© Med Sci Monit, 2008; 14(4): PH17-25
PMID: 18376357

Received: 2007.07.26
Accepted: 2008.01.03
Published: 2008.04.01

Cardiovascular risk reduction and factors influencing loss to follow-up in the coronary health improvement project

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Ray M. Merrill[CDEF], **Steven G. Aldana**[ABG]

Department of Health Science, Brigham Young University, Provo, UT, U.S.A.

Source of support: Depertmental sources

Summary

Background: This study determined whether the Coronary Health Improvement Project (CHIP) can improve cardiovascular disease risk factors through one year of follow-up and identified factors influencing loss to follow-up.

Material/Methods: The CHIP program, an intensive four week community-based health education intervention designed to improve coronary risk factors, was evaluated using a quasi-experimental design. Analyses were based on 1,712 community volunteers, ages 30 to 87 from the Rockford, Illinois Metropolitan area. Of the participants, 97.7% completed the lifestyle evaluation at both baseline and after four weeks, and 51% provided data through one year.

Results: Participants showed significant improvements in all cardiovascular risk factors considered (body mass index, resting heart rate, systolic blood pressure, diastolic blood pressure, cholesterol, high-density lipoprotein, low-density lipoprotein, triglycerides, and glucose) after both four weeks and one year. Loss to follow-up was highest among those who were ages 30–39, had a history of diabetes, had a history of being overweight, smoked, lived with a heavy smoker, were physically less active, or were experiencing stress. Those with higher BMI, SBP, DBP, or glucose at baseline were also more likely to be lost to follow-up through one year. Those who failed to improve their BMI, resting heart rate, serum cholesterol, HDL, LDL, triglycerides, or glucose after four weeks were 16%, 9%, 22%, 21%, 16%, 22%, and 15% more likely to be lost to follow-up, respectively.

Conclusions: The CHIP program improves cardiovascular disease risk factors through one year of follow-up. Poorer health status at baseline is associated with increased loss to follow-up. Failure to improve one or more cardiovascular risk factors after four weeks of intervention is predictive of loss to follow-up through one year.

key words: **CHIP • cardiovascular disease risk factors • health education • behavior change**

Full-text PDF: http://www.medscimonit.com/fulltxt.php?ICID=850307
Word count: 3170
Tables: 6
Figures: –
References: 35

Author's address: Ray M. Merrill, PhD, MPH, Professor, Brigham Young University, Department of Health Science, 229-A Richards Building, Provo, Utah 84604, U.S.A.

BACKGROUND

Americans today have more body fat, more metabolic syndrome, and more diabetes than at any other time in recorded history [1,2]. A national trend of increasing incidence of obesity is alarming and the implications are ominous because excessive body fat is the cause of most cases of type 2 diabetes and the cause of death for most diabetics is cardiovascular disease [3]. Even before the recent increases in obesity and diabetes, cardiovascular disease and cancer were the leading killers of Americans. Some have estimated that as much as 82% of cardiovascular disease is lifestyle related [4]. The primary lifestyle-related causes of cardiovascular disease are poor nutrition, lack of physical activity, and tobacco use.

Several lifestyle intervention programs targeting cardiovascular risks by altering lifestyle behaviors have been developed [5–10]. One such program is the Coronary Health Improvement Project (CHIP) [11]. The CHIP was created with the goal of reducing atherosclerosis-related diseases and improving the overall health of the public by providing a lifestyle change program to both the community and the workplace. The CHIP, developed as a 30-day, 40-hour live lecture educational course, highlights the importance of making better lifestyle choices for preventing and reducing cardiovascular disease. The program also teaches participants how to implement these choices through a change in dietary, physical activity, and smoking habits.

Using the CHIP in a community setting, Diehl was able to use a one-group pre-test/post-test design to document significant reductions in several cardiovascular risk factors [12]. Pre- and post-intervention (4 weeks) data from 288 participants were gathered and analyzed. Results indicated significant decreases in systolic blood pressure (SBP), diastolic blood pressure (DBP), body mass index (BMI), and body weight. Participants also experienced significant reductions in total cholesterol and low-density lipoprotein (LDL) cholesterol levels. Men and women with the highest baseline LDL cholesterol levels (>189 mg/dL) exhibited the largest decreases (34% and 19% respectively). Additionally, 83% of the male participants who had elevated triglyceride levels at baseline were able to lower their triglyceride levels. A randomized clinical trial assessing the CHIP showed similar results after four weeks of follow-up [13]. Further investigation of the CHIP showed that improvement in many heart disease risk factors after four weeks persisted through six months of follow-up, as did health knowledge, diet knowledge, and diet and physical activity behaviors [14].

Since 2000, CHIP community-based classes have been conducted. The purpose of this study is to determine whether in this real world setting, the CHIP can improve cardiovascular disease risk factors through one year of follow-up. The study will also characterize those participants most likely to be lost to follow-up. A better understanding of those who are not likely to comply with the intervention may assist researchers in improving compliance.

MATERIAL AND METHODS

Recruitment

Participants in this study voluntarily enrolled in one of six separate CHIP classes offered through the SwedishAmerican Center for Complimentary Medicine (SACCM). Recruitment was conducted by CHIP alumni groups, corporate clients, and the SACCM through targeted advertising and through marketing efforts. Complete recruitment details of the intervention have been published elsewhere [11]. The SwedishAmerican Health System (SAHS) is the largest medical care provider in Rockford, Illinois. Like many other health care providers, SwedishAmerican Health System is trying to integrate primary prevention efforts into the existing disease treatment model. This desire is demonstrated by its support for research efforts that can evaluate primary prevention strategies.

All participants were encouraged to enroll in the study with a spouse or significant other to increase their support network. For those who participated in the program with their partner (42%), the unit of randomization was *pairs*. For those who participated as individuals (58%), the unit of randomization was *individuals*. No significant differences were observed between pairs and individuals. The study was approved by the Institutional Review Board of the SwedishAmerican Health System in January 2003.

Intervention

The CHIP is an intensive community-based education intervention. Participants attend a four-week class, with four sessions per week. Each class is two hours long. Cumulative class time is approximately 32 hours. Theory-based intervention planning was used to develop the curriculum, class design, alumni association, and each of the take-home assignments [15–17]. The intervention incorporated learning theory (behaviorism) in which changes in physical and dietary behaviors were promoted using health education and positive reinforcement. In addition to encouragement and positive feedback from staff, the CHIP alumni program was designed to help participants maintain positive behavior changes. The curriculum includes the following topics: atherosclerosis, cardiovascular risk factors, obesity, dietary fiber, smoking, diabetes, hypertension, hypercholesterolemia, dietary fat and cholesterol, exercise, osteoporosis, cancer, lifestyle and health, the optimal diet, behavioral change, and intrinsic self-worth.

To compliment the program, participants receive a textbook and workbooks with additional information, worksheets, and exercises to reinforce class content. These materials closely follow the discussion topics and contain assignments with learning objectives for each topic. The purpose of the assignments was to help participants better understand and integrate the concepts and information presented in the class lectures. Participants also had access to scheduled grocery shopping tours and cooking demonstrations given to further support program objectives. Additionally, medical professionals and community health advocates were invited to speak, providing nutrition, physical activity, and medical information.

Participants were guided and motivated to set progressive dietary and exercise goals. The dietary goals included adopting a more plant-food centered diet with an emphasis on unrefined complex carbohydrate foods (65–70% of total calories), such as grains, legumes, vegetables, and fresh fruits. The diet is low in fat (less than 20% of energy), an-

imal protein, sugar, and salt, very low in cholesterol, and high in fiber and micronutrients.

Exercise recommendations from the Centers for Disease Control and Prevention were followed [18]. Program participants progressively worked toward walking at least 30 minutes each day. They maintained daily exercise logs and recorded miles walked. Upon completion of the intensive four-week instructional program, participants were encouraged to enroll in the CHIP alumni association. CHIP alumni receive a monthly newsletter, have socials, dinners, and special events designed to help them maintain their new behaviors, and provide extra social support.

The lifestyle evaluation was completed by participants before and after the four-week program, and again at one year. It provided information on demographics, health history, asthma/hay fever, current smoking and alcohol use, medical history, and whether and how often they exercised. Demographic information included age, gender, and marital status. A dichotomous variable was created to indicate a history of heart disease if they had previously experienced angina, a heart attack, an angioplasty, a bypass, heart failure, an abnormal EKG (last 3 years), or irregular heartbeats. The other variables were dichotomized as yes or no, except for exercise, which had four levels: "none," "mild 2–3 days/week," "moderate 3–5 days/week," and "vigorous 4–6 days/week."

The lifestyle evaluation also collected information on weight and height, which was used to calculate BMI. The evaluation also recorded information on blood pressure, pulse, and results from blood tests. Trained program staff measured weight and height using standard medical weight and height scales regularly calibrated by the Biometrics Department of the SwedishAmerican Hospital. BMI was determined using the formula: weight (kg)/height (m^2). Current definitions commonly in use for BMI were adopted: 18.5–24.9 for normal weight, 25.0–29.9 for overweight, and 30 or greater for obese [19]. Total cholesterol mg/dL, high-density lipoprotein (HDL) cholesterol mg/dL, LDL cholesterol mg/dL, triglycerides mg/dL, and glucose (fasting) mg/dL were taken with a fasting blood draw.

There were 1,712 CHIP participants (aged 30 years and older) from six classes who were followed for 1 year. The average number of participants in these classes was 285, with the smallest cohort having 168 participants and the largest cohort having 421 participants. Of the participants, 1,672 (98%) completed the lifestyle evaluation at both baseline and after four weeks. The number of participants who completed the lifestyle evaluation at baseline and one year was 873 (51%). Race is not considered because approximately 95% of the participants were Caucasian.

Statistical analysis

Descriptive assessment of selected demographic, health history, and exercise variables were made using frequencies, percentages, means, and standard deviations. Mean scores for selected cardiovascular risk factors were derived at baseline, four weeks, and one year. Changes in mean scores for BMI, SBP, DBP, total cholesterol, HDL, LDL, triglycerides, and glucose were assessed using the paired t-test [20]. The percentage lost to follow-up across the levels of demographic, health history, exercise, stress, and cardiovascular risk factor variables were assessed using the Mantel-Haenszel chi-square test for trend [21]. Relative risks were calculated, adjusted for age and the CHIP class of the participants, in order to further assess the increased risk of being lost to follow-up through one year across the levels of the selected variables. Corresponding confidence intervals were calculated. Statistical significance and confidence intervals were based on the 0.05 level. Analyses were performed using SAS version 9.1 (SAS Institute Inc, Cary, NC, USA, 2003).

Table 1. Description of 1,712 Coronary Health Improvement Project (CHIP) participants according to selected variables.

	No.	%
Age		
30–39	126	7.36
40–49	374	21.85
50–59	645	37.68
60–69	403	23.54
70–79	164	9.58
Female	1,115	65.13
Married	1,371	80.98
History of heart disease*	384	22.43
History of cancer	38	2.22
History of diabetes	228	13.32
History of being overweight	867	50.64
Lives with heavy smoker	75	4.38
Current smoker	72	4.21
Alcohol drinker	732	42.76
Exercise		
None	627	37.08
Mild 2–3 days/week	585	34.59
Moderate 3–5 days/week	403	23.83
Vigorous 4–6 days/week	76	4.49

* History of angina, heart attack, angioplasty, bypass, heart failure, abnormal EKG (last 3 years), or irregular heartbeats.

Results

Participants had a mean age of 55.2 (SD=10.7), ranging from 30 to 87. A description of the study participants is presented in Table 1. The majority of participants were female, married, had a history of being overweight, and exercised two or more days per week. About 43% drank alcohol weekly. Among the chronic diseases considered, a history of heart disease was most common, followed by diabetes and then cancer. More than 4% lived with a heavy smoker and/or were current smokers.

Mean cardiovascular risk factor scores for the participants were 31.2 (SD=7.5) for BMI, 135.8 mm Hg (SD=18.9) for SBP,

Table 2. Mean cardiovascular risk factor scores and change scores after four weeks and after one year for 1,712 Coronary Health Improvement Project (CHIP) participants according to loss to follow-up status after one year.

Cardiovascular risk factor	Lost to follow-up after one year			
	No.#	Baseline	After four weeks	Mean change
Body mass index	843	32.60	31.48	–1.12***
Resting heart rate, beats/min	835	72.12	69.62	–2.50***
Systolic blood pressure, mm Hg	842	137.17	130.55	–6.62***
Diastolic blood pressure, mm Hg	842	83.14	78.62	–4.52***
Cholesterol, mg/dL	844	203.52	182.78	–20.74***
High density lipoprotein, mg/dL	844	52.76	46.53	–6.23***
Low-density lipoprotein, mg/dL	832	120.59	107.45	–13.14***
Triglycerides, mg/dL	844	158.60	146.81	–11.79***
Glucose, mg/dL	843	111.67	105.75	–5.92***

Cardiovascular risk factor	Not lost to follow-up after one year					
	No.#	Baseline	After four weeks	Mean change	After one year	Mean change
Body mass index	866	29.89	28.74	–1.15***	28.43	–1.46***
Resting heart rate, beats/min	860	71.48	68.75	–2.73***	68.54	–2.94***
Systolic blood pressure, mm Hg	866	134.35	128.12	–6.23***	130.92	–3.43***
Diastolic blood pressure, mm Hg	866	80.87	77.28	–3.59***	77.71	–3.16***
Cholesterol, mg/dL	867	202.71	179.13	–23.58***	197.24	–5.47***
High density lipoprotein, mg/dL	867	52.18	46.00	–6.18***	50.14	–2.04***
Low-density lipoprotein, mg/dL	834	120.4	105.92	–14.48***	118.44	–1.96*
Triglycerides, mg/dL	867	155.82	141.38	–14.44***	143.51	–12.31***
Glucose, mg/dL	867	103.85	99.28	–4.57***	96.29	–7.56***

Tests of significance based on the paired t-test.
Numbers may differ because of nonresponse to the specific items; * p<0.05; ** p<0.01; *** p< 0.001.

82.0 mm Hg (SD=10.2) for DBP, 203.0 mg/dL (SD=40.1) for total cholesterol, 52.4 mg/dL (SD=14.1) for HDL, 120.5 mg/dL (SD=33.6) for LDL, 157.0 mg/dL (SD=125.5) for triglycerides, and 107.7 mg/dL (SD30.3) for glucose. Changes in these cardiovascular risk factors after four weeks and after one year are presented according to loss to follow-up status at one year (Table 2). Significant decreases occurred for each of the cardiovascular risk factors in both time periods for those lost and those not lost to follow-up at one year. Those lost to follow-up had significantly higher mean BMI, SBP, DBP, and glucose at baseline.

Younger age, a history of diabetes, a history of being overweight, a history of smoking, living with a smoker, and less exercise at baseline were significantly associated with an increased risk of being lost to follow-up (Table 3). Sex, marital status, history of heart disease, history of cancer, and drinking alcohol were not significantly associated with loss to follow-up (data not shown). The relationship between baseline categories of the selected cardiovascular risk factors and loss to follow-up are presented in Table 4. For example, compared with those with normal serum glucose at baseline, those with serum glucose of 110–125 mg/dL were 15% more likely to be lost to follow-up and those with serum glucose of at least 126 mg/dL were 33% more likely to be lost to follow-up.

Participants were asked at baseline whether they sleep restlessly, feel under pressure, are easily emotionally upset, or feel fearful or depressed (Table 5). These stress-related variables were also associated with follow-up status at one year. Restless sleeping or feeling under pressure affected about 34% of the participants; being easily emotionally upset affected about 23%; and feeling fearful or depressed affected roughly 18%. The risk of loss to follow-up significantly increased among those who indicated they slept restlessly, felt under pressure, were easily emotionally upset, or felt fearful or depressed. For example, those who indicated that

Table 3. Distribution of selected variables at baseline for 1,712 Coronary Health Improvement Project (CHIP) participants according to loss to follow-up status after one year.

	Baseline no.	Loss to follow-up no.	Loss to follow-up %	Relative risk[#]	95% CI[#]
Age					
30–39	126	78	62**	1.00	–
40–49	374	194	52	0.76	0.60, 0.97
50–59	645	313	46	0.68	0.54, 0.86
60–69	403	176	44	0.60	0.48, 0.77
70+	164	78	48	0.56	0.41, 0.78
History of diabetes					
No	1,484	694	47***	1.00	–
Yes	228	145	67	1.49	1.25, 1.78
History of being overweight					
No	845	374	44***	1.00	–
Yes	867	465	54	1.23	1.12, 1.35
Lives with heavy smoker					
No	1,637	792	48*	1.00	–
Yes	75	47	63	1.36	1.01, 1.82
Smoker					
No	1,640	794	48*	1.00	–
Yes	72	45	63	1.23	0.95, 1.75
Exercise					
None	627	333	53***	1.00	–
Mild 2–3 days/week	585	300	51	0.99	0.88, 1.12
Moderate 3–5 days/week	403	161	40	0.82	0.73, 0.92
Vigorous 4–6 days/week	76	31	41	0.83	0.69, 1.01

Tests of significance based on the Mantel-Haenszel chi-square test for trend.
[#] Adjusted for age and CHIP class; * p<0.05; ** p<0.01; *** p<0.001.

they were easily emotionally upset were 22% more likely to be lost to follow-up. Those who experienced one or two of these four stress-related variables compared with none were 18.3% (95% CI 6.6% to 31.4%) more likely to be lost to follow-up. Those who experienced three to four of these stress variables compared with none were 27.1% (95% CI 11.5% to 45.0%) more likely to be lost to follow-up.

The number of stress-related variables experienced was directly associated with BMI. After adjusting for age and CHIP class, BMI was 30.2, 31.2, 31.9, 32.5, and 35.6 for those experiencing 0, 1, 2, 3, or 4 of the stress conditions at baseline. This positive relationship was statistically significant (P<0.0001).

In addition to considering how baseline values were associated with loss to follow-up, changes in cardiovascular risk factor status through four weeks was also predictive of loss to follow-up (Table 6). Those who failed to improve their cardiovascular risk status after four weeks were significantly more likely to be lost to follow-up (P<0.05), with the exception of SBP (P=0.22) and DBP (P=0.22). For example, those who failed to improve their total cholesterol after four weeks of the intervention were 22% (95% CI 10% to 37%) more likely to be lost to follow-up.

Discussion

The CHIP is effective at improving nutrition, exercise, and lowering tobacco use. Positive improvements were observed through four weeks and one year for the selected cardiovascular risk factors considered in this study. Improved heath risks are believed to be primarily the result of the adoption and maintenance of healthy nutrition and physical activity behaviors.

Table 4. Distribution of selected cardiovascular risk factor scores by baseline category for 1,712 Coronary Health Improvement Project (CHIP) participants according to loss to follow-up status after one year.

Cardiovascular risk factor category	Baseline no.	Loss to follow-up no.	Loss to follow-up %	Relative risk	95% CI[#]
Body mass index (kg/m^2)					
Normal (18.5–24.9)	325	113	35***	1.00	–
Overweight (25.0–29.9)	556	237	43	1.68	1.43, 1.96
Obese (≥30.0)	826	485	59	1.23	1.03, 1.46
Resting heart rate, beats/min					
<70	729	344	47	1.00	–
70–79	524	267	51	1.06	0.96, 1.18
≥80	442	216	49	1.05	0.94, 1.18
Systolic blood pressure (mm Hg)					
Normal (<120)	287	123	43**	1.00	–
Prehypertensive (120—139)	752	354	47	1.11	0.96, 1.29
High (140—159)	467	248	53	1.30	1.12, 1.51
Dangerous (≥160)	202	110	54	1.34	1.13, 1.60
Diastolic blood pressure (mm Hg)					
Normal (<80)	622	262	42***	1.00	–
Prehypertensive (80—89)	672	337	50	1.15	1.02, 1.28
High (90—99)	326	186	57	1.33	1.17, 1.50
Dangerous (≥100)	88	50	57	1.31	1.09, 1.58
Total cholesterol (mg/dL)					
Normal (<200)	835	410	49	1.00	–
Borderline (200—239)	582	280	48	0.98	0.88, 1.08
High risk (≥240)	294	149	51	1.01	0.89, 1.14
High-density lipoprotein (mg/dL)					
High (≥60)	435	219	50	1.00	–
Normal (40—59)	497	497	50	1.02	0.91, 1.13
Low (<40)	292	123	42	0.95	0.81, 1.10
Low-density lipoprotein (mg/dL)					
Optimal (<100)	472	238	50	1.00	–
Above optimal (100—129)	571	280	49	1.00	0.89, 1.12
Borderline (130—159)	423	192	45	0.93	0.81, 1.06
High (160—189)	158	76	48	1.00	0.84, 1.20
Very high (≥190)	42	28	67	1.15	0.93, 1.42
Triglycerides (mg/dL)					
Normal (<150)	1,023	494	48	1.00	–
Borderline (150—199)	320	155	48	0.99	0.87, 1.12
High (200—499)	248	181	52	1.02	0.91, 1.14
Very high (≥500)	20	9	45	0.99	0.62, 1.60
Glucose (mg/dL)					
Normal (<110)	1,268	46	04***	1.00	–
Impaired fasting glucose (110—125)	220	53	24	1.15	1.02, 1.29
Diabetes (≥126)	222	62	28	1.33	1.20, 1.48

Tests of significance based on the Mantel-Haenszel chi-square test for trend.
[#] Adjusted for age and CHIP class; * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 5. Distribution of selected stress factors at baseline for 1,712 Coronary Health Improvement Project (CHIP) participants according to loss to follow-up status after one year.

Stress risk factors	Baseline no.	Loss to follow-up no.	Loss to follow-up %	Relative risk	95% CI#
Sleep restlessly					
No	1,125	521	46**	1.00	–
Yes	587	318	54	1.16	1.06, 1.27
Feel under pressure					
No	1,124	526	47*	1.00	–
Yes	588	313	53	1.11	1.01, 1.23
Easily emotionally upset					
No	1,317	619	47**	1.00	–
Yes	395	220	56	1.22	1.08, 1.37
Feel fearful or depressed					
No	1,403	669	48*	1.00	–
Yes	309	170	55	1.18	1.04, 1.34

Tests of significance based on the Mantel-Haenszel chi-square test for trend.
Adjusted for age and CHIP class; *p<0.05; **p<0.01; ***p<0.001.

Table 6. The risk of being lost to follow-up after one year if no improvement was observed in the selected cardiovascular risk factor after four weeks.

Cardiovascular Risk Factor	Baseline No.**	No improvement no.	No improvement %	Relative risk*	95% CI*
Body mass index (kg/m^2)	1,662	94	5.7	1.16	1.05, 1.29
Resting heart rate, beats/min	1,644	738	44.9	1.09	1.00, 1.18
Systolic blood pressure (mm Hg)	1,663	576	34.6	1.07	0.96, 1.19
Diastolic blood pressure (mm Hg)	1,663	631	37.9	1.07	0.96, 1.19
Total cholesterol (mg/dL)	1,669	319	19.1	1.22	1.10, 1.37
High-density lipoprotein (mg/dL)	1,669	294	17.6	1.21	1.08, 1.36
Low-density lipoprotein (mg/dL)	1,612	424	26.3	1.16	1.04, 1.30
Triglycerides (mg/dL)	1,669	800	47.9	1.22	1.11, 1.35
Glucose (mg/dL)	1,667	658	39.5	1.15	1.04, 1.28

* Each variable adjusted for age, CHIP class, and baseline cardiovascular risk factor category;
** Numbers may differ because of nonresponse to the specific items.

With most cardiovascular lifestyle interventions there is a certain amount of healthy behavior recidivism; that is, after the formal intervention ends many participants revert to previous behaviors, which subsequently results in the return of heart disease risk factors to baseline levels. Therapeutic lifestyle trials that lasted longer than three months and included lipid outcomes have reported such outcomes [22–25]. Among those who were not lost to follow-up after one year in the current study, a partial return to baseline scores was observed for all cardiovascular risk factors except resting heart rate and serum glucose, which continued to improve through one year. However, the improvements observed through one year remained statistically significant for each of the cardiovascular risk factors. Although it is unknown whether those who were lost to follow-up would have continued to show significant improvement in the cardiovascular risk factors through one year, after four weeks they showed similar improvements to those not lost to follow-up through one year.

The CHIP followed a simple framework for behavior change: improving awareness, enhancing motivation, building skills,

and providing opportunities for healthy behaviors [26]. As participants worked though the program they gained awareness, motivation, skills, and learned how community, cultural, and environmental factors can either encourage or discourage health behaviors. Other lifestyle intervention programs that targeted cardiovascular risks by altering lifestyle behaviors have used similar frameworks. Gordon and colleagues used a community-based lifestyle management program to help 2,390 ethnically diverse men and women reduce hypertension, hyperlipidemia, and impaired blood glucose [27]. After 12 weeks, many participants reached healthy risk levels without pharmocotherapeutic intervention. After one year, Boylan and colleagues showed that education and one-on-one follow-up can significantly change health risk behavior [28]. They also demonstrated that a comprehensive community-based screening and individualized review conducted in neighborhood places of worship decrease women's risk for cardiovascular disease. Community cardiovascular disease prevention interventions in Holland and Sweden also showed that it is possible to lower dietary fat consumption, increase physical activity and improve BMI, waist to hip ratios, and serum cholesterol concentration [29,30]. Using just participant education and awareness, the Hearts for Life program was able to improve cardiovascular disease risk knowledge and reduce risk behaviors in healthy adults over a short time period [5].

Part of the apparent success of the CHIP may be due to the concentrated, intense immersion that was experienced by participants. This intensity is markedly different from what participants in a rural community trial such as the "Health and Inequalities in Finnmark" cardiovascular disease risk reduction trial might experience [31]. Participants in this intervention used empowerment and cooperation between different organizations, and the primary healthcare system to help a fishing community in the Norwegian Artic reduce cardiovascular risk factors [31]. After several years, participants experienced an 8.6% increase in physical activity, and reduced SBP by 0.01 mmHg and DBP by 2.1 mmHg. These small improvements would be expected from a fairly diffused community-wide attempt to change nutrition and physical activity behaviors. This intervention is considerably less intense than the CHIP and would be expected to have a much smaller impact. Earlier CHIP studies utilized a randomized clinical trial design and found similar positive results with reductions in chronic disease risk factors [13,14].

The analysis on loss to follow-up indicates that people most likely lost to follow-up are younger, have a history of diabetes, have a history of being overweight, smoke, live with a heavy smoker, or are less physically active at the beginning of the study. The younger age may be related to the fact that the participants tended to be older and that younger people, particularly those in their 30s, may not have felt as comfortable with the social climate. The other variables may reflect individuals who are less health oriented, thus less likely to remain in a lifestyle change program over the long run. Other variables related to a general health orientation that were associated with loss to follow-up were body mass index, systolic and diastolic blood pressure, and glucose.

Studies have associated stress with heavier body weight [32–35]. In the current study, a positive relationship was observed between the number of stress-related items and BMI. The stress-related items also predicted loss to follow-up.

This intervention study suffers from some internal threats to validity. Health history, exercise, and stress variables were self-reported, which may be biased. Further, a control group which was not exposed to the intervention was not available. Yet, similar results to the current study were found in a previous randomized controlled trial of the CHIP [13,14]. Participants were community volunteers who may have had elevated levels of commitment and motivation since the program is relatively intensive. The potential for selection bias may affect internal validity and delimits the generalizeability of the results. Thus, these results may represent best case and may only be applicable to similarly motivated volunteers. Results at the one year point may also be misleading because of the high loss to follow-up. However, the large percentage of participants lost to follow-up allowed us to identify factors associated with their failure to remain in the study through one year.

Conclusions

The CHIP study shows that a community based lifestyle change program improves most cardiovascular disease risk factors. For many adults, community based programs may be the only avenue available to help them adopt and maintain healthy behaviors. For many of those who are willing to participate, improvements in health risks can persist for a year and beyond. However, those who begin with poorer cardiovascular health and higher emotional stress are less likely to remain in the CHIP. In addition, those who failed to improve their cardiovascular risk after the initial four weeks of the intervention were significantly more likely to be lost to follow-up after one year. Future studies should address ways to improve participation and decrease loss to follow-up among individuals in community lifestyle change programs with poorer cardiovascular health and greater emotional stress. Ways to retain those who fail to show improvements during the initial period of the study also needs consideration.

References:

1. Behavioral Risk Factor Surveillance System, Center for Disease Control, 2004. Available at: URL:*www.cdc.gov/brfss*
2. Foreyt JP: Need for lifestyle intervention: how to begin. Am J Cardiol, 2005; 96(4A): 11E–14E
3. Must A, Spadano J, Coakley EH et al: The disease burden associated with overweight and obesity. JAMA, 1999; 282(16): 1523–29
4. Stampfer MJ, Hu FB, Manson JE, Rimm EB, Willett WC: Primary prevention of coronary heart disease in women through diet and lifestyle. N Engl J Med, 2000; 343(1): 16–22
5. Kirk-Gardner R, Steven D: Hearts for Life: a community program on heart health promotion. Can J Cardiovasc Nurs, 2003; 13(1): 5–10
6. O'Donnell MP: A simple framework to describe what works best: improving awareness, enhancing motivation, building skills, and providing opportunity. Am J Health Promot, 2005; 20(1): Suppl.1–7 following 84, iii
7. Gordon NF, Salmon RD, Franklin BA et al: Effectiveness of therapeutic lifestyle changes in patients with hypertension, hyperlipidemia, and/or hyperglycemia. Am J Cardiol, 2004; 94(12): 1558–61
8. Boylan MJ, Renier CM, Knuths JS, Haller IV: Preventing cardiovascular disease in women: an intervention-control randomized study. Minn Med, 2003; 86(5): 52–56
9. Ronda G, Van Assema P, Candel M et al: The Dutch Heart Health community intervention 'Hartslag Limburg': results of an effect study at individual level. Health Promot Int, 2004; 19(1): 21–31
10. Lingfors H, Lindstrom K, Persson LG et al: Lifestyle changes after a health dialogue. Results from the Live for Life health promotion programme. Scand J Prim Health Care, 2003; 21(4): 248–52

11. Englert HS, Diehl HA, Greenlaw RL: Rationale and design of the Rockford CHIP, a community-based coronary risk reduction program: results of a pilot phase. Prev Med, 2004; 38(4): 432–41
12. Diehl HA: Coronary risk reduction through intensive community – based lifestyle intervention: the Coronary Health Improvement Project (CHIP) experience. Am J Cardiol, 1998; 82(10B): 83T–87T
13. Aldana SG, Greenlaw RL, Diehl HA et al: Effects of an intensive diet and physical activity modification program on the health risks of adults. J Am Diet Assoc, 2005; 105(3): 371–81
14. Aldana SG, Greenlaw RL, Salberg A et al: The Behavioral and Clinical Effects of Therapeutic Lifestyle Change on Middle-aged Adults. Prev Chronic Dis, 2006; 3(1): A05. Epub 2005 Dec 15
15. Green LW, Kreuter NW: Health promotion planning: an educational and ecological approach. Mountain View, CA, Mayfield, 1999
16. McKenzie JF, Smeltzer JL: Planning, implementing, and evaluating health promotion programs: a primer. Boston, MA, Allyn & Bacon, 2001
17. Armitage CJ, Conner M: Social cognition models and health behaviour: a structured review. Psychol Health, 2000; 15: 173–89
18. Pate RR, Pratt M, Blair SN et al: Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA, 1995; 273(5): 402–7
19. World Health Organization Technical Report Series 894. Obesity: preventing and managing the global epidemic. Geneva: World Health Organization, 2000. Available at: *http://whqlibdoc.who.int/trs/WHO_TRS_894_(part1).pdf*
20. Goulden CH: Methods of Statistical Analysis, 2nd ed. New York: Wiley, 1956; 50–55
21. Mantel N, Haenszel W: Statistical aspects of the analysis of data from retrospective studies of disease. J Natl Cancer Inst, 1959; 22: 719–48
22. Tudor-Locke C, Bell RC, Myers AM et al: Controlled outcome evaluation of the First Step Program: a daily physical activity intervention for individuals with type II diabetes. Int J Obes Relat Metab Disord, 2004; 28(1): 113–19
23. Toobert DJ, Glasgow RE, Strycker LA et al: Biologic and quality-of-life outcomes from the Mediterranean Lifestyle Program: a randomized clinical trial. Diabetes Care, 2003; 26(8): 2288–93
24. McAuley KA, Williams SM, Mann JI et al: Intensive lifestyle changes are necessary to improve insulin sensitivity: a randomized controlled trial. Diabetes Care, 2002; 25(3): 445–52
25. Oldroyd JC, Unwin NC, White M et al: Randomised controlled trial evaluating the effectiveness of behavioural interventions to modify cardiovascular risk factors in men and women with impaired glucose tolerance: outcomes at 6 months. Diabetes Res Clin Pract, 2001; 52(1): 29–43
26. O'Donnell MP: A simple framework to describe what works best: improving awareness, enhancing motivation, building skills, and providing opportunity. Am J Health Promot, 2005; 20(1): Suppl 1–7 following 84, iii
27. Gordon NF, Salmon RD, Franklin BA et al: Effectiveness of therapeutic lifestyle changes in patients with hypertension, hyperlipidemia, and/or hyperglycemia. Am J Cardiol, 2004; 94(12): 1558–61
28. Boylan MJ, Renier CM, Knuths JS, Haller IV: Preventing cardiovascular disease in women: an intervention-control randomized study. Minn Med, 2003; 86(5): 52–56
29. Ronda G, Van Assema P, Candel M et al: The Dutch Heart Health community intervention 'Hartslag Limburg': results of an effect study at individual level. Health Promot Int, 2004; 19(1): 21–31
30. Lingfors H, Lindstrom K, Persson LG et al: Lifestyle changes after a health dialogue. Results from the Live for Life health promotion programme. Scand J Prim Health Care, 2003; 21(4): 248–52
31. Lupton BS, Fonnebo V, Sogaard AJ; Finnmark Intervention Study. The Finnmark Intervention Study: is it possible to change CVD risk factors by community-based intervention in an Arctic village in crisis? Scand J Public Health, 2003; 31(3): 178–86
32. Petroni ML, Villanova N, Avagnina S, Fusco MA, Fatati G, Compare A, Marchesini G; QUOVADIS Study Group. Psychological distress in morbid obesity in relation to weight history. Obes Surg, 2007; 17(3): 391–99
33. Nishitani N, Sakakibara H: Relationship of obesity to job stress and eating behavior in male Japanese workers. Int J Obes (Lond), 2006; 30(3): 528–33
34. Wyshak G: Weight change, obesity, mental health, and health perception: self-reports of college-educated women. Prim Care Companion J Clin Psychiatry, 2007; 9(1): 48–54
35. Dragan A, Akhtar-Danesh N: Relation between body mass index and depression: a structural equation modeling approach. BMC Med Res Methodol, 2007; 7: 17

www.IndexCopernicus.com

One Stop Shop in Science

- Scientists networking & collaboration
- Online Research Team
- Scientists profiles
- Individual career monitor
- Personalized information delivery
- Information intergration: literature/grants/patents/jobs

INDEX COPERNICUS

Index Copernicus International Plc.

International Office: 415 Madison Ave., 14th Floor, New York , NY 10017, U.S.A.
phone +1 (646) 673-8415, fax +1 (646) 673-8414

European Office: Ustrzycka 11, 01-141 Warsaw, Poland
phone +48 (0)22 868 1265, fax +48 (0)22 868 1273

e-mail: office@IndexCopernicus.com