ns
Emotional distress	-0.18	0.67	0.06	-0.11	0.42	0.03	0.40	1.28	ns
Physical symptoms	-0.22	0.60	0.05	-0.08	0.41	0.03	1.52	5.91	<.05
Stress management	0.48	0.74	0.06	0.21	0.88	0.07	5.56	8.44	<.01
Adaptability	0.21	0.67	0.05	0.11	0.82	0.06	0.75	1.33	ns
Resilience	0.14	0.46	0.04	-0.06	0.68	0.05	3.12	9.06	<.01
Emotional vitality	0.16	0.72	0.06	0.05	0.73	0.06	0.87	1.68	ns
Life changes	4.11	54.57	4.47	-3.80	53.20	4.15	4895.80	1.69	ns

*RCA indicates Reformed Church of America; ns, not significant. †Single-factor ANOVA.

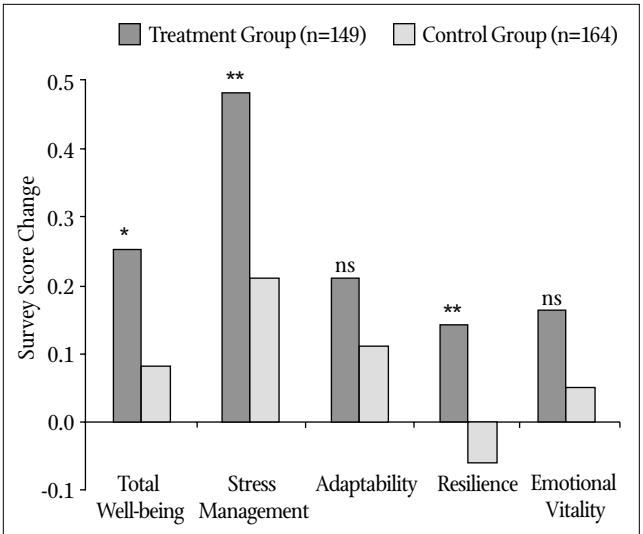

FIGURE 1 Improvements in Stress and Well-Being Survey (SWS): Revitalize You! vs Control

*P < .05, **P < .01, ns = not significant

.05), lack of social support (P < .05), physical symptoms of stress (P < .05), stress management (P < .01), and resilience (P < .01), all in favor of the HM group. In addition, the pastors were asked to complete a customer satisfaction survey, and 96% of those who had participated in the HM program indicated that they were satisfied or extremely satisfied with the program. Although the results of the Stress and Well-being and the customer satisfaction surveys were very positive, the most important question remained: Does the HM program lower our health care costs?

COMPARISON OF COHORT COSTS AND TRENDS

Health care costs and trends were assessed in terms of covered charges rather than benefits paid for participation to avoid the possibility of obscuring the results due to different plan options chosen. During the initial 2006 year, the HM Revitalize You! program was offered to only those pastors who had three or more lifestyle risks. Therefore, it is understandable that this cohort had a 55.9% higher starting claims cost than the non-HM cohort. The analysis of the 2007 and 2008 data for two cohorts (144 HM participants vs 343 matched controls) found that the HM participants had reduced medical and pharmacy claims costs compared to the control group. It should be noted that for both populations, an annual increase in costs of 4% to 6% is expected due to normal aging, considering that more than 60% of the participants in both groups were between 45 and 60 years of age.

Significant findings of the analysis were as follows:

1. Medical costs
   a. HM participants experienced a reduction in medical costs of 3.8%, prior to regression (-11.5%)
   b. Control group participants experienced an increase in medical costs of 9%, prior to regression (+14%)
2. Pharmacy trend costs
   a. HM participants experienced an increase in pharmacy costs of 7.9%, prior to regression (+4.7%)
   b. Control group participants experienced an increase in pharmacy costs of 13.3%, prior to regression (+15.4%)
3. Total claim costs
   a. HM participants experienced a reduction of 0.6% prior to regression (-7.1%)
   b. Control group participants experienced an increase of 10% prior to regression (+14.4%)

Because the HM cohort had higher initial claims than the control cohort due to the program being offered to participants with three or more lifestyle risks, it was possible that the lower costs of the HM cohort could be due to the statistical phenomenon known as "regression to the mean," which refers to the tendency of higher-cost members to converge to a common point (the average costs). Therefore, in the final analysis, a conservative approach was taken by including an adjustment for this potential convergence. See above the results prior to applying "regression to the mean" methodology. With this adjustment, a reduction in medical costs of 3.8% for HM participants was found in comparison with an

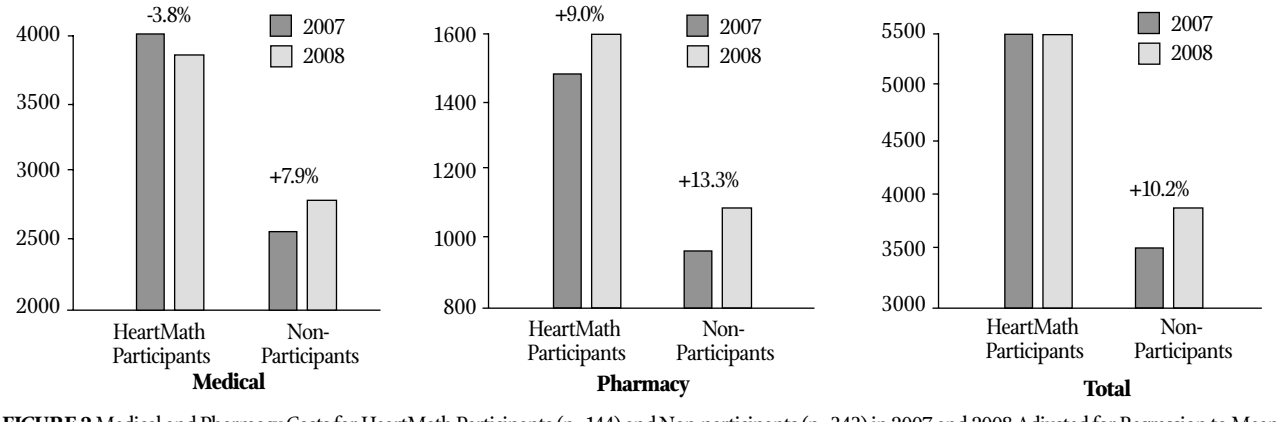

FIGURE 2 Medical and Pharmacy Costs for HeartMath Participants (n=144) and Non-participants (n=343) in 2007 and 2008 Adjusted for Regression to Mean

increase of 9.0% for the control group participants. For the adjusted pharmacy costs, an increase of 7.9% was found compared with an increase of 13.3% for the control group.

Cost savings were measured by comparing the adjusted 2008 costs to 2007 costs trended forward at the control-participants' adjusted trend rates. This comparison indicates a first year savings of $585 per participant ($6002-$5416). If the pastors had not participated in the HM program, their costs would have been increased according to the same adjusted trend rates as the control participants (ie, +9.0% medical costs and +13.3% pharmacy costs, Figure 3).

In the analysis of types of medications and diseases most impacted by the Revitalize You! program, nine prescription drug classes and four medical diagnosis categories were identified. The diagnosis categories with the highest medical costs for both cohorts were for the circulatory system, digestive system, genitourinary system, and muscular-connective tissues. The comparison of cost differences for prescription drug classes between HM participants and control participants appears in Table 2. In the case of prescription drugs, in four out of the nine categories, the HM participants had lower costs than control participants. For medical costs, three of the four categories had positive per-member per-year trends for HM participants.

In the more detailed medical cost analysis, one of the higher cost categories was for essential hypertension, which would be expected to be sensitive to improvements in stress reduction. Control participants experienced a substantial increase (47%) in costs associated with essential hypertension, driven primarily by a 30% increase in incidence rate. For HM participants, however, a 23% decrease in costs for this diagnosis was observed, despite an incidence rate increase of 38%. For both cohorts, the increase in the incidence rates was likely driven by the fact that most RCA pastors participated in the HRA for the first time in 2007, which increased awareness of having hypertension.

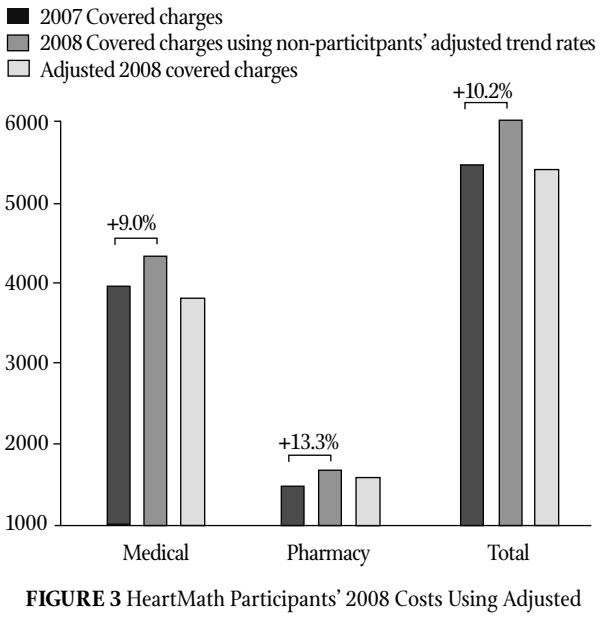

FIGURE 3 HeartMath Participants' 2008 Costs Using Adjusted Trend Rates and Adjusted Covered Charges

Return on Investment

RCA's cost for providing the HeartMath Revitalize You! program was $300 per participating pastor. The savings calculated above for the first year of the program were $585, representing a return on investment (ROI) of about 2:1. This ROI does not consider the likely savings resulting from reduced absenteeism, disability programs, or increased presenteeism. Since there are no additional costs for participants, the ROI is expected to grow substantially. If the next year's savings are only equal to those for 2008 (estimated at $585), the HM program will return $3.90 for every dollar invested by the end of 2009, ie, a ROI of 4:1.

DISCUSSION

The results of the cost analysis show that there was a clear difference in medical and pharmacy costs between pastors that used HM stress reduction techniques and those who did not. In particular, a marked reduction in costs for drugs for gastrointestinal complaints, antiarthritics, and muscle relaxants and a much less pronounced increase in costs for hypertension drugs were observed for the HM participants. This was consistent with the overall reduction of medication and pharmacy costs of -0.6% for the HM participants compared to an increase in the total costs of 10.2% for the control participants. These results are impressive considering they have been calculated after "regression to the means" methodology, which provides a more conservative approach to the analysis.

With respect to the claims, the data show that approximately one-third of the pastors had a diagnosis of hypertension. A recent edition of the *American Journal of Health Promotion* found the annual cost of hypertension to be $392.31, costs related to heart disease another $368.34, and costs relating to depression to be $348.04 per employee per year.[26] These costs are only due

TABLE 2 Pharmacy Costs by Therapeutic Category

Drug Class	Change in Charges from Prior Year (%)	
	HeartMath Participants (N = 144)	Non-Participants (N = 343)
Analgesics	50.8	19.0
Antiarthritics	-44.4*	31.8
Autonomic drugs	4.7*	28.0
Cardiac drugs	-10.2	-11.8
Cardiovascular drugs	8.5	8.3
Diuretics	24.0	1.7
Gastrointestinal drugs	-17.2*	14.5
Muscle relaxants	-70.8*	33.9
Sedative/hypnotics	9.1	-5.1

*HM participants had lower prescription drug costs than control participants

to presenteeism associated with the diagnosis and not the associated medical and absenteeism costs. A large randomized controlled study of patients with coronary artery disease showed lifestyle changes had large improvements in patients compared to 55% of those who received medication therapy alone.[27] Stress reduction techniques such as HM together with lifestyle changes may offer a viable nonpharmacological approach to primary prevention, disease interruption, and reduction of health care costs, thus carrying enormous public health significance.

Biomarkers such as HRV, salivary cortisol, blood glucose, blood lipids, and blood pressure as objective measures of risk and stress together with assessments of presenteeism are proposed as a comprehensive way to assess workplace health costs and productivity when developing health promotion programs.[28] In addition, the results presented here suggest that with the HM program, there is the potential for savings not only in terms of direct medical costs but in productivity costs as well. Techniques used in the HM program allow one to influence coherence in order to influence stress-related hormones and nervous system activity that act directly through the autonomic pathways that connect the heart and brain. With practice, one can learn how to balance the two branches of the nervous system and bring the heart rhythms into coherence, thereby further positively influencing emotions and hormone regulation, which affect the digestive, muscular, immune, and cardiovascular systems.

The present analysis was the first retrospective claim analysis completed involving the HM methods. The outcome confirms that the application of stress-reduction techniques is worth the time, effort, and expense because there was a clear health benefit for the participants, and the RCA was able to reduce its overall health insurance costs. To achieve a sustained savings in health care costs, the following is recommended.

- Continue to monitor participants using the stress-reduction techniques and non-participant cohort costs to confirm the future savings expectations.
- Assess the extent to which stress-reduction techniques continue to be practiced as time passes. Depending on these findings, determine if it would be cost-effective to implement sustainability initiatives to reinforce these programs.
- Determine the amount of "crossover" between stress-reduction techniques such as HM and other wellness initiatives.
- Evaluate the effectiveness of potentially synergistic initiatives, perhaps using a multivariate approach to identify the most efficient combination of programs.
- Study medical and pharmacy data for spouses to determine whether stress reduction techniques should be extended to them.

SUMMARY AND CONCLUSIONS

Adjusted annual medical cost trends were remarkably lower for HM participants than for control participants (-3.8% vs +9.0%). Pharmacy cost trends also were significantly lower for HM participants than for control participants (7.9% vs 13.3%). Total 2008 savings due to the HM program are estimated at $585 per participant, compared to intervention costs of $300, yielding an ROI of 1.95:1. These findings support the benefit of stress reduction techniques such as HM in improving patient outcomes and reducing health care costs by increasing self-regulation and physiological coherence.

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