Modifiable Disease Risk, Readiness to Change, and Psychosocial Functioning Improve With Integrative Medicine Immersion Model

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Background • Stroke, diabetes, and coronary heart disease (CHD) remain leading causes of death in the United States and are largely attributable to lifestyle behaviors. Integrative medicine can provide a supportive partnership that focuses on improving health by identifying and implementing lifestyle changes based upon personal values and goals.

Objective • This prospective observational study was designed to assess the effectiveness of an integrative medicine intervention on modifiable disease risk, patient activation, and psychosocial risk factors for stroke, diabetes, and CHD.

Design • Sixty-three adults participated in a 3-day comprehensive, multimodal health immersion program at Duke Integrative Medicine, Duke University Medical Center, Durham, North Carolina. Participants received follow-up education, physician support, and telephonic health coaching between the immersion program and the endpoint 7 to 9 months later.

Primary Outcome Measures • Psychosocial functioning, readiness to change health behaviors, and risk of developing diabetes, stroke, and CHD were assessed at baseline and endpoint.

Results • Although cardiac risk remained unchanged ($P = .19$) during the study period, risk of diabetes ($P = .02$) and stroke ($P < .01$) decreased significantly. Perceived stress remained unchanged, but improvements were seen in mood ($P < .05$) and relationship satisfaction ($P < .004$). Patients became more activated towards self-management of health ($P < .001$), endorsed greater readiness to change health behaviors ($P < .01$), and reported increased aerobic exercise ($P < .001$) and stretching ($P = .006$) following the intervention.

Conclusion • An integrative health model can help patients become more engaged in self-management of health and support them in making and maintaining healthy lifestyle changes. These findings provide support for use of an integrative health model in adult disease risk reduction. (*Altern Ther Health Med.* 2011;17(4):38-47.)

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Stroke, diabetes, and coronary heart disease (CHD) remain leading causes of death in the United States[1] and are largely attributable to behavior.[2-4] Expert recommendations for disease risk reduction include increasing physical activity, moderating caloric intake, and reducing stress.[5-8] Nonetheless, inactivity remains pervasive in the United States, with as much as 62% of the population not participating in any vigorous activity in the span of a year.[9] Caloric intake has increased steadily over the past 3 decades,[10] and the resulting imbalance between caloric intake and energy expenditure has resulted in an increased rate of obesity and excess weight.[1] In addition, a large segment of the population reports negative psychosocial factors—chronic stress, negative mood, and low levels of social support—that contribute to risk of stroke, diabetes, and CHD.[11-14]

Prospective trials have clearly demonstrated that improvements in diet[15] and exercise[16] can have a profound impact upon

markers for disease risk. Furthermore, recent studies have shown that alternative approaches to stress reduction such as yoga[17,18] and meditation[19-21] can likewise influence chronic disease risk. Research has shown that improving health behaviors can lead to improvement in overall health and well-being; however, individuals desiring to better their health often face obstacles when it comes to initiating and maintaining changes in behavior. An integrative health model may help overcome these hurdles through supportive patient partnerships that focus on identifying and implementing lifestyle changes based upon personal values and goals. Integrative health professionals trained in coaching can support and promote this process by building trusting relationships with patients that encourage personal growth, enhance motivation, and promote self-efficacy.[22]

There has been only limited investigation into the effectiveness of a patient-centered program that combines multiple strategies into a whole-person paradigm for disease risk reduction.[23,24] Accordingly, the aim of the current study was to evaluate patient outcomes from an integrative health program designed to provide holistic, patient-centered care and incorporate conventional and complementary medicine approaches for the reduction of chronic disease risk.

METHODS

Study Design

A prospective observational study design was used to assess changes in modifiable disease risk, patient activation, and behavioral and psychosocial measures after an integrative medicine health program. This program included two principal components: a 3-day health immersion phase conducted at an academic integrative medicine facility and a support phase consisting of telephonic health coaching and monthly didactic sessions on health topics. The research protocol was approval by the Duke University Medical Center Institutional Review Board.

Participants

Participants included 63 individuals (33 male and 30 female) who provided written informed consent and attended a discounted, self-paid 3-day health immersion program at Duke Integrative Medicine. Participation was limited to members and employees of an early retirement community in South Carolina, all literate in English and 18 years of age or older. Individuals were excluded if they were pregnant, had severe psychiatric disease, a cognitive impairment (eg, dementia, Alzheimer's disease), or other conditions that would limit their ability to provide informed consent.

Intervention

Phase I: 3-day Health Immersion. During the health immersion, participants spent 3 days at the Integrative Medicine center, participating in a variety of conventional and complementary therapies including nutritional counseling, acupuncture, massage, exercise training, yoga, and mind-body therapy (Table 1). Classes and individual consultations focused on topics identified on the Duke Integrative Medicine (IM) Wheel of Health (Figure 1).[25] This model centers on mindfulness and includes topics related to both professional care (eg, pharmaceuticals/supplements, preventive medicine, and conventional/CAM treatments) and self-care (eg, mind-body connection, movement/exercise, nutrition, physical environment, relationships, and personal growth/spirituality). A team of health care providers worked with each participant individually to develop a personalized health plan[26] corresponding to the 10 integral areas of health identified on the Wheel of Health (Figure 1). During the 3 days, participants also met with health coaches to reflect on personal goals and values as well as to refine and implement the health plan. Thus by the end of the immersion, participants had established a comprehensive multimodal plan for implementing lifestyle changes.

Phase II: Support Phase. After completing the health immersion, participants were provided with follow-up integrative health coaching (IHC) by telephone. IHC is a relatively recent addition to the field of coaching.[22] The IHC model builds upon elements of life coaching such as appreciative inquiry[27] and motivational interviewing[28] and in addition helps patients explore motivation to move toward whole-person health as conceptualized by the Wheel of Health (Figure 1). Specifically, IHC strives to link desired lifestyle changes with personal values and mission.

Masters-level professionals trained in IHC performed the

TABLE 1 Duke Integrative Medicine Three-day Health Immersion Program

1. Introduction to Integrative Medicine, information on the Three-day Health Immersion program, description of personalized health planning, and explanation of the Duke Integrative Medicine Wheel of Health
2. Individual integrative physician consultations
   - New patient consultation on day 1 (80 min)
   - Follow-up consultation on day 3 (30 min)
3. Health coaching
   - Three group coaching sessions (50 min each) or one individual coaching session via phone (90 min)
4. Individual fitness assessment (60 min)
5. Individual manual therapies
   - Acupuncture or acupressure (60 min)
   - Massage (60 min)
6. Group movement classes
   - Yoga (60 min)
   - Qigong (60 min)
7. Nutrition consultation and education
   - Individual integrative nutrition consult with registered dietician (60 min)
   - Nutrition class: In Search of the Optimal Diet (60 min)
8. Healthful cooking class (60 min)
9. Individual mind/body consultation (60 min)
10. Group mindfulness classes
    - Introduction to mindfulness-based meditation (60 min)
    - Mindful-eating lunch (60 min)
11. Program conclusion and final reflection (group setting)

All subjects participated in the above health-related activities during a 3-day period between January and March 2008.

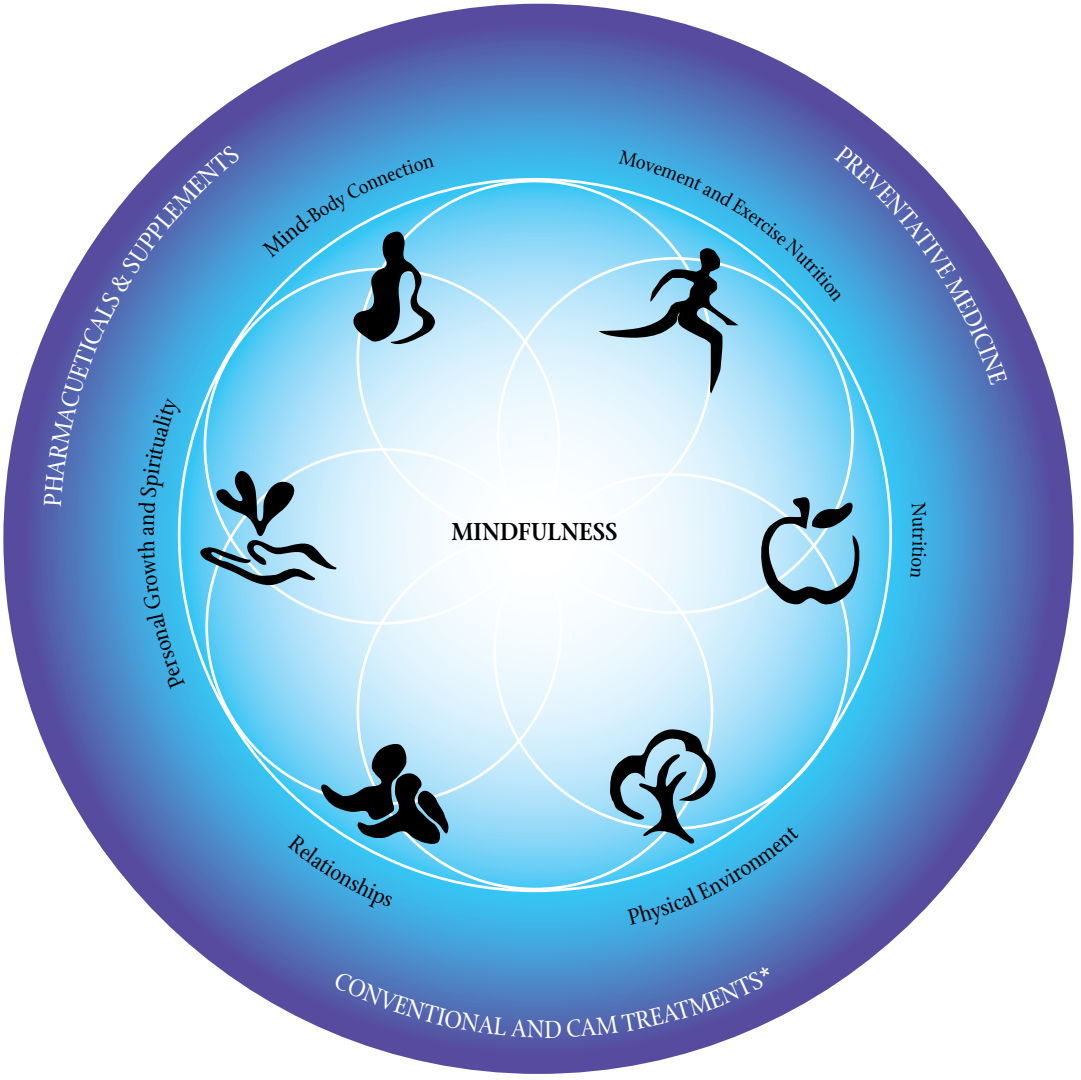

FIGURE 1 Duke Integrative Medicine Wheel of Health

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health coaching and provided participants with support and guidance in implementing their personalized health plans. The support phase included five 30- to 40-minute one-on-one phone calls during the 31- to 37-week period. Participants initiated calls at agreed-upon times convenient to both coaches and participants. Within the first 2 months of the support phase, participants also were offered a 30-minute phone consultation with their integrative physicians. This phone call provided an opportunity for physicians to address patient questions, update participants on baseline lab results, and explain results from Know Your Number (KYN) disease risk assessments (Biosignia, Inc, Durham, North Carolina; see Measures). Participants also were provided with eight monthly education lectures that were delivered in person by Duke IM clinicians in the participants' home communities. Lectures provided general preventive health education and further expanded upon the Wheel of Health concepts learned in the 3-day health immersion program (Table 2).

Measures

Disease Risk. Primary outcomes included 5-year risk of developing diabetes, stroke, and CHD, as estimated by the KYN disease assessment tool. The KYN tool calculates disease risk using a multivariate, meta-analytic disease model that incorporates biological measures and information provided by a comprehensive patient

TABLE 2 Group Education Sessions Provided During the Support Phase

1. A Healing Journey Through Cancer: Integrative Medicine Approaches for Prevention and Treatment
2. Maximize Back, Joint, and Muscular Health
3. A Woman's Midlife Health Journey: Embracing Perimenopause and Menopause
4. When Working Out Hurts: Alternative Treatments for Pain Management and Relief for Sports and Exercise-related Injuries
5. Integrative Medicine Strategies for Optimal Living: Approaches to the Prevention and Treatment of Cardiovascular Disease
6. Give Yourself Health: The Power of Your Mind/Body Connection
7. In Search of the Optimal Diet
8. Emotional Wellness: How Emotions Affect Your Health and Well-being

questionnaire (demographics, disease history, family history, and behavioral measures; Table 3).[29,30] The model provides estimates of relative risk (5-year absolute risk relative to a peer group matched for age and gender), modifiable risk (level of 5-year risk that can be altered by behavior), and absolute risk (probability of disease expression within 5 years). The KYN patient questionnaire was completed online within the 2 weeks preceding the health immersion (baseline) and during the 2 weeks before the follow-up appointment 7 to 9 months later (endpoint). The biological measures included in the KYN profile were collected in a fasting state on the first day of the immersion and again at the follow-up appointment. Approximately 2 weeks after baseline and endpoint, participants received information on their 5-year disease risk.

Biological Measures. Biological outcome measures included blood pressure (BP), resting pulse, height, weight, body composition, body mass index (BMI), waist circumference, fasting glucose, lipid profile, and high sensitivity C-reactive protein (CRP). BP was measured on the left arm, using a manual sphygmomanometer.[31,32] Participants were directed to sit quietly for 5 minutes before the first measurement. The radial pulse was taken for 30 seconds after completing the BP, and a second BP and pulse were taken 2 minutes later. Height was measured twice consecutively. Duplicate measurements of pulse, blood pressure, and height were averaged. Body weight was taken on a Tanita Scale (TBF-310GF; Tanita Corporation, Arlington Heights, Illinois) with participants in light indoor clothing and without shoes; participants were asked to fast 12 hours prior to measurements and void before weighing. Body mass index was calculated as weight in kg divided by height in meters squared. Waist circumference was measured in triplicate and averaged according to the method used by Canoy et al.[34] All blood samples were collected after participants had fasted for 12 hours. Blood assays were carried out by the Clinical Laboratory Improvement Amendments–certified Duke University Health System core laboratory.

Self-reported Psychosocial Measures. ***Burns Brief Mood Survey (BMS).*** The BMS[35] includes three five-item subscales for assessment of depression, anxiety, and anger during the previous 1-week period. The BMS has been shown to be valid and reliable.[35-37] In the present study, Cronbach's α for anger, anxiety, and depression subscales were 0.82, 0.85, and 0.90, respectively.

Relationship Satisfaction Scale (RSAT). The RSAT assesses the level of satisfaction or dissatisfaction felt by the participant in reference to their closest personal relationship; it was selected for the current study as an indicator of social support. This five-item scale demonstrates good convergent and discriminate validity.[35] Responses were measured on a Likert scale with anchors of satisfied and dissatisfied. Cronbach's α was 0.97 in the present study.

TABLE 3 Know Your Number Disease Rick Components*

Risk Factor	CHD	Stroke	Diabetes
Age	■	■	■
Gender	■	■	■
Ethnicity	■	■	■
Diagnosed with CHD	■	■	
Previous stroke	■		
Diagnosed with diabetes	■	■	
Diagnosed with LVH	■	■	
Family history of CHD	■		
Daily aspirin use	■		
Current HRT therapy	■		
BMI	■	■	■
Systolic blood pressure	■	■	■
Current smoker	■	■	■
Past smoker			■
Exercise level	■	■	■
Total cholesterol	■		
HDL	■		
C-reactive protein	■		
Diagnosed with other CVD		■	
Diagnosed with atrial fibrillation		■	
Family history of stroke		■	
Current use of hypertension medication		■	
Previous diagnosis of gestational diabetes			■
Years since gestational diabetes			■
Family history of diabetes			■
Waist measurement			■
Fasting blood glucose			■

Abbreviations: CHD, coronary heart disease; LVH, left-ventricular hypertrophy; HRT, hormone replacement therapy; BMI, body mass index; HDL, high-density lipoprotein; CVD, cardiovascular disease.
*Diabetes indicates type 2 diabetes mellitus; darkened blocks reflect variables used to calculate specific disease risks. Table content provided by Biosignia.

Perceived Stress Scale (PSS). Participants' nonspecific, self-appraised stress was measured using the four-item PSS. The PSS measures perceived stress over the past month; it has demonstrated reliability and construct validity.[38,39] Cronbach's α was 0.78 in the present study.

Behavioral Activation. ***Patient Activation Measure (PAM).*** The 13-item PAM was used to assess patients' knowledge, skill, and confidence toward self-management of health. Higher scores on this measure have consistently been associated with healthy behavior, health information seeking, and readiness to change in both healthy and chronically ill populations.[40-43] The PAM has been shown to be both valid and reliable.[41] Cronbach's α was 0.77 in the present study.

Readiness to Change (RTC). A six-item RTC questionnaire was designed for this study to assess readiness to change[44] in the areas of weight reduction, exercise, smoking cessation, diet, stress management, and meditation. The items have independently demonstrated construct validity in previous studies.[45-48]

Exercise Behavior. Exercise behavior was measured with a brief questionnaire that assessed frequency of aerobic exercise (≥20 minutes duration), stretching (≥15 minutes duration), and muscular strengthening exercise (≥20 minutes duration). Available responses included fewer than once per month, one to two times per week, three to four times per week, and five or more times per week.

Intervention Integrity Check. ***Wheel of Health Questionnaire (WHQ).*** The 20-item WHQ, designed for this study, was used to assess whether participants integrated aspects of the intervention into multiple domains of living. Measured dimensions included movement and exercise, nutrition, physical environment, relationships, personal growth and spirituality, mind-body connection, preventive medicine, conventional and CAM treatments, pharmaceuticals/supplements, and mindfulness. Performance and satisfaction in each of the 10 dimensions of the Wheel of Health were measured on a 1-to-10 scale anchored by the descriptors "low" and "high." All dimensions were summed to create subscores for WHQ performance and WHQ satisfaction.

ANALYSIS

An intention-to-treat analysis was conducted, based upon the 63 participants who were enrolled in the study, attended the 3-day immersion, and completed any assessment at baseline. The last observation was carried forward to replace endpoint values for those participants with missing data. Baseline and endpoint data were excluded (pairwise) in the cases where a participant's baseline questionnaire was incomplete. Analyses were performed using SPSS version 17 (SPSS, Chicago, Illinois). All data except for total cholesterol and HDL cholesterol were non-normally distributed as measured by the Kolmogorov-Smirnov test with Lilliefors Significance Correction and Shapiro-Wilk test ($P < .05$)[49,50]; therefore, all P-values were determined using the nonparametric Wilcoxon Signed Rank test.[51] Statistical significance was set at the $P < .05$ level.

RESULTS

Participants

Participants ranged in age from 33 to 73 years with a mean age of 59.6 (SD = 8.2). The sample was near equally divided between men and women and consisted predominantly of white individuals who reported relatively high levels of education and income. Thirty-three percent of participants had metabolic syndrome at baseline as defined by the International Diabetes Federation.[52] Descriptive statistics on the demographic characteristics of this sample are listed in Table 4.

Retention and Adherence

During the support phase, participants completed a median of two of the five available health coaching calls and used an average of 101.0 minutes of total coaching per person (50.5% of available session time). Six of the initial 63 participants were lost to contact or unavailable for the endpoint data collection.

Disease Risk and Disease Risk Biomarkers. ***Relative Risk.*** When matched for gender and age with a national sample, the median 5-year relative risk percentile at baseline was well below average at 7% (SD = 20.1%) for coronary heart disease, 16% (SD = 24.1%) for diabetes, and 25% (SD = 28.8%) for stroke.

Modifiable Risk. Five-year median modifiable risk of diabetes shifted ($P = .02$) from 0.37% (SD = 2.55%) at baseline to 0.16% (SD = 2.98%) at endpoint (Figure 2); median stroke risk decreased ($P < .01$) from 0.37% (SD = 2.09%) to 0.23% (SD = 2.32%). Median CHD risk declined from 0.95% (SD = 1.30%) to 0.72% (SD = 1.97%). Although the reduction in median CHD risk is nearly equal in magnitude to that of diabetes and stroke risk, the change in coronary risk was not statistically significant ($P = .17$) due in part to an upward shift in CHD risk variability (interquartile range of 0.23-1.73 at baseline to 0.20-1.87 at endpoint).

Absolute Risk. The change in 5-year absolute risk of diabetes was nonsignificant with a decrease in median risk from 1.28% (SD = 2.87%) at baseline to 1.06% (SD = 3.31%) at endpoint. Median absolute risk of CHD also declined slightly (nonsignificant) from 1.91% (SD = 2.42%) to 1.82% (SD = 2.96%). In contrast, the absolute risk of stroke decreased significantly ($P = .02$) from a median of 1.28% (SD = 2.87%) at baseline to 1.06% (SD = 3.30%) at endpoint.

Biomarkers for disease risk, including BMI ($P = .008$), waist circumference ($P = .003$), and pulse ($P < .001$) improved significantly across the study period (Table 5). Total cholesterol increased significantly during the study ($P = .007$). Systolic blood pressure ($P = .237$), diastolic blood pressure ($P = .095$), HDL cholesterol ($P = .109$), glucose ($P = .300$), and CRP ($P = .068$) did not change.

These data represent intention-to-treat analyses (n = 63); however, analyses including only completers (n = 57) yielded similar results (data not shown) for all outcomes measured.

Behavioral and Psychosocial. Participants experienced a highly significant increase ($P < .001$) in activation (PAM) during the study period (Table 6), and measures of psychosocial function, including anger, anxiety, depression, and relationship satisfaction, improved significantly ($P < .05$). Importantly, baseline

TABLE 4 Participant Baseline Demographics (n = 63)

Highest Level of Education	
Grade school	1 (1.6%)
High school	3 (6.3%)
Undergraduate	23 (36.5%)
Graduate	22 (34.9%)
Postgraduate	14 (22.2%)
Gender	
Male	33 (52.4%)
Female	30 (47.6%)
Ethnicity	
White non-Latino	62 (98.4%)
Other	1 (1.6%)
Age, y	
<40	1 (1.6%)
40-49	8 (12.7%)
50-59	15 (23.8%)
>60	39 (61.9%)
Marital status	
Single	5 (7.9%)
Married	55 (87.3%)
Widowed	3 (4.8%)
Annual household income	
$20 001-$50 000	2 (3.5%)
$50 001-$100 000	7 (12.3%)
>$100 000	48 (84.2%)
Work status	
Employed full-time	18 (28.6%)
Employed part-time	3 (4.8%)
Unemployed	1 (1.6%)
Retired	40 (63.5%)
Other	1 (1.6%)
Health status	
Metabolic syndrome*	21 (33.3%)

*International Diabetes Federation criteria for metabolic syndrome.

activation (PAM) in completers was not significantly correlated with change in risk of stroke (bivariate r = 0.09), diabetes (bivariate r = 0.20), and CHD (bivariate r = –0.12).

Analyses also demonstrated highly significant ($P < .001$) improvements in the median frequency of aerobic exercise and readiness to change (RTC) for stress reduction and mental focus. Strengthening exercise and exercise stage of change remained unchanged, although all other behavioral measures also improved significantly ($P < .05$) (Table 7). Finally, measures of intervention integrity, including WHQ health performance and satisfaction increased significantly ($P < .001$), as shown in Tables 6 and 7.

DISCUSSION

To our knowledge, this is the first study to evaluate an integrative health model that combines an intensive 3-day health immersion and personalized health plan with follow-up education and physician and coaching support. Integrative medicine builds upon concepts of self-determination theory and emphasizes the individual's role in health.[53] For a patient-centered program, one of the key objectives of the current intervention was to help individuals establish health and wellness goals that were based upon their own personal values. A second and equally important objective was to partner with patients in achieving self-stated goals.

Our findings indicate that although cardiac risk remained unchanged, modifiable risk factors for diabetes and stroke decreased significantly across the intervention. While the magnitude of change may appear less than significant from an epidemiological standpoint, it is notable that participants demonstrated improvements in spite of floor effects commonly observed among relatively healthy populations. In addition, multiple psychosocial and behavioral measures improved and participants became more activated towards self-management of health. Significant improvements in patient activation indicate that participants became more confident in making and maintaining healthy lifestyle changes. Importantly, baseline activation did not mediate the changes in modifiable risk. Rather, the intervention itself appears to have activated patients to change lifestyle behavior and reduce risk.

The mean BMI of participants at baseline was near the normal range at 26.8, so many patients sought to maintain an already healthy weight rather than include weight loss among their health goals. Maintenance of a healthy weight represents a clinically relevant outcome in and of itself since body mass tends to increase through the sixth decade of life and such increases are related to high absolute risk of disease and mortality.[54] Participants lost 0.9 kg (approximately 2 lbs; mean = 80.5, SD = 21.3 to mean = 79.6 SD = 21; $P = .01$) across the intervention; however, even moderate weight loss has been associated with improvements in risk factors for cardiovascular disease and diabetes.[55-57] Furthermore, each kilogram of weight loss is on average associated with a decrease in incidence of diabetes by 16%[58] and a reduction in systolic blood pressure of 1.0 to 2.4 mm Hg.[59]

While short-term improvements in KYN disease risk measures may appear modest, the KYN model did not account for the potential long-term benefits that can result from reduced anger, anxiety, and depression and increased social support. Such psychosocial and quality of life measures have shown utility in predicting future health status and mortality.[60,61] High levels of anger, anxiety, and depression have been associated with risk of cardiovascular disease[62] and stroke.[63] Hence, the reduction in anger, anxiety, and depression and improvement in WHQ satisfaction and performance may represent long-term benefits not captured by the KYN disease risk model.

TABLE 5 Changes in Biomarkers of Disease Risk With Integrative Program*

	Baseline			Endpoint			
	Mean	Median	SD	Mean	Median	SD	*P* value†
BMI (kg/m2)	26.8	26.7	5.5	26.5	25.8	25.8	.008
Waist circumference (cm)	91.6	90.0	15.3	90.2	89.5	89.5	.003
Pulse (BPM)	64.8	64.0	9.9	60.7	60.0	60.0	<.001
Systolic BP (mm Hg)	121.0	119.5	13.7	119.8	116.0	116.0	.237
Diastolic BP (mm Hg)	76.8	78.0	7.4	75.6	75.0	75.0	.095
Total cholesterol (mg/dL)	198.8	195.0	40.1	212.4	205.0	205.0	.007
HDL cholesterol (mg/dL)	65.4	66.0	21.0	63.1	64.0	64.0	.109
Glucose (mg/dL)	95.5	91.0	17.1	96.3	95.0	95.0	.300
CRP (mg/L)	2.3	1.4	3.8	2.2	1.2	1.2	.068

*Intention-to-treat sample (n = 63).
†*P* value was calculated by the Wilcoxon Signed Rank Test.
Abbreviations: BMI, body mass index; BPM, beats per minute; BP, blood pressure; HDL, high-density lipoprotein; CRP, C-reactive protein (high sensitivity).

TABLE 6 Changes in Psychosocial Measures With Integrative Program*

	Baseline			Endpoint			
	Mean	Median	SD	Mean	Median	SD	*P* value†
Anger BMS (0-20)	2.6	2.0	2.6	1.9	1.0	2.6	.014
Anxiety BMS (0-20)	3.3	3.0	3.0	2.4	1.0	2.9	.004
Depression BMS (0-20)	2.0	1.0	2.8	1.4	0.0	2.5	.021
Perceived stress PSS (0-16)	3.8	3.0	2.8	4.3	4.0	2.8	.311
Relationship datisfaction RSAT (0-30)	21.7	25.0	8.1	24.4	26.0	6.8	.004
Patient activation PAM (0-100)	68.3	68.0	16.3	76.7	78.0	16.1	<.001
Health satisfaction WHQ (10-100)	68.6	69.0	13.1	75.5	76.0	13.3	<.001

*Intention-to-treat sample (n = 63).
†*P* value was calculated by the Wilcoxon Signed Rank Test.
Abbreviations: BMS, Brief Mood Survey; PSS, Perceived Stress Scale; RSAT, Relationship Satisfaction Test; PAM, Patient Activation Measure; WHQ, Wheel of Health Questionnaire.

Changes Accounting for Reduction in Disease Risk

A significant drop in mean BMI and waist circumference and an increase in aerobic exercise frequency (Tables 5 and 6) explain the decrease in modifiable diabetes risk, as calculated by the KYN disease assessment tool (Table 3). Improvements in BMI and exercise frequency also accounted for the drop in modifiable risk of stroke after the intervention. In contrast, the CHD risk-reducing effects of decreased BMI and increased exercise level were counterbalanced by increases in total cholesterol; these counterbalanced effects explain the lack of improvement in modifiable CHD risk.

The increase in cholesterol observed in the study was interesting since total cholesterol does not increase appreciably with age during the fifth and sixth decades of life.[64] It is not clear which factors contributed to the mean increase in cholesterol; however, a portion of the change can be attributed to three participants whose total cholesterol increased by more than 79 mg/dL each. One of these was diagnosed with cancer and experienced a notable increase in body mass, the second participant increased weight by 1.2 kg (2.6 lbs) and discontinued a lipid lowering medication, and the third participant gained 0.9 kg (2 lbs) but otherwise reported no notable changes.

Resting pulse was not part of the disease risk algorithm; nonetheless, it decreased significantly between baseline and endpoint, probably related to improved exercise level reflecting better fitness and cardiovascular conditioning.

Patient activation at baseline did not predict the variability in disease risk reduction. This result is consistent with the intervention's personalized approach to lifestyle change. The health immersion and follow-up coaching were tailored to the participant's baseline level of motivation and engagement. Clinicians and coaches worked within this context to enhance patient

TABLE 7 Changes in Health Behavior With Integrative Program*

	Baseline			Endpoint			
	Mean	Median	SD	Mean	Median	SD	*P* value†
Stretching frequency (1-4)	1.9	2.0	0.9	2.2	2.0	1.0	.006
Aerobic exercise frequency (1-4)‡	2.3	2.0	1.0	2.6	3.0	0.9	<.001
Strengthening exercise frequency (1-4)	1.8	2.0	0.8	1.9	2.0	0.8	.252
State of Change (RTC): Weight reduction (0-4)	1.8	1.0	1.4	2.4	3.0	1.4	.009
State of Change (RTC): Exercise RTC (0-4)	2.5	3.0	1.3	2.7	3.0	1.3	.122
State of Change (RTC): Healthier eating (0-4)	2.7	3.0	1.2	3.0	3.0	1.0	.008
State of Change (RTC): Stress reduction (0-5)	2.7	3.0	1.8	3.4	4.0	1.7	<.001
State of Change (RTC): Mental focus (0-4)	1.7	1.0	1.3	2.4	3.0	1.4	<.001
Health Performance WHQ (10-100)	67.6	68.5	11.7	74.7	77.0	12.7	<.001

*Intention-to-treat sample (n = 63).
†*P* value was calculated by the Wilcoxon Signed Rank Test.
‡Exercise (>20 min) frequency per week: 1 = fewer than once; 2 = 1-2 times; 3 = 3-4 times; 4 = 5 or more times.
Abbreviations: RTC, readiness to change; WHQ, Wheel of Health Questionnaire.

engagement and accomplish patient-stated goals. These results are encouraging from the standpoint that participants were able to achieve disease risk reduction regardless of baseline level of activation. The increases in PAM seen in the present study can be benchmarked against a previous intervention that also used tailored telephonic coaching as a disease management strategy. Both studies demonstrated significant increases in mean PAM scores; however, the current study showed an increase in score of 8.4 (68.3 at baseline to 76.7 at endpoint) compared to an increase of 4.6 (64.3 at baseline to 68.9 at endpoint) in the benchmark trial.[65]

The moderate utilization of telephonic coaching (50.5% mean utilization of available coaching) is of interest. It contrasts with two of our other studies that used the same approach and even some of the same coaches; in these two RCT studies, telephonic coaching adherence was 74%[26] and 93%.[66] Possible explanations for the utilization differences in the present study include the following: (1) The study intervention offered "optional" IH coaching whereas coaching was much more strongly encouraged in the other two intervention studies; (2) distinct demographics in the present study (ie, older population with fewer women, minorities, and persons of low or moderate socioeconomic status) compared to the previous trials; and (3) according to the treatment team and lead physician, the present sample was composed of "high achievement–oriented individuals, many of whom wanted a personalized health plan and then acted on it independently." Hence, it appears that latent factors such as motivation, personality (eg, Type A), and life experiences (many executives) contributed to the lower level of coaching utilization.

The improvements in disease risk biomarkers seen here are somewhat less extensive then those reported from intensive multimodal lifestyle interventions such as those conducted by Daubenmier et al[23] and Ornish et al.[24] There are, however, substantive differences between the present intervention and previous lifestyle trials. Namely, the current intervention was significantly shorter in duration and intensity. In addition, the current trial was conducted among a sample with lower initial disease risk. Given the rapidly growing cost concerns in health care, it is reasonable to evaluate outcomes in the context of program duration and intensity. Within this context, the results of the current study are notable since they were achieved with a 3-day intervention plus fewer than 4 hours of telephonic follow-up. In contrast, the Lifestyle Heart Trial conducted by Ornish et al[24] employed a 7-day retreat with 4-hour twice-weekly group support meetings lasting for 1 year.

The lifestyle changes in the present study are comparable to those of a previous controlled trial that tested the effects of an integrative intervention with health coaching[26] on cardiovascular

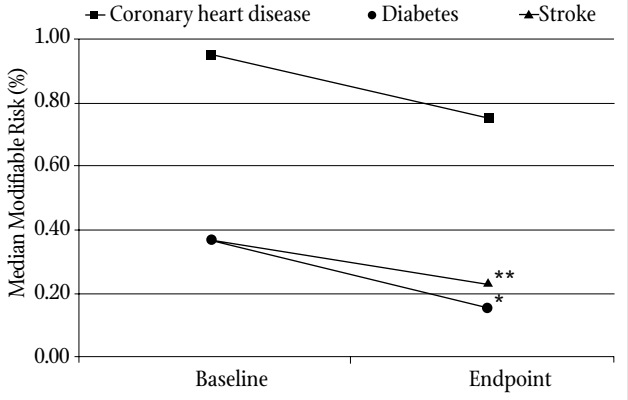

FIGURE 2 Median 5-year Modifiable Disease Risk

The median modiable risk of diabetes decreased (**P*=.02) from 0.37% SD 2.55% to 0.16% SD 2.98%; risk of stroke decreased significantly (***P*<.01) from 0.37% SD 2.09% to 0.23% SD 2.32%; and risk of coronary heart disease declined (nonsignificant; *P*=.17) from 0.95% SD 1.30% to 0.72% SD 1.97%.

risk. The current study was conducted in a healthier population, utilized less coaching, and capitalized on the added benefit of a 3-day health immersion. Both studies, however, demonstrated similar baseline-to-endpoint improvements in readiness to lose weight and increase physical activity, frequency of exercise, and reduction in BMI.

Future study of integrative health models of care would benefit from RCT designs with larger samples. There is also a need to further explore the mechanisms of behavior change and the dose effect of these interventions. Finally, from a cost-effectiveness perspective, it may be useful to clarify which aspects of the program are most effective for which participants.

The principle limitations of this study were low sample diversity, moderate sample size, and the observational study design. The intervention demonstrated effectiveness among a sample of relatively healthy older adults who were predominantly white and reported income and education well above the median. It is yet to be seen if these findings will generalize to other populations. A self-selection bias may have also influenced the results; participants who elected to take part in this study may have had stronger motivation to change health behaviors. However, selection bias is not evident based on initial patient activation scores, which are in fact slightly below the normative mean of 69 observed among employed adults.[40] Also, the observational study design, though appropriate for exploratory purposes, does not account for the influence of expectancy or the natural course of health. Finally, analysis of mean changes in heterogeneous groups presents a challenge since large sample variability can mask important shifts in subsets of individuals. This warrants further study utilizing methods such as structural equation modeling and path analysis to assess individual differences and determine patterns of change.

CONCLUSION

Health behavior changes were accompanied by an improvement in patient activation and psychosocial measures (anger, anxiety, depression, relationship satisfaction) and a decrease in modifiable risk of stroke and diabetes. This suggests that an integrative health model can help patients become more engaged in self-management of health and support them in making and maintaining healthy lifestyle changes.

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