Improving Overall Health Status Through the CHIP Intervention

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***Objective*: To evaluate the efficacy of a coronary heart disease prevention program at improving selected health indicators. *Methods*: A randomized controlled health intervention study was used, with 348 participants from metropolitan Rockford, Illinois, followed for 6 months; ages ranged from 24 to 81 years. Health indicators were based on the SF-36v2. *Results*: Those in the intervention group showed significantly greater increases in scale scores for physical functioning, role-physical, bodily pain, general health perceptions, vitality, social functioning, role-emotional, and mental health. *Conclusion*: The prevention program improved functional health and well-being scores as well as psychometrically based physical and mental health summary measures.**

***Key words*: cardiovascular risk, CHIP, quality of life measures.**

***Am J Health Behav.* 2009;33(2)135-146**

Studies have shown that health promotion efforts can prevent and reverse a variety of chronic conditions.[1-7] For example, programs aimed at reducing high blood pressure, elevated blood cholesterol, cigarette smoking, environmental tobacco smoke, physical inactivity, diabetes, obesity, and dietary fat can reduce the risk of cerebrovascular disease, diabetes mellitus, cancer, and other chronic conditions. Although many chronic disease prevention programs have been shown to be efficacious, few have been successfully translated and disseminated to benefit large numbers of people.[8-10] On the other hand, since 1988 over 40,000 individuals have participated in the Coronary Health Improvement Project (CHIP) in various settings (faith-based communities, worksites, hospitals, and municipalities).[11] There are now more than 150 CHIP alumni chapters and close to 10,000 alumni from faith-based communities alone.[11]

The CHIP is a health education intervention that teaches people the importance of making better choices in nutrition, physical activity, and tobacco in order to prevent, arrest, and possibly reverse coronary heart disease.[12,13] The intervention incorporates learning, in which positive reinforcement, cues, and shaping are carried out on the individual level. The CHIP intervention was designed to improve participants' cognitive understanding of the importance of healthy lifestyles, nutrition and physical activity behaviors, and risk factors associated with diabetes, hypertension, cardiovascular disease, and cancer.[12] Studies, including a randomized controlled trial, have shown that participants in the CHIP intervention significantly improve in health knowledge, diet, and physical activity; and they reduce in several cardiovascular risks.[14-18]

The improved dietary and physical activity behaviors and reduced cardiovas-

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cular risk factors experienced among CHIP participants may also promote better mental health. For example, previous studies have associated weight loss with improved mood state, psychosocial functioning, and mental well-being.[19-22] In addition, physical activity has been shown to positively affect mood, anxiety, and depression.[23-27] In a study involving older individuals suffering from depression, exercise was found to be a reasonable alternative to antidepressant medication in some patients.[28] Deficiencies in the B complex of vitamins have been shown to increase the risk of depressive disorders.[29,30] Excessive alcohol intake has been linked with deficiencies in these vitamins,[31] and alcohol, being a depressant, can worsen existing depression.[32] Further, although caffeinated drinks (eg, coffee and tea) may increase energy levels in depressed people, caffeine can prevent deep, restful sleep, which is necessary for well-being, and can raise anxiety levels.[33]

The purpose of this study is to evaluate the extent to which the CHIP intervention positively influences functional health and well-being, psychometrically based physical and mental health, and a preference-based health utility index. In addition, changes in these outcome measures according to changes in selected demographic, coronary heart disease risk factors, and nutrients from food will also be assessed.

METHODS

Subject Recruitment and Design

Recruitment of study participants was carried out by the SwedishAmerican Center for Complementary Medicine (SACCM) in the greater Rockford, Illinois, metropolitan area. Recruitment involved targeted advertising and marketing through the Centers of Excellence, CHIP alumni groups, corporate client sites, and the Swedish American Medical Group. Four hundred three individuals were assessed for eligibility. Twenty-six were excluded because of major health problems that would prevent them from exercising. A total of 377 completed baseline data collection, but 29 refused to participate in future data collection. This left 348 participants who were randomly assigned to either the health intervention class or the control group. Control participants were told they could enroll in the health intervention class 6 months later. All participants provided informed consent. Forty-two percent participated with a partner or significant other, in which the unit of randomization was the pair. No significant differences in age, sex, race, marital status, annual family income, or education were observed between pairs and individuals at baseline. Randomization was determined by a random-number generator. The study coordinator conducted the participant sign-up process, randomization, and group assignments. Through 6 weeks, 9 people in the intervention group and 3 people in the control were lost to follow-up. By 6 months these numbers increased to 21 and 9, respectively.

Those lost to follow-up through 6 months were significantly more likely to be in the intervention group ($P = 0.022$) and younger ($P = 0.0441$). Loss to follow-up was not significantly associated with sex, race, marital status, income, or education.

Informed consent was provided by all study participants. Participants were encouraged to participate with a spouse or significant other. The cost for those taking the class was $290, of which all was returned if they completed the intervention. Program sign-up, randomization via a random-number generator, and group assignments were made by the study coordinator. The study was approved by the Institutional Review Board of the SwedishAmerican Health System on August 29, 2002.

CHIP Intervention

CHIP is an educationally intensive lifestyle intervention program endorsed by the Physicians Committee for Responsible Medicine and the Center for Science in Public Interest, both headquartered in Washington, DC. The program focuses on developing a greater measure of intelligent self-care involving a clearer understanding of the nature and etiology of heart disease, its epidemiology, and its risk factors. The goal of the program is to facilitate disease reversal by lowering blood cholesterol, triglycerides, and blood sugar levels by reducing excess weight, lowering high blood pressure, enhancing daily physical activity, and eliminating smoking.

The CHIP began in March 2003. Participants met for 4 weeks–4 times each week, Monday through Thursday, for 2 hours–where they attended lectures, food

demonstrations, and question-and-answer sessions. Theory-based intervention planning was used to develop the curriculum, class design, alumni association, and each of the take-home assignments.[34-36] The intervention incorporated learning theory (behaviorism) in which changes in physical and dietary behaviors were promoted using health education and positive reinforcement. Positive reinforcement involved encouragement and positive feedback from staff. In addition, the CHIP alumni program was designed to help participants maintain positive behavior changes through continued encouragement and positive feedback. Topics covered by the CHIP included modern medicine and health myths, atherosclerosis, coronary risk factors, obesity, dietary fiber, dietary fat, diabetes, hypertension, cholesterol, exercise, osteoporosis, cancer, lifestyle and health, the Optimal Diet, behavioral change, and self-worth.

In conjunction with the CHIP lectures, participants received a health promotion textbook and workbooks that closely followed the discussion topics and contained assignments with learning objectives for every topic presented. The workbook allowed participants to test their knowledge on the topics presented through review questions. These assignments were designed to assist participants in understanding and integrating the concepts and information into their own lives. Workbook assignments involved approximately 30 minutes outside of each class session. Dietitians and medical professionals spoke to the group weekly, introducing them to the latest nutritional and medical information related to the prevention of chronic diseases. In addition, participants had access to scheduled shopping tours and cooking demonstrations given by a dietitian. Finally, the lecturer and program staff presided at each of the educational sessions and were available to answer questions regarding the presentations, workbook assignments, and the program.

Participants were encouraged to make and follow dietary and exercise goals. The dietary goal involved adopting a more plant food-based diet, which emphasized "as-grown," unrefined foods high in complex carbohydrates and fiber and low in fat, animal protein, sugar, and salt. Consumption of whole grains, legumes, vegetables, and fresh fruits was encouraged. In addition, the prescribed diet was low in fat (less than 20% of energy), animal protein, sugar, and salt, very low in cholesterol, and high in fiber.

Participants were also encouraged to progress toward regular walking or other forms of exercising at least 30 minutes a day. All participants were given a pedometer and encouraged to keep an exercise log to record the miles walked each day. At the completion of the program, participants were encouraged to join the Rockford CHIP Alumni Organization for an annual cost of $25 for an individual or $35 for a couple. The alumni organization was designed to help participants maintain their new nutritional and physical activity behaviors. A monthly newsletter was sent to alumni containing news of health-promoting community events such as healthy dinners, walking groups, and support-group meetings. The alumni were encouraged to attend special lectures on healthy living and ways to avoid relapse.

Measures

Data were gathered by a registered nurse at baseline, 6 weeks, and 6 months. Demographic data were collected at baseline (age, sex, race, marital status, income, and education). To ascertain energy expenditure contributed by physical activity, a 7-day self-recorded pedometer log was maintained by each participant. Participants wore the Walk4Life Model 2000 Life Stepper pedometer (Plainfield, IL) on a belt at the right hip directly above the right kneecap each day for 7 days. Immediately prior to going to bed, the pedometer counts for the day were recorded and the number reset. Strike counts from pedometers are a valid and reliable method of monitoring and measuring free-living physical activity.[37-39] Weight and height were measured using standard medical scales recently calibrated by the Biometrics Department of the SwedishAmerican Health System. Body mass index (BMI) was determined using the formula: weight (kg)/height (m^2). Further, this study considered alcohol drinking and consumption of coffee and/or tea. The level of consumption of these variables was self-reported, reflecting the number of drinks weekly.

To assess dietary intake, the Block 98 full-length dietary questionnaire (Block 98.2, Block Dietary Data Systems, Berke-

Table 1
Comparison of Demographic Characteristics of Intervention and Control Groups in a Therapeutic Lifestyle-Modification Program

Demographic Characteristic	Intervention (n=174) No.	%	Control (n=174) No.	%	χ^2 P-value
Age					
24–39	83	16.9	74	14.5	0.22
40–49	136	27.6	170	33.3	
50–59	165	33.5	154	30.2	
60+	108	22.0	112	22.0	
Sex					
Male	47	27.0	51	29.3	0.63
Female	127	73.0	123	70.7	
Race					
White	167	96.0	160	93.0	
Black	4	2.3	10	5.8	0.23
Other	3	1.7	2	1.2	
Marital Status					
Never married	12	6.9	20	11.6	0.39
Married	138	79.8	127	73.4	
Divorced	16	9.2	16	9.2	
Widowed	7	4.1	10	5.8	
Annual Family Income					
$0 – <$20,000	14	8.2	12	7.1	0.79
$20,000 – <$40,000	34	20.0	28	16.5	
$40,000 – <$60,000	37	21.8	41	24.1	
$60,000 +	85	50.0	89	52.3	
Education					
<High school	4	2.3	7	4.0	0.16
High school	37	21.5	46	26.6	
Some college	58	33.7	39	22.5	
Bachelor degree	39	22.7	38	22.0	
Post-bachelor degree	34	19.8	43	24.9	

ley, CA) was used. The Block 98 questionnaire has been extensively studied and validated.[40-42] It is self-reported and optically scanned and scored. Daily nutrients from food, obtained from the Block 98, considered in this study are calories, protein, total fat, carbohydrates, calcium, phosphorus, iron, sodium, potassium, saturated fat, polyunsaturated fat, monounsaturated fat, cholesterol, and fiber.

The Short-Form 36 Health Survey Version 2.0 (SF-36v2) was used to measure overall health and functional status from which health-related quality of life may be inferred. It is a generic measure that is not restricted to a single disease state, age-group, or treatment group.[43-45] It is a proven survey for comparing the relative burden of diseases and in differentiating health benefits produced by a wide range of different interventions. The SF-36v2 is a valid and reliable tool that has been extensively adopted in research.[46] The SF-36v2 was administered to participants using pencil and paper.

The SF-36v2 yields an 8-scale profile of functional health and well-being scores as well as psychometrically based physical and mental health summary measures and a preference-based health utility index. These 8 scale profiles are physical functioning, role-physical, bodily pain, general health perceptions, vitality, social functioning, role-emotional, and mental health. Details of these scale

Table 2
Physical Activity, Body Mass Index, and Daily Nutrients From Food at Baseline, 6 weeks, and 6 Months Among Participants in a Therapeutic Lifestyle-Modification Program

Physical and dietary behavior	Time Effect P Value[a]	Group by Time Effect P Value[a]	Baseline Mean	Mean Change Through 6 Weeks	Group by Time Effect P Value[b]	Mean Change Through 6 Months	Group by Time Effect P Value[c]
Physical Activity (steps/week)							
Intervention	<0.0001	<0.0001	40579	12468	<0.0001	13739	<0.0001
Control			43869	2194		5644	
Body Mass Index							
Intervention	**<0.0001**	**<0.0001**	**33.3**	**-1.2**	**<0.0001**	**-2.3**	**<0.0001**
Control			**31.4**	**-0.2**		**-0.3**	
Calories (kcal/day)							
Intervention	<0.0001	<0.0001	2092	-388	<0.0001	-570	<0.0001
Control			1919	-163		-157	
Protein (g/day)							
Intervention	**<0.0001**	**<0.0001**	**79.2**	**-17.2**	**0.0008**	**-23.8**	**<0.0001**
Control			**70.6**	**-5.3**		**-4.3**	
Total Fat (g/day)							
Intervention	<0.0001	<0.0001	88.6	-33	<0.0001	-39	<0.0001
Control			76.8	-8.5		-5.5	
Carbohydrates (g/day)							
Intervention	**<0.0001**	**0.0762**	**248**	**1**		**-26**	
Control			**239**	**-16**		**-22**	
Calcium (mg/day)							
Intervention	<0.0001	<0.0001	854	-166	0.0006	-273	<0.0001
Control			780	-56		-67	
Phosphorus (mg/day)							
Intervention	**<0.0001**	**<0.0001**	**1350**	**-194**	**0.0039**	**-295**	**<0.0001**
Control			**1225**	**-78**		**-70**	
Iron (mg/day)							
Intervention	0.0228	0.0404	15.3	1	0.0167	-0.7	0.6998
Control			14.7	-0.8		-1	
Sodium (mg/day)							
Intervention	**<0.0001**	**0.0036**	**2941**	**-369**	**0.1204**	**-624**	**0.0008**
Control			**2712**	**-243**		**-251**	
Potassium (mg/day)							
Intervention	<0.0001	0.2157	3258	-60		-312	
Control			3072	-159		-188	
Saturated Fat (g/day)							
Intervention	**<0.0001**	**<0.0001**	**26.3**	**-11.5**	**<0.0001**	**-13.3**	**<0.0001**
Control			**21.8**	**-2.8**		**-1.6**	
Polyunsaturated Fat (g/day)							
Intervention	<0.0001	<0.0001	21.2	-6.6	<0.0001	-7.9	<0.0001
Control			19.3	-2		-1.8	
Monounsaturated Fat (g/day)							
Intervention	**<0.0001**	**<0.0001**	**34.3**	**-13.3**	**<0.0001**	**-15.8**	**<0.0001**
Control			**29.7**	**-3.3**		**-2**	
Cholesterol (mg/day)							
Intervention	<0.0001	<0.0001	216	-99	<0.0001	-126	<0.0001
Control			182	-16		4	
Total Dietary Fiber (g/day)							
Intervention	**<0.0001**	**<0.0001**	**19.7**	**9.2**	**<0.0001**	**7.3**	**<0.0001**
Control			**19.5**	**-0.3**		**-0.8**	
Alcohol (servings/week)							
Intervention	<0.0001	0.0001	1.9	-1	<0.0001	-0.5	0.1563
Control			2.0	-0.08		-0.2	
Coffee and/or Tea (servings/week)							
Intervention	**<0.0001**	**<0.0001**	**10.8**	**-5.2**	**<0.0001**	**-3.8**	**0.0179**
Control			**9.6**	**-0.2**		**-1.2**	

Note.

a Based on the F test.

b Based on the F test with means compared between baseline and 6 weeks.

c Based on the F test with means compared between baseline and 6 months.

Table 3
Physical and Mental Health Summary Measures (0-100 scale) at Baseline, 6-weeks, and 6-month Follow-up Among Participants in a Therapeutic Lifestyle-Modification Program

Variable	Time Effect P Value	Group by Time Effect P Value[a]	Baseline Mean	Mean Change Through 6 Weeks	Group by Time Effect P Value[b]	Mean Change Through 6 Months	Group by Time Effect P Value[c]
Physical Functioning							
Intervention	<0.0001	<0.0001	75.9	9.9	<0.0001	11.1	0.0011
Control			80.4	2.6		3.5	
Role-Physical							
Intervention	<0.0001	<0.0001	78.3	9.2	<0.0001	9.2	0.0003
Control			85.1	0.4		-0.5	
Bodily Pain							
Intervention	<0.0001	<0.0001	65.3	12.7	<0.0001	10.6	<0.0001
Control			71.1	1.8		0.9	
General Health							
Intervention	<0.0001	<0.0001	62.4	12.8	<0.0001	11.6	<0.0001
Control			67.9	2.1		3.3	
Vitality							
Intervention	<0.0001	<0.0001	53.4	17.9	<0.0001	13.1	<0.0001
Control			58.5	1.6		4.2	
Social Functioning							
Intervention	<0.0001	<0.0001	80.9	10.5	<0.0001	5.5	0.0052
Control			85.3	0.4		1.5	
Role-Emotional							
Intervention	<0.0001	<0.0001	83.0	9.6	<0.0001	8.6	0.0269
Control			86.3	1.3		3.7	
Mental Health							
Intervention	<0.0001	<0.0001	72.9	9.6	<0.0001	7.3	<0.0001
Control			76.5	1.4		0.9	

Note.
a Based on the F test.
b Based on the F test with means compared between baseline and 6 weeks.
c Based on the F test with means compared between baseline and 6 months.

items are described elsewhere.[45]

Scales were scored so that a higher score indicates a better health state. Raw scale scores were transformed to a 0-100 scale. The 8 scale items had a Cronbach's α of 0.90, which indicates that the items are doing a good job measuring the same underlying concept. The BDI was significantly negatively associated with each of the 8 scale items ($P < 0.0001$).

A z score transformation was also generated for each of the 8 scale items. It was computed by subtracting each scale score at 6 weeks from the corresponding baseline scale score and dividing the difference by the corresponding standard deviation from the scale at baseline. The purpose of the transformation of the 8 SF-36v2 multi-item scales is to enable meaningful comparisons of magnitude of change among the 8 scales.

Statistical Techniques

Cross-tabulations were used to perform bivariate analyses between selected variables, with statistical significance based on the chi-square test for independence (χ^2). The t test was used for assessing differences in means between groups. Repeated measures analyses were performed on multiple measurements of selected response variables using the mixed models method. Stepwise regression analyses were performed to assess the extent that changes in the SF-36v2 quality-of-life measures through 6 months were influenced by the intervention and age, sex, and changes in BMI, total steps, alcohol drinking and coffee or tea consumption, and selected nutrients from food intake. Intervention status was retained in the stepwise regression, with the other variables entering or exiting

Table 4
Percentage of the Change in Each SF-36v2 Scale Through 6 Months Explained by Age, Sex, and Changes in Selected Variables in the Model

	Physical Functioning	Role-Physical	Bodily Pain	General Health	Vitality	Social Functioining	Role Emotional	Mental Health
Group[a]	3%	3%	5%	5%	6%	2%	1%	5%
Group[b]	0%	3%	5%	2%	1%	2%	0%	1%
Age					2%			
Sex					1%			
Change in BMI	7%			7%	5%			
Change in Total Steps	1%	3%	3%			3%		
Change in Calories						2%		
Change in Sodium						1%		
Change in Potassium				1%				1%
Change in Saturated Fat				2%	4%		3%	7%
Change in Polyunsaturated Fat			2%					2%
Change in Fiber					3%		1%	
Change in Alcohol	1%							

Note.
a Only group was included in the model.
b Group was included in each stepwise regression model, with the other variables only entering or exiting from the model at the 0.1 level of significance. Change in variables that failed to enter any of the models included protein, total fat, carbohydrates, calcium, phosphorous, iron, monounsaturated fat, cholesterol, coffee or tea.

based on the 0.10 level of significance. Analyses were performed using SAS version 9.1 (SAS Institute Inc, Cary, NC, USA, 2003). With the exception of using 0.10 in the stepwise analyses, statistical significance was based on the 0.05 level.

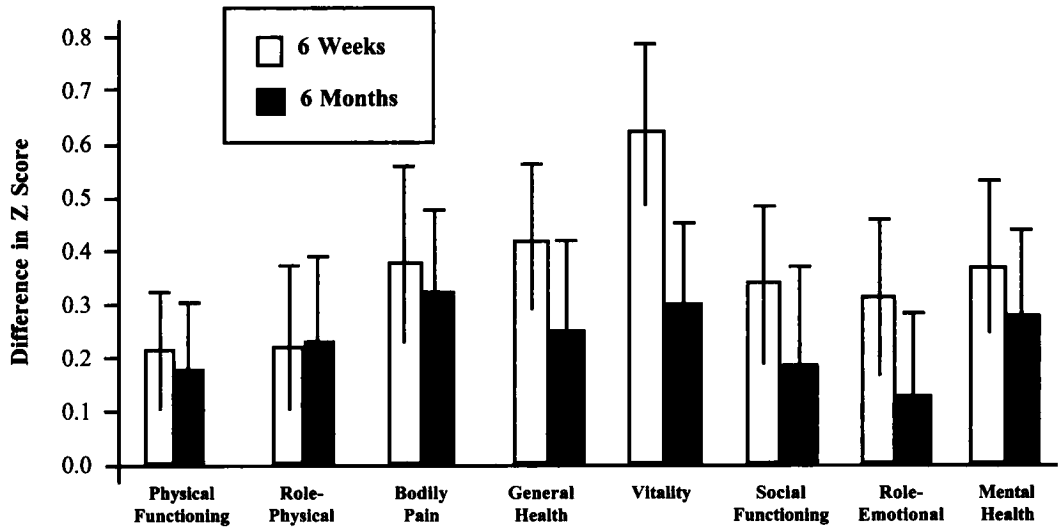
RESULTS

Participants ranged in age from 24 to 81 (M = 50.4, SD = 11.1). No significant difference was observed in the distribution of age, sex, race, marital status, annual family income, and education between the intervention and control groups (Table 1). The study participants tended to be in the age range 40-59, female, white, married, with annual family income of $60,000 or more and to have at least some college education.

At baseline, those in the intervention group compared with those in the control group had significantly higher BMI and dietary protein, total fat, phosphorous, potassium, saturated fat, monounsaturated fat, and cholesterol. A repeated measures design assessed the time (baseline, 6 weeks, and 6 months) and group by time effects for physical activity, body mass index, and selected daily nutrients from foods (Table 2). There were significant time effects for each of the variables and significant differences in the time effects between intervention and control groups for each of the variables, with the exception of carbohydrates and potassium. For those variables with an overall significant group by time effect, group by time effects were assessed from baseline to 6 weeks and from baseline to 6 months. Participants in the intervention group showed significantly greater improvements than those in the control group through 6 weeks in physical activity, BMI, calories, protein, total fat, calcium, phosphorus, iron, saturated fat, polyunsaturated fat, monounsaturated fat, cholesterol, total dietary fiber, alcohol, and coffee and/or tea. Significantly greater improvements among those in the intervention group were also observed through 6 months for each of these variables, with the exceptions of iron and alcohol.

An 8 SF-36v2 scale multivariate repeated measures design was computed with the group, age, and sex as independent variables. The time effect significantly differed across the scales (P <

Figure 1
Mean Difference in Standardized Scoring of the 8 SF-36v2 Scales Between the Intervention and Control Groups



0.0001), and the scale by time effects differed according to group ($P < 0.0001$). The scale effects differed according to age ($P < 0.0001$) and sex ($P < 0.0001$), but the scale by time effects did not differ by the levels of age and sex. A repeated measures design assessed the time and group by time effects for each of the 8 SF-36v2 scales (Table 3). There was a significant time effect for each scale and a significant difference in the time effect between intervention and control groups for each scale. Those in the intervention group compared with those in the control group showed significantly greater increases in scale scores from baseline to 6 weeks and from baseline to 6 months in all the physical and mental health summary measures.

The variation in each of the SF-36v2 scales through 6 months explained by the intervention was between 1% for role-emotional to 6% for vitality (Table 4). Change in physical functioning was explained by changes in BMI, total steps, and alcohol consumption; change in general health was largely explained by changes in BMI, potassium, and saturated fat; change in vitality was largely explained by age, sex, changes in BMI, saturated fat, and fiber; change in role-emotional was explained by changes in saturated fat and fiber; and change in mental health was largely explained by changes in potassium, saturated fat, and polysaturated fat.

Differences in z score standardized scales between the intervention and control groups are presented for each of the 8 SF-36v2 scales at 6 weeks and again at 6 months in Figure 1. The higher values for those in the intervention group compared with the control group are most pronounced through 6 weeks, except for role physical. Through 6 weeks, the intervention had the greatest positive effect on vitality, followed by general health, bodily pain, and then mental health. Through 6 months, the intervention had the greatest positive effect on bodily pain, followed by vitality, mental health, and then general health. The improvement in the intervention compared with the control group was significantly greater at 6 weeks than at 6 months for general health, vitality, and role-emotional.

DISCUSSION

The CHIP was shown to improve physi-

cal activity, BMI, and daily nutrients from food; and lowered consumption of alcohol, coffee, and tea was shown. Although some of these results have been shown previously,[16-18] simultaneous improvements in functional health and well-being, psychometrically based physical and mental health, and a preference-based health utility index among CHIP participants have not been previously reported. The primary purpose of this study was to show whether the CHIP intervention could simultaneously improve functional health and well-being, psychometrically based physical and mental health, and a preference-based health utility index.

Participants in the intervention group compared with the control group had significantly higher scale scores across time for physical functioning, role-physical, bodily pain, general health perceptions, vitality, social functioning, role-emotional, and mental health. Improvements in the scale scores from baseline to 6 weeks tended to be similar to improvements in scale scores from baseline to 6 months, statistically significant in each case. However, much lower mean change through 6 months compared with 6 weeks for social functioning may be because of the nature of the questions upon which social functioning was based: "During the past 4 weeks, to what extent have your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?" and "During the past 4 weeks, how much of the time have your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc)?" Because the intervention took place during the first 4 weeks of the study, merely having taken this class could have influenced this result.

Although a very small component of the intervention directly involved discussing self-worth, the primary explanation for the improved quality-of-life indicators in general appears to be increased physical activity, decreased BMI, and improved levels of daily nutrients from food (Table 4). Increased physical activity has been shown to positively affect mental health.[23-27]

This may be because physical activity increases endorphin and monoamine levels, which, in turn, decrease clinical depression and depressive symptoms.[47,48] Three other psychological hypotheses that have been proposed include (1) the distraction hypothesis, which says that diversion from unfavorable stimuli results in improved mood during and after exercise;[49] (2) the self-efficacy hypothesis, which says that because of the challenging nature of physical activity, consistent involvement might lead to improved mood and self-confidence;[50] and (3) the social interaction hypothesis, which says that social relationships that often accompany physical activity, as well as mutual support among individuals involved in physical activity, may have a positive effect on mental health.[51]

A number of studies have shown that overweight and obese individuals who lose weight experience improved mood state, psychosocial functioning and mental well-being, as well as decreased depression and anxiety.[19-22,52] Better mental health is likely the result of better physical health. Scientific evidence has shown weight loss among overweight individuals can decrease blood pressure (and thereby the risk of hypertension), reduce abnormally high levels of blood glucose (associated with diabetes), bring blood concentrations of cholesterol and triglycerides (associated with cardiovascular disease) down to appropriate levels, improve sleep, decrease osteoarthritis of the weight-bearing joints, increase self-esteem, and decrease depression.[53]

Alcohol is a mood-altering depressant drug.[32] Nearly 40% of heavy drinkers display symptoms that resemble depressive illness.[54] Alcohol consumption may result in low mood as well as anxiety, poor sleep, and reduced appetite. Similarly, caffeine can prevent deep, restful sleep, which is necessary for well-being, and in turn, may raise anxiety levels.[33] Hence, reduction in alcohol drinking and consumption of coffee and/or tea, as observed in the current study, may have contributed to the improved mental health score.

In a general sense, it may be that the 3 psychological hypotheses mentioned above as possible explanations for better mental health among those who engage in physical activity similarly apply to the CHIP overall. Specifically, the CHIP provided a diversion from possibly unfavorable stimuli and facilitated social relationships and a social support system that had a positive effect on mental health. Further, as positive changes were real-

ized in physical activity, nutrition, and cardiovascular risks, self-efficacy increased, further impacting mental health.

Limitations of this study include self-selection and self-reported responses. Participants in both the intervention and control groups were interested in making health behavior changes. They were also primarily white, married, and had an annual income of at least $60,000. Generalization of the results should be made with caution. In addition, self-reported responses may be biased. However, weight and height, which were used to compute BMI, were acquired objectively from a trained nurse, physical activity was monitored using pedometer readings, and individuals were encouraged to complete the questionnaires as accurately and honestly as possible. Further, it is possible that some of the observed effects were the result of simply participating in the CHIP intervention, regardless of the content of the intervention. This may be especially true for those scales (role-physical, bodily pain, and social functioning) where demographic, cardiovascular-risk factors, and nutrients from foods did not explain the significant intervention effect. To assess this, future research might examine the differences in SF-36v2 scale measures between individuals who participate in CHIP and those who participate in a traditional support group.

CONCLUSION

The CHIP study suggests that a community-based lifestyle-change program that improves cardiovascular disease risk factors also improves functional health and well-being, psychometrically based physical and mental health, and preference-based health. For many adults, community-based programs may be the only avenue available to help them adopt and maintain healthy behaviors. The results of this study show that for those who participate in coronary heart disease prevention programs that focus primarily on reducing cardiovascular risks, improvements may also result in an array of quality-of-life indicators that include physical functioning, role-physical, bodily pain, general health perceptions, vitality, social functioning, role-emotional, and mental health.

Acknowledgment

This research was funded by the State of Illinois Excellence in Academic Medicine Act and the SwedishAmerican Health System. ■

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