LONG-TERM OUTCOMES OF A WELLNESS PROGRAM FOR SALT LAKE COUNTY EMPLOYEES

by

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SUPERVISORY COMMITTEE APPROVAL

of a dissertation submitted by

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This dissertation has been read by each member of the following supervisory committee and by majority vote has been found to be satisfactory.

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FINAL READING APPROVAL

To the Graduate Council of the University of Utah:

I have read the dissertation of Beverly Hyatt Neville in its final form and have found that (1) its format, citations, and bibliographic style are consistent and acceptable; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the supervisory committee and is ready for submission to The Graduate School.

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ABSTRACT

The Salt Lake Valley Health Department established a worksite intervention called the Healthy Lifestyle Incentive Program (HLIP) in 1990, as a voluntary option for 4000 eligible employees. Its initial impact on health risk factors was evaluated in 1996. After 18 years in operation, this study reports on facets of the program from three different studies, with the perspective of its long history.

Five different sets of guidelines from the literature and industry experts were synthesized, and a process evaluation on the existing program used the resulting 10 elements. A quantitative analysis used data gathered from archived records for employees who participated between 1997 and 2007. With a quasi-experimental retrospective cohort study design, dosage levels were compared to outcomes, with post hoc subgroup analysis. The indicator for dosage was the annual points earned by participants. A final study was a comparison between self-reports of health behaviors and the participants' biometric outcomes over 10 years, as an evaluation of the accuracy of the self-reports upon which most of the program's incentive-award system is based.

In the process evaluation, HLIP's greatest strengths were found in comprehensive screening which addresses multiple health issues and a well-developed incentive plan. Weaknesses were found in involving stakeholder partners in program planning and in building cultural and social supports. A demographic summary showed that long-term

participants in HLIP were more likely to be female, college educated, and White or Asian.

The quantitative analysis showed that decreasing BMI, body fat percent, and total blood cholesterol were significantly correlated with increased intervention dosage. Post hoc subgroup comparisons for BMI, blood pressure and blood cholesterol risk categories showed greatest improvements resulted for those in the highest risk levels.

On the basis of this study, HLIP has demonstrated effectiveness in many areas, and has the potential for more impacts on employee health by focusing on areas identified.

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Background

The Salt Lake Valley Health Department established a worksite intervention called the Healthy Lifestyle Incentive Program (HLIP) in 1990, in response to increasing rates of chronic lifestyle-related diseases (Katz, et al. 2005). Since that year, these chronic diseases including heart disease, cancer and diabetes have continued to emerge as the most serious health concerns facing the population.

Public health workers had made remarkable progress during the twentieth century, according to a report from the Centers for Disease Control and Prevention (CDC, 1999). Reflecting on their accomplishments over the past century, the report called the improvements in safer and healthier foods one of the top 10 greatest achievements of the 1900s. However, as nutritional deficiency diseases like pellagra and rickets therefore declined, new diseases of abundance emerged, such as obesity, heart disease, and diabetes.

On the occasion of CDC's 60th anniversary, one former director observed that after public health made dramatic advances in controlling infectious diseases, the focus shifted to programs addressing the emerging leading killers of cancer, heart disease and diabetes (Mason, 2006). These chronic diseases are now the primary causes of death for Americans, and obesity is one of the key precursors. The surgeon general called the health consequences of obesity among the most burdensome public health issues faced by the nation, and called on leaders from diverse groups to cooperate in addressing them (USDHHS, 2001).

Lifestyle-related chronic diseases are now the leading causes of death and illness not only in the United States, but throughout the world. The World Health Organization (WHO) announced in their most recent release of *World Health Statistics* that chronic diseases such as heart disease and stroke, associated with the Western lifestyle, have become the primary causes of death worldwide, now eclipsing infectious diseases which had traditionally been the biggest killers (WHO, 2008).

In their summary of the public health impact of obesity, Visscher and Seidell (2001) noted that obesity has already grown to epidemic proportions and is continuing to increase worldwide, with an especially rapid rise in disability and decrease in quality of life. They advocated for preventing weight gain rather than treating people who are already obese, but admitted that few prevention programs have been successful.

Another evidence of obesity's effect on public health is its economic impact. Estimated direct costs of obesity in 2001 were around 7% of the total healthcare costs in the United States (Visscher & Seidell, 2001). Obesity has been shown repeatedly to be among the major risk factors for diabetes, cardiovascular disease, and cancer (Katz et al., 2005), and these chronic diseases are known to add to the rapidly increasing healthcare costs (Visscher & Seidell, 2001). In 1996, Hoffman and colleagues found that healthcare per capita costs for those with chronic conditions are over three times higher than those of persons without chronic conditions (Hoffman, Rice, & Sung, 1996). They further projected that applying the rate in 1995 to future years, the numbers of chronic sufferers and their direct healthcare costs would both increase by 50% in the next 35 years.

Recent evidence has revealed diabetes as one of the most costly of the chronic diseases. In 2002, people with diabetes incurred 18% of all healthcare costs, and per capita medical expenditures for people with diabetes were 2.4 times higher than for those without diabetes (Hogan, Dall, & Nikolov, 2003). Visscher and Seidell called diabetes "by far the most expensive public health consequence of obesity" (2001, p. 356).

Employers providing healthcare insurance have been severely affected by these increasing costs. From 2001 to 2005, municipal employees' healthcare costs increased 63% at the same time that general budgets increased 15% (BMRB 2007). For the population of interest, Salt Lake County employees, the increase in health care insurance costs from 2001 to 2008 was 95.2% (Townsend, 2007).

Worksite Setting for Health Promotion

Because most of the adult population is employed, the worksite is an important setting where adults can be educated to reduce the prevalence and burden of overweight and obesity. According to a task force assembled by the Centers for Disease Control and Prevention (CDC), one important advantage to addressing health in the worksite is that these areas "allow access to employees in a controlled environment through existing channels of communication and social support networks" (Katz et al., 2005, p. 2). Chapman (2004) called the worksite one of the most influential settings where health education can take place and health behaviors can be improved.

In the early 1970s, programs to promote health in worksites had primarily only a medical, first aid, or substance abuse and smoking cessation focus. In the 1980s

Employee Assistance Programs to assess and treat alcohol and drug abuse in employees were widely implemented in worksites; however they focused on wellness but not on prevention. The first published study on a worksite wellness intervention reported a program for hypertensive employees at Gimbels department store in New York (Alderman & Schoenbaum, 1975). However, by the 1990s, lifestyle issues and chronic disease prevention were a higher priority to be addressed (UDOH, 2007).

Many researchers have documented cost savings, estimating that for every dollar spent on a worksite wellness program, a company would save $6.00 in reduced health care costs (UDOH, 2007). In another study wellness program participation correlated with decreased employee absenteeism, resulting in a cost savings of $15.60 for every dollar spent on the program (Aldana et al., 2005).

Status of Worksite Health Promotion Research

In many of the articles about successful interventions, researchers report recurring themes of effective elements, including (a) complex interventions that integrate other disciplines and target multiple health behaviors; (b) longer-term programs instead of single event or short-term interventions; and (c) financial incentives, showing success proportional to dollar value offered.

Evidence of Effective Interventions

Goetzel and colleagues (1998), employing a cross-sectional study of over 8,000 employees in a large corporation with a well-developed wellness program, found a strong association between worksite health promotion and decreased health care costs. The components of the effective programs they identified included one-on-one risk intervention, referrals of high-risk individuals to clinicians, screenings, participation incentives and fitness programs integrated with weight management. Reaching similar conclusions that year, Sorensen and her team (1998) found improvements in dietary habits and smoking in a randomized intervention study after 2 years of health education programs that included worker-management participation and worksite environmental changes, rather than shorter single-issue programs.

Aldana (2001) showed effectiveness of health promotion programs in a review of 72 studies. He researched the question of whether health promotion programs improve financial outcomes in worksites. Synthesizing the data from the various worksite wellness approaches, he found a strong correlation between high health risks and both health care costs and absenteeism. He also showed that fitness programs were associated with reduced health care costs, but more comprehensive health promotion programs were associated with both lower health care costs and lower absenteeism.

In one systematic review of worksite health promotion interventions commissioned by the Centers for Disease Control and Prevention, the most common programs found to address obesity included nutrition education, exercise prescription, behavioral techniques, providing self-directed materials, specific dietary prescriptions, financial incentives, and group exercise programs. Among the 20 qualifying studies, reviewers found evidence of significant positive effectiveness only when nutrition and physical activity were both included in multicomponent programs (Katz et al., 2005).

Sorensen, Linnan and Hunt (2004) reviewed worksite programs that sought to increase fruit and vegetable consumption. They discovered that support was needed from multiple areas including management, supervisors, and the workers' neighborhoods and families. Programs were more effective when they addressed more than one risk factor and included multiple agency delivery.

Naito and a large team (2008) demonstrated that a 4-year physical activity intervention was successful in raising HDL cholesterol in over 2000 participants in five worksites. Additional components adding to the program success included environmental rearrangement and awareness campaigns that targeted walking. In a review of 38 studies about exercise interventions, Trost and colleagues (2002) identified social support as a strong correlate of successful engagement and participation in physical activity programs.

Chapman (2005) published a meta-evaluation of 58 studies conducted between 1983 and 2005. One of the findings was that recent studies (after 1994) used newer prevention technologies, which are also associated with higher levels of outcome effectiveness and economic return. Such successful elements include the following:

1. Use of the Transtheoretical Model and stages of change (Prochaska, 2007)
2. Internet-provided health information
3. Tailoring to specific target populations risk and protective factors
4. Benefits-linked financial incentives
5. Telephonic high-risk intervention coaching
6. Self-directed change
7. Annual required morbidity-based health risk appraisals (HRAs) used for individual targeting of interventions.

Questions That Remain

Including these effective core components does not guarantee an effective program. Despite the inclusion of core program components of effectiveness in several tested interventions, the results have not always been positive. For example, many reports mention the need for environmental supports (Goetzel, 2007; Koffman, 2005; UDOH, 2007), yet in a Missouri study of environmental factors, Catlin and colleagues (2003) failed to find an association between the worksite infrastructure and overweight. In a study in the Netherlands, environmental measures were instituted to facilitate healthier food choices in a company lunchroom. However, the intervention did not result in increasing fruit and vegetable intake and decreasing fat intake as intended, but actually caused attitude and self-efficacy scores to become more negative (Engbers et al., 2006).

Physical Activity Alone

An Australian team found that many physical activity programs have been ineffective in decreasing obesity (Atlantis et al., 2006). They reviewed 10 randomized controlled trials of worksite physical activity interventions and found inconsistencies in program design and high dropout rates. They concluded that the exercise programs that they examined without a dietary intervention were not effective, and that significant barriers to exercise in the worksite exist.

Educational Messages

Although Koffman (2005) and others advocate frequent and simple health messages such as are found on posters in many places of work, one study in New Zealand found no effect on physical activity with posters that promoted the use of stairs (Badland & Schofield, 2005). In fact, when posters were made visible, measures of physical activity by men stayed the same and activity by women decreased.

Contests and pedometers are popular ways to promote activity, but a team competition program with pedometers in a Salt Lake City worksite failed to increase physical activity over 12 weeks (Behrens, Domina, & Fletcher, 2007). Another promotion of physical activity using pedometers evaluated men's reactions to the *10,000 Steps a Day* message (Burton, Walsh, & Brown, 2008). They found that most of the men in ages 45-65 years did not like the messages and were not interested in the health program.

Use of Screenings

Biometric screenings are included in most worksite programs, but their value in promoting health is not always evident (Chapman, 2003). Chapman reviewed 38 research articles about routine biometric tests and concluded that screening programs may represent a significant financial expenditure without a corresponding improvement in the health status of the population being screened. Specifically, he noted that screening is only meaningful after careful targeting of high risk groups. Screening asymptomatic working adults, especially women, was not found to be helpful. Those at highest risk who are most in need of health improvement are least likely to volunteer for screenings.

Incentives

Monetary incentives are frequently used in health promotion, and their value is controversial. Recent studies reflect an increased interest in measuring the effects of financial incentives in worksite interventions. Eric Finkelstein and his colleagues (2007) tested different levels of financial rewards in an employee weight loss program. They discovered that in a 3-month period, weight loss was proportional to the amount of money offered, with $7 per pound sufficient to motivate employees to lose weight.

Kruger and colleagues (2007) also completed a recent survey about preferred incentives. With over 2000 respondents, they concluded that the most preferred incentives were employer-provided location and work time for exercising, weight loss programs and exercise classes at work, and healthy vending and cafeteria food choices.

Hall (2008) studied health incentives and predicted their use would continue to increase in the near future. However he pointed out some disadvantages, such as the possibility of abuse of the incentive system from those who exaggerate self-reports, the desired behavior stopping when the reward stops, and incentives rewarding unintended consequences, such as unhealthy or extreme dieting behavior for weight loss rewards. He recommended that simple incentives are generally better than complicated programs, and those tied in closely to the behavior are more effective than cash prizes.

In related business management applications, Kohn (1993) argued against using incentives. He maintained that external monetary rewards decreased intrinsic motivation. "Any incentive or pay-for-performance system tends to make people less enthusiastic about their work" (p. 62). He also asserted that rewards succeed at securing only temporary compliance. Since rewards are extrinsic motivators they may even work against producing lasting changes in attitudes and behavior, because they replace intrinsic motivation (Kohn, 1993).

With the opposite view in a more recent article, Chapman strongly defended the use of incentives saying "incentives are absolutely essential to participation and engagement in wellness and prevention activities for virtually all populations and are likely to become a standard feature of health plans" (Chapman, 2006, p. 431).

In summary, components of worksite wellness programs that are possibly effective but not consistently successful include solitary interventions, monetary incentives, environmental supports, and general screenings. More consistently effective have been found to be integrated multicomponent programs that include management participation, targeted screening and counseling, and social support.

Need for This Study

Despite the popularity of worksite programs, health status has not improved appreciably over the population. *Healthy People 2010*, a national health promotion and disease prevention initiative by the Department of Health and Human Services, identified two specific goals for increasing health promotion programs in the worksite setting. Goal 7-5 is to "*Increase the proportion of worksites that offer a comprehensive employee health promotion program to their employees*" (USDHHS, 2000). A target of 75% was set, and the baseline in 1999 was 33-50% of worksites having such programs (Lusk & Raymond, 2002). Goal 7-6 is to "*Increase the proportion of employees who participate in employer-sponsored health promotion activities*." Again the target was 75% and the baseline in 1999 for employees who participated in any component of an employer-provided health program was 61%. In Salt Lake County, 37.5% of employees participate in the complete Healthy Lifestyle Incentive Program.

The *Healthy People 2010 Midcourse Review* noted that indicators in several focus areas are now even farther from stated goals than they were at baseline. American people are getting less healthy instead of progressing toward targets (USDHHS, 2006). As indicated in Table 1.1, diabetes prevalence has increased from 5.5 new cases per 1000 at baseline to 7.6 new cases per 1000 in 2006. The percentage of adults with high blood pressure has increased to 31 instead of decreasing from the baseline of 26%. Researchers theorized that increases in both diabetes and high blood pressure reflected increases in obesity.

Fewer Americans are making healthy nutrition choices, with only 34% consuming recommended amounts of saturated fats, and 29% eating recommended amounts of total fats. While the goal was set to increase to 65% the number who limited sodium, the actual number has decreased to only 13%. As of 2006 only 32% of adults were at a healthy weight, compared to 42% at baseline, and 33% are obese, compared to 23% when the goals were set in 2000. Possible causes have been theorized to include general increases in portion sizes and more sedentary habits.

The Healthy People 2010 report noted that the highest risk employees are least likely to participate in worksite wellness programs and that many such programs lack comprehensive design or sufficient duration. This study of Salt Lake County's worksite wellness program was undertaken to explore results over an extended period. The program has functioned since 1990 when 714 employees joined the program, comprising 28% of the 2540 employees eligible. The program 18 years later includes the same elements as it did originally and the participation rates are at 37.5%. Based on self-recorded health logs turned in monthly, at the end of the year employees' healthy behaviors are assigned a score and they receive a cash bonus according to points accumulated.

Table 1.1

Progress Toward Healthy People 2010 Targets

Focus Area	Objectives for Improving Health	Target	Baseline 2000	Progress
5-2 *	Prevent diabetes (new cases per 1,000 population per year)	3.8	5.5	7.6 by 2006
5-5 *	Reduce the diabetes death rate. (deaths per 100,000 population)	46	75	77 by 2005
5-6	Reduce diabetes-related deaths among persons with diabetes (deaths per 1,000 persons with diabetes)	7.8	8.8	6.9 by 2006
5-7	Reduce deaths from cardiovascular disease in persons with diabetes (deaths per 100,000 persons with diabetes)	299	332	232 by 2005
7-5	Increase the proportion of worksites that offer a comprehensive employee health promotion program to their employees (percent of worksites with >750 employees)	50	75	no data
7-6	Increase the proportion of employees who participate in employer-sponsored health promotion activities (percent)	88	67	59
12-1	Reduce coronary heart disease deaths (deaths per 100,000 population)	162	203	154 by 2005
12-7	Reduce stroke deaths (deaths per 100,000 population)	50.	62	47 by 2005
12-9 *	Reduce the proportion of adults with high blood pressure (percent)	14	26	31 2001-2004
12-10	Increase the proportion of adults with high blood pressure whose blood pressure is under control.	68%.	25%	36 2001-2004
12-11	Increase the proportion of adults with high blood pressure who are taking action (for example, losing weight, increasing physical activity, or reducing sodium intake) to help control their blood pressure.	98%.	84%	93 2003
12-12	Increase the proportion of adults who have had their blood pressure measured within the preceding 2 years and can state whether their blood pressure was normal or high	95%	90%	90 2003
12-13	Reduce the mean total blood cholesterol levels among adults (mg/dL)	199	206	202 2004
12-14	Reduce the proportion of adults with high total blood cholesterol levels	17%	21%	17
12-15	Increase the proportion of adults who have had their blood cholesterol checked within the preceding 5 years	80%	67%	73 2003
15-19	Increase use of safety belts	92%	69%	82 2005
19-1 *	Increase the proportion of adults who are at a healthy weight (BMI = 18.5-24.9)	60%.	42%	32 2006
19-2 *	Reduce the proportion of adults who are obese (BMI $\geq$ 30)	15%	23%	33 2006
19-5	Increase the proportion of persons aged 2 years and older who consume at least two daily servings of fruit	75%	39%	40 2004
19-6	Increase the proportion of persons aged 2 years and older who consume at least three daily servings of vegetables, with at least one-third being dark green or orange vegetables	50%	4%	4 2004
19-7	Increase the proportion of persons aged 2 years and older who consume at least six daily servings of grain products, with at least three being whole grains	50%	4%	3 2004
19-8	Increase the proportion of persons aged 2 years and older who consume less than 10% of calories from saturated fat	75%	36%	34 2004

Table 1.1 continued

Focus Area	Objectives for Improving Health	Target	Baseline 2000	Progress
19-9 *	Increase the proportion of persons aged 2 years and older who consume no more than 30% of calories from total fat	75%	33%	29 2004
19-10 *	Increase the proportion of persons aged 2 years and older who consume 2,400 mg or less of sodium daily	65%	15%	13 2004
19-16	Increase the proportion of worksites that offer nutrition or weight management classes or counseling	84%	54%	no data
22-1	Reduce the proportion of adults who engage in no leisure-time physical activity.	20%	40%	39 2006
22-2	Increase the proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least 30 minutes per day	50%	32%	31 2006
22-3	Increase the proportion of adults who engage in vigorous physical activity that promotes the development and maintenance of cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion	30%	23%	22 2006
22-4	Increase the proportion of adults who perform physical activities that enhance and maintain muscular strength and endurance.	30%	18%	19 2003
22-5	Increase the proportion of adults who perform physical activities that enhance and maintain flexibility	43%	30%	31 2001
22-13	Increase the proportion of worksites offering employer-sponsored physical activity and fitness programs.	75%	46%	no data
27-1	Reduce tobacco use by adults			
	Cigarette smoking	12%	24 %	21
	Spit tobacco	0.4%	2.5 %	2.3
	Cigars	1.2 %	2.4 %	2.2
27-5	Increase smoking cessation attempts by adult smokers.	75%	41%	43 2006

*Objectives in which results are growing even farther away from the targets, rather than making progress toward reaching HP 2010 goals (USDHHS, 2006).

The program is funded by a surcharge in employee insurance premiums which pays for supplies, two full-time employee equivalents, and the yearly cash bonuses. After 4 years of this program's implementation, its impact on health risk factors was assessed. Poole, Kumpfer, and Pett (2001) found significant improvements in the 304 participants in body fat, cholesterol, blood pressure, physical activity, smoking prevalence, and seat belt use, by using a prospective cohort design. Few worksite wellness programs have been evaluated longitudinally (Pelletier, 2005), but conducting a longitudinal study was feasible for this program.

Now that the same worksite program has been in place for 18 years, this longer-term retrospective study shows some of the program's effects on employees who have been involved for 10 years or more. A preliminary analysis of enrollment data found that enrollment in the program as of the end of 2007 was 1495 employees. Of these, 475 were enrolled 10 years earlier in 1997, and 398 have participated for 10 consecutive years.

Scope of Proposed Study

To understand more about the effectiveness of this program, this study sought to examine three main areas: (a) overall changes in health of employees over a 10-year period, (b) differences in results for continuous HLIP participants compared to intermittent or withdrawing participants, and (c) the association between self-reports of health behaviors and biometric outcomes. Demographics of participants and the effects of the program on employees at different risk levels at baseline were also examined.

Research Questions

1. How did levels of participation in HLIP, as measured by points earned, compare to improvements in health behaviors (as reported in Health Risk Appraisals) and in biometric health outcomes, from year 1 to year 10?

H_o: Level of participation in HLIP (as measured by points earned) is not associated with change in health behaviors and biometric outcomes.

H_a: Higher level of participation in HLIP (as measured by points earned) is positively associated with greater improvements in health behaviors and biometric outcomes.

Design. A quasi-experimental retrospective cohort study was used, with a post hoc subgroup analysis comparing high dosage to low dosage. The indicator for dosage was points earned by participants.

High dose: O_{98} X O_{99} X O_{00} X O_{01} X O_{02} X O_{03} X O_{04} X O_{05} X O_{06} X O_{07}

Low dose: O_{98} X O_{99} X O_{00} X O_{01} X O_{02} X O_{03} X O_{04} X O_{05} X O_{06} X O_{07}

2. How did three levels of consistency of participation in HLIP (continuous for 10 years, intermittent over 10 years, and terminated before the end of 10 years) correspond to improved health behaviors and biometric measures of outcomes, from baseline to end of participation?

H_o: Consistency of participation is not associated with change in health behaviors and biometric health outcomes.

H_a: Greater consistency of participation is positively associated with improved health behaviors and biometric health outcomes.

Design. A retrospective cohort, with cross-sectional assessment at baseline of three different groups.

(a) Continuous Group

O_{98} X O_{99} X O_{00} X O_{01} X O_{02} X O_{03} X O_{04} X O_{05} X O_{06} X O_{07}

(b) Intermittent Group:

O_{97} X O_{98} X O_{99} X O_{00} X O_{01} . . . O_{07}

(c) Withdrawn Group:

O_{97} X O_{98} X O_{99} X O_{00} X O_{01}

3. How did selected self-reported health behaviors of HLIP participants compare with biometric health outcomes?

H_o: Improved change in self-reported health behaviors is not associated with improved change in biometric measures of blood pressure, body mass index, body fat percent, and cholesterol level.

H_a: Improved change in self-reported health behaviors is associated with improved overall change in biometric measures of blood pressure, body mass index, body fat percent, and cholesterol level.

Methods

Design

A quasi-experimental retrospective cohort study was used employing a post hoc statistical between-subjects design comparing outcomes to dosage. The number of points earned annually was the indicator of high versus low dosage. Additionally subjects served as their own within-subjects controls, comparing baselines from 1997 to the repeated measures every year until 2007.

Changes in self-reported health behaviors were compared to changes in biometric outcome measures (Table 1.2).

Participants

Participants were chosen from the current database of Salt Lake County employees. All 475 individuals who had recorded data between 1997 and 2007 were included in this study. We differentiated between those who were involved continuously and those who dropped out and re-entered. There were 375 who were involved continuously for 10 years. Baseline measurements were taken from their HRAs, screening forms, and biometric data in 1997.

Measures

For each year between 1997 and 2007, participants completed the Carter Center for Emory University's *Health Risk Appraisal* which was assessed by Gazmarian and

Table 1.2

Potential Associations Between Behaviors and Outcomes

Self-reported Health Behaviors	Potentially Related Biometric Health Outcomes
Fruit and vegetables consumption	Weight, blood pressure
High fat food consumption	Weight, total cholesterol
High fiber food consumption	Weight, total cholesterol
Days per week of exercise	Weight, body fat percent
Monthly exercise points accrued	Weight, body fat percent
Use of hypertension medication	Blood pressure

associates (1991), and the Utah Department of Health's *Blood Pressure/Cholesterol Screening Form*. Their responses to selected questions were noted, including those about blood pressure, exercise activity, and eating behaviors.

Biometric measurements were recorded as they were taken by Health Department staff and were noted for comparison to the self-reports. Body fat percent was measured with three different methods over the 10 years. Different scales were used for weighing participants over the 10 years, but each was calibrated for accuracy. Total blood cholesterol and blood pressure were measured with the same instruments for 10 years. Height was obtained by self-report from participants. Body mass index was determined using the formula: weight (kg)/height $(m)^2$.

Data Collection Methods

The data have been collected over 10 years. This constitutes a limitation to the study in that true consistency of collection methods can not be confirmed. Although the staff has been relatively stable, considerable turnover occurs over 10 years, with resulting potential variation in collection of biometric measures. This has been moderated by a consistent and detailed training program for all staff employed in annual screenings.

Cholesterol measurements have been done for all 10 years with the Cholestech LDX System which has been certified by the Cholesterol Reference Method Laboratory Network (CRMLN, 2007). This certification validates that the system meets the gold standard for accuracy and reproducibility developed by the CDC (Cholestech, 2006).

Weights have been taken on different scales over the years, which may introduce a small amount of inconsistency in the data collected. Each scale was calibrated before screenings, to minimize the instrumentation difference. Another source of variation is that heights have been self-reported rather than measured in the clinic. Two different recent studies of self-reported heights and weights found weight was under-reported by 3.2 % but height was over-reported by less than 0.2% (Nyholm et al., 2007) and (Brunner Huber, 2007), so the self-reports of height are likely accurate enough for this study.

Introduction to Additional Chapters

Chapter 2 contains a description and qualitative evaluation of Salt Lake County's wellness program. Citing five sources from the literature which suggest guidelines for success in worksite interventions, the *Healthy Lifestyle Incentive Program* is assessed as to compliance with the best current evidence-based recommendations.

Chapter 3 reports the major 10-year longitudinal outcomes of the HLIP intervention by the two main research questions regarding the effectiveness of the wellness program, using archival data.

Chapter 4 reports on the third research question, showing comparisons between outcome measures and employee self-reports during the 10-year study period.

Chapter 5 summarizes the results of the study and highlights major findings, limitations, implications, and recommendations for the future.

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CHAPTER 2

DESCRIPTION AND PROCESS EVALUATION OF A WORKSITE WELLNESS PROGRAM

Abstract

Obesity and lifestyle diseases are among the most serious public health issues in our nation, and the worksite is an important setting for programs which address these health issues. This study describes the long-term worksite intervention of Salt Lake County's *Healthy Lifestyle Incentive Program* (HLIP) and presents a process evaluation as a case study of how elements in worksite wellness programs can be prioritized.

Guidelines from five different health education and industry expert sources were synthesized, resulting in a list of 10 basic elements with common threads from the five guideline sources. The 10 elements were then used in a case study and each given a score of 0 to 4. The resulting scores were used to prioritize improvement efforts.

The highest scoring elements were annual screenings, financial incentives, and multiple health issues addressed. Lowest scores were received by involvement of partners and social and cultural supports. Other areas needing improvement included management and environmental supports, communication of health messages, individual focus, referrals to other health services, and program evaluation.

These findings can be used by program administrators to further develop the HLIP and enhance its strengths. One critical need is for a quantitative evaluation of program outcomes, now that HLIP has been implemented for 18 years.

Background

The U.S. Surgeon General called the health consequences of obesity among the most burdensome public health issues faced by the nation, and called on leaders from diverse groups to cooperate in addressing them (USDHHS, 2001). Because most of the adult population is employed, the worksite is an important setting where adults can be educated to reduce the prevalence and burden of overweight and obesity. According to a task force assembled by the Centers for Disease Control, one important advantage to addressing health in the worksite is that these areas "allow access to employees in a controlled environment through existing channels of communication and social support networks" (Katz et al., 2005, p. 2). Chapman (2004) called the worksite one of the most influential settings where health education can take place and health behaviors can be improved.

In the early 1970s, programs to promote health had a medical, first aid, or smoking cessation focus. The first published study on a worksite intervention reported a program for hypertensive employees at Gimbels department store in New York (Alderman & Schoenbaum, 1975). In the 1990s, lifestyle issues and chronic disease prevention were addressed (UDOH, 2007). Health promotion in the worksite has evolved over the past 3 decades and hundreds of studies have now been documented about what makes worksite health promotion successful. Five compilations will be listed here, showing various ways of describing key elements of successful health promotion.

In 2005, the Utah Department of Health surveyed 482 companies in Utah, and assessed their compliance with *Healthy People 2010* guidelines. They concluded there are five critical elements that must be present in a successful comprehensive worksite wellness program (UDOH, 2007):

1. Worksite wellness programs should focus on including both primary and secondary health education programs.

2. More corporate policies should be established to create a supportive social and physical environment that allows for a healthy lifestyle.

3. Worksite Wellness Committees of employees should be established to ensure that employees' health needs and interests are addressed.

4. Funding for wellness programs should be included in corporate budgets.

5. Wellness programs should be linked to other health offerings such as employee assistance programs, nurse advice lines, and on site health screenings to ensure program accessibility to all employees.

Chapman discovered in his review of studies on worksite wellness that both academic experts and practitioner experts reached similar conclusions about the most significant factors promoting worksite wellness success in an organization (Chapman, 2004). He listed the *Best Practices* identified by expert panelists as:

1. Building top management support
2. Integrating program with organizational/business goals
3. Sound communication process
4. Uses of stages of change concept
5. Creating supportive cultures

6. Incentive recruitment features

7. Personal contact or word of mouth

8. Targeted personal invitations

9. Targeted personal communication

10. Announcements made during meetings

11. Sense of program ownership

12. Use of self-efficacy concept

13. Use of a health website, Internet and Intranet strategies

14. Use of a program database or informational structure.

A review of 19 studies by Koffman and associates (2005) revealed seven factors which, if included in a cardiovascular health program, would potentially yield a $3 to $6 return-on-investment. The components they identified were the following:

1. Medical screenings, health risk assessments, and referrals

2. Effective individual risk factor follow-up education and counseling after screening

3. Plantwide environmental interventions to support healthy lifestyles

4. Frequent and simple heart disease and stroke-prevention messages

5. Health education classes, workshops, medical self-care, and support groups with individual goal setting

6. Financial and other incentives

7. Corporate policies that support a healthy lifestyle.

Goetzel (2007) conducted a benchmarking study by means of a literature review, expert interviews, and site visits, and identified seven promising practices likely to lead to the most successful health and productivity management (HPM) indicators. HPM was defined by Goetzel (2001) as a management approach that includes services to address all dimensions of employee health, including prevention programs, healthcare, and programs to enhance morale and increase productivity. The seven promising practices he identified are the following:

1. Integrating HPM programs into the organization's operations
2. Simultaneously addressing individual, environmental, policy, and cultural factors affecting health and productivity
3. Targeting several health issues simultaneously
4. Tailoring programs to address specific needs
5. Attaining high participation
6. Rigorously evaluating programs
7. Communicating successful outcomes to key stakeholders.

The Wellness Council of America (WELCOA), a not-for-profit organization promoting workplace wellness among more than 3,200 member companies, published their list of seven benchmarks for results-oriented wellness programs (Hunnicut & Leffelman, 2006). They listed common elements inherent in successful health promotion initiatives as the following:

1. Capturing senior level support
2. Creating a cohesive wellness team
3. Collecting data
4. Crafting an annual operating plan
5. Choosing appropriate health promotion interventions

6. Creating a supportive, health-promoting environment

7. Carefully evaluating outcomes.

Despite the varied nature of these five lists of recommendations, there are common threads from their different perspectives. Table 2.1 shows the 10 different themes and the commonalities between the five ways of categorizing determinants of effectiveness.

As the table shows, two themes were identified by all five studies: the need for management/environmental supports and the need to address social and cultural factors. Two themes were mentioned in four of the five studies: individual focus and involvement of partners. Three elements were identified by three of the five: multiple health issues, incentives, and planning/evaluation. Screenings, communication of health messages and referrals were each identified by only two of the five.

Methods

These 10 elements were used to form the framework for a process evaluation, using the Salt Lake County's *Healthy Lifestyle Incentive Program* (HLIP) as a case study example of a well-established worksite wellness program. The HLIP has functioned since 1990 when 714 employees joined the program. The program in 2008 includes the same elements as it did originally, with 1495 employees participating. Employees are screened for health status upon enrolling in the program. Based on self-recorded health logs turned in monthly, at the end of the year employees' healthy behaviors are assigned points and participants receive a cash bonus according to points accumulated.

For the process evaluation, interviews were held with program administrators and staff, who assigned scores for each of the 10 elements. Scores ranged from 0 to 4, where

Table 2.1

Categories of Effectiveness Elements From Five Studies

Elements	Chapman 2004	Koffman 2005	WELCOA 2006	UDOH 2007	Goetzel 2007
1) Management and environmental supports	Top management support; Integrating with organizational goals	Corporate policies support health. Plantwide environmental interventions	Capture senior level support. Supportive health-promoting environment	Include funding for wellness in budgets. Supportive physical environment	Integrate health programs into operations; Address environment and policy
2) Multiple health issues addressed		Effective individual follow-up education and counseling		Primary and secondary health education programs.	Target several health issues
3) Communication of Health Messages	Sound communication, Targeted personal communication	Frequent and simple heart disease prevention messages			
4) Cultural and social factors	Creating supportive cultures	Corporate policies that support a healthy lifestyle	Supportive health-promoting environment	Supportive social environment	Address cultural factors
5) Screenings		Medical screenings, health risk assessments		On site health screenings	
6) Referrals to other health care services		Referrals		Link to others: employee assistance, nurse advice lines.	
7) Incentives	Incentive recruitment features	Financial and other incentives			Attain high participation
8) Individual Focus	Uses of stages of change concept and self-efficacy concept	Health classes, workshops, medical self-care, goal setting	Appropriate health promotion interventions		Tailor programs to address specific needs
9) Planning and evaluation capability	Use of a program database or informational structure		Collect data, results-oriented; evaluate outcomes. Annual plan		Rigorously evaluate programs
10) Involvement of partners	Sense of program ownership		Create a cohesive wellness team	Committees to ensure health needs are addressed.	Communicate successful outcomes to key stakeholders

0 = no evidence of this element, 1 = minimal evidence only of this element, 2 = promising starts for this element, 3 = some established success in this element but room for improvement, and 4 = evidence of excellence in this element. Numerical scores given by those interviewed were averaged, and were not used for a quantitative comparison, but in order to prioritize areas for additional development.

Results

Management and Environmental Supports

HLIP recently received more attention by top administrators so that it now enjoys a high level of support and shows promising starts in this area. In 2007 the Salt Lake County Council allocated $600,000 of budget support to HLIP. A policy that encourages healthy behavior was incorporated in 1990, allowing employees to combine break and lunch times for exercise activities. A fitness room was provided at the main administrative office location, allowing employees there an on-site location to exercise, take fitness classes, and shower. In addition to support by the County Mayor, other managers and supervisors could be more proactive and encourage more participation in wellness programs.

Some environmental interventions have been incorporated, but much remains to be done. Promising developments include the existence of a fitness room in the administrative offices. Posters remind employees to take the stairs instead of elevators. Many more environmental supports are lacking, such as improvements in healthy food offerings in the employee cafeteria and vending machines. Employees in noncentral locations would also benefit by provision of exercise rooms and shower facilities. Score = 2.0, *promising starts for this element.*

Multiple Health Issues Addressed

HLIP is multifaceted and addresses several different health issues. Biometric measures are taken of weight, body composition, blood pressure, and blood cholesterol level. Points are recorded for physical exercise, wearing seatbelts, self-exams for breast and testicular cancer, stopping tobacco use, and receiving medical screenings. Attention is shown to both primary prevention (smoking cessation, seatbelts) and secondary prevention (medical screenings). In addition to measurements of current health status, the program provides education and motivation for improvements. The variety of health issues addressed shows evidence of success in focusing on multiple areas rather than a single risk factor. Room for improvement exists in that screenings are not conducted nor interventions provided for the additional factors of mental health, resilience, substance abuse, or adult immunizations. Score = 3.2, *some established success in this element but room for improvement.*

Communication of Health Messages

Periodic health messages are communicated via monthly health logs HLIP participants are required to submit. Occasional health-related articles are included in employee newsletters. Health-themed posters are displayed surrounding seasonal events such as *Breast Cancer Awareness* or *Wear Red for Heart Health* weeks. Many more health messages could be communicated using a wide variety of media, including email messages, a regular health column in the employee newsletter, frequently updated health messages in cafeteria table tents, and exercise reminders in work areas.

Worksite wellness literature contains several promising approaches using simple communication methods. For example, Gladys Block and her team (2004) conducted a successful campaign using only emails to deliver a 12-week nutrition intervention in a worksite. Although it was an inexpensive intervention, they were able to show significant changes in reported consumption of fruits and vegetables and significant decreases in dietary fat. With the typical office worker depending heavily on emails for daily communication, an email channel seems highly practical for other worksite health promotion messages. Score = 2.0, *promising starts for this element.*

Cultural and Social Factors

Occasional employee activities have been included which incorporate social factors, such as promoting teams from office worksites. These successfully engage social pressure in morale-building health-related team events. Since so much of health behavior is related to social and cultural factors, much more could be done in this area. Possible activities include engaging family members in fitness activities, or conducting healthy-recipe contests with weekly potluck lunches. Score = 1.3, *minimal evidence only of this element.*

Screenings

HLIP has excelled at conducting annual screenings for biometrics, and keeping records on progress made by individuals. The program has functioned since 1990 when 714 employees joined the program, comprising 28% of the 2540 employees eligible. Enrollment in the program as of the end of 2007 was 1495 employees. Of these, 475 were enrolled 10 years earlier in 1997, and 390 have participated for 10 consecutive years. Score = 3.9, *evidence of excellence in this element.*

Referrals to Other Health Care Services

When annual screenings reveal biometric measures outside the optimal range, health educators recommend follow-up with individuals' health care providers. In addition, incentives are provided encouraging follow-up and rewarding medical evaluation. Participants in HLIP are eligible for employer-subsidized medical care with generous preventive healthcare services, such as an allowance for annual physical exams. However specific referral and connecting of participants to health care is not provided. Score = 1.8, *promising starts for this element.*

Incentives

A well-developed record system tallies points for healthy behaviors at annual screening events and during the year via monthly logs kept by participants. Points are totaled yearly and converted into cash value. Checks are mailed to participants, ranging from $75 to $700, with an average of $150 earned by participants. Occasional activities provide additional small articles including water bottles, T-shirts, and pedometers. The overall incentive program could potentially be improved by providing more immediate financial rewards such as a direct discount on health insurance for participants. Score = 3.4, *some established success in this element but room for improvement.*

Individual Focus

Each individual participant has the opportunity to earn rewards for healthy behaviors, and awards are adjusted according to individual effort shown. More effective individual interventions could be provided, assessing each individual's readiness for change. Health coaches could provide goal-setting and interventions could be tailored to individual health needs and provided by email, on-line and by phone follow-up. Score = 2.2, *promising starts for this element.*

Process and Outcome Evaluation Capability

Individual participant enrollment and biometric screening data have been kept for all 18 of the years HLIP has been in existence. After 4 years of this program's implementation, its impact on health risk factors was assessed. Poole, Kumpfer, and Pett (2001) found significant improvements in body fat, cholesterol, blood pressure, physical activity, smoking prevalence, and seat belt use. The current study is the first time in the ensuing 14 years in which the data have been revisited with the study aim of determining long-term effectiveness. Annual evaluation reports on program effectiveness to management have been minimal, and this area has great potential for improvement. Score = 1.8, *promising starts for this element.*

Involvement of Partners

Although some stakeholder groups have been identified such as fitness room participants and responsible budgetary authorities, these have not been formally included in planning and implementation of programs. As concluded in the UDOH Worksite Wellness Survey Report (2007), "Worksite Wellness Committees should be established to ensure that employees' health needs and interests are addressed." A wellness advisory council could be formed, including representatives from every division of employees. The council would be a route for communicating with employees in both directions, both to relay feedback from participants and disseminate health messages. Score = 1.3, *minimal evidence only of this element.*

Discussion

The best-developed element in HLIP is screening, which is extensive and valued by participants. This area scored higher than all the others. The next two high-scoring areas are incentives and multiple health issues. The established incentives are a key feature of the program, and use most of the budget allotted to wellness. HLIP covers a wide range of health issues as suggested by *Healthy People 2010* (USDHHS, 2006). In addition to these, more complementary and alternative medicine approaches could be considered. These can be effective in worksites, as was shown in the intervention by Waite and Richardson (2004) who identified increases in productivity after resiliency training in a government agency workplace.

Dietz, Cook and Hersch (2005) reported on integrating other disciplines into traditional wellness programs, specifically proposing to incorporate substance abuse prevention with stress management and cardiovascular education. They found that the decline in substance abuse rates coincided with improvements in cardiovascular health. They made a case for using worksite wellness programs as an effective vehicle to accomplish more health improvements by adding substance abuse indicators to the screenings, brief interventions by trained clinical professionals, and prevention messages to the health messages delivered.

Five elements or half of the evaluated areas showed evidence of promising starts but had significant room for improvement. Management gives considerable support, but more environmental factors could reinforce healthier behaviors. Some health messages are communicated but not consistently and not using all available channels. Some referrals are made to medical care but not in a systematic process for all health risks identified. Individual records are kept but health coaching is not provided enabling individual goal setting. Data are available and records have been kept for 18 years, but evaluation and systematic planning have not been performed.

Two areas scored lowest: cultural/social factors and involvement of partners. In both areas a potential for significant improvement exists. Social groups in the workplace could be utilized as a setting for health promotions, such as a friendly competition between work teams to walk 10,000 steps per day. A worksite wellness council of employees would provide valuable partnerships to reinforce wellness efforts. Families could be included in activities for social reinforcement, such as inviting families to form teams or encouraging employees to conduct *Wii Fit* activities with their children.

Table 2.2 provides a graphical representation of evaluation findings. The column of *HLIP Features* summarizes strengths of the current program, and the column of *Areas for Improvement* shows examples of ways the elements could be developed.

Conclusion

This description and process evaluation serve to summarize the current HLIP wellness program as now functioning. Greatest strengths are in consistent and comprehensive annual screenings, financial incentives, and multiple health issues addressed.

The evaluation highlighted the need for involving partners such as an advisory council which could represent employees from a wide variety of workplaces within the

Table 2.2

Summary of HLIP Evaluation

Elements	HLIP Score *	HLIP Features	Areas for Improvement
1) Management and environmental supports	2.0	Increased budget, mayor's support, central fitness room	Healthier food choices in cafeteria and vending machines, fitness rooms in noncentral worksites.
2) Multiple health issues addressed	3.2	Biometrics: weight, body composition, blood pressure, cholesterol; logs track exercise, self-exams, seatbelts, tobacco use, medical screenings	Mental health, resilience, substance abuse, adult immunizations
3) Communication of Health Messages	2.0	Posters, logs, intermittent articles	Regularly-featured health columns, email campaigns
4) Cultural and social factors	1.3	Worksite teams compete in periodic events	Engage families, schedule healthy recipe contests for worksite potlucks
5) Screenings	3.9	Annually available to all on voluntary basis during end-of- year clinics	Increase participation to all employees, make available year-round
6) Referrals to other health care services	1.8	Informal recommendations	Direct connections and follow-up
7) Incentives	3.4	Annual cash reward	Consider more immediate rewards, discounted health insurance premium
8) Individual Focus	2.2	Individual records kept, rewards vary by points earned	Assess readiness for change. Health coaching and goal setting
9) Planning and evaluation capability	1.8	Data kept 18 years. Study completed at 4 years	Needs current outcome data evaluation.
10) Involvement of partners	1.3	Informal and limited	Countywide advisory council

* 0 = no evidence; 1.0 = minimal evidence; 2.0 = promising starts; 3.0 = some established success but room for improvement; 4.0 = evidence of excellence.

county. More attention should be paid to cultural and social factors, which may include engaging families and social groups within worksites. Other areas needing improvement included management and environmental supports, communication of health messages, individual focus, referrals to other health services, and program evaluation.

Additional Research Needed

Now that general processes of HLIP have been described and evaluated, the need is apparent for research into long-term outcomes for participants. More specific quantitative data are needed, on effectiveness of HLIP for employee health behaviors, risks, and outcomes.

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CHAPTER 3

TEN-YEAR LONGITUDINAL OUTCOMES OF A COMPREHENSIVE, INCENTIVIZED WORKSITE WELLNESS PROGRAM

Abstract

Salt Lake County has offered a worksite wellness program to its employees for the past 18 years, to address obesity and lifestyle diseases, which are among the most serious public health issues in our nation. This study seeks to evaluate the long-term effectiveness of this program on health outcomes for participants who were involved for the 10-year period between 1997 and 2007.

A quasi-experimental retrospective cohort study of 475 employees examined self-reports of behaviors from Health Risk Appraisals as well as annual clinical measures of weight, blood pressure, cholesterol, and body fat percent. Participants were divided into their risk levels at baseline according to BMI, blood pressure, and cholesterol risk. Outcomes were compared to dosage level, with annual points earned by participants used as the indicator for dosage.

A demographic comparison revealed that a typical participant was White, female, and college educated. Annual percent change in total points was significant, at 2.6 % per year (p = 0.037). Participants had lower increases in BMI than the general population had during the same time period. BMI, blood pressure and cholesterol improvements were

seen most markedly in those who were at highest obesity, hypertension and cholesterol risk levels at baseline.

Effectiveness was demonstrated in some but not all areas. Most benefits were found to participants in high risk groups. This program has the potential to extend its impact by reaching more employees in high health risk categories, and in population groups that participated in relatively lower numbers: males, Hispanics, and those without college educations. Since the wellness intervention is continuing at Salt Lake County, a case-control prospective cohort study could be undertaken. More specific results could be obtained by measuring both participants and a similar group of nonparticipants from the same worksite population.

Introduction

The Salt Lake Valley Health Department established a worksite intervention called the Healthy Lifestyle Incentive Program (HLIP) in 1990, in response to increasingly high rates of chronic conditions such as obesity, diabetes, heart disease, and cancer (Mokdad et al., 2003). Since that year, these lifestyle-related chronic diseases have continued to emerge as the most serious health concerns facing the population. The most recent estimate from the National Health and Nutrition Examination Survey (NHANES) is that 42% of American adults have at least one chronic condition (Wilper et al., 2008).

In their summary of the public health impact of obesity, Visscher and Seidell (2001) noted that obesity has already grown to epidemic proportions and is continuing to increase worldwide. They predicted that problems will worsen as disability increases and quality of life decreases, and they advocated for prevention programs which are more promising than weight reduction efforts. Their prediction has been realized in Utah, where obesity has increased 112% in the past 16 years (UDOH, 2007). Most recent national data show that obesity in Utah was at 22.4% in 2007. This rate of obesity is substantially less than the national average of 26.3% (NCCDP, 2008).

Another evidence of obesity's effect on public health is its economic impact. Diabetes for example is one of the most costly of the chronic diseases. In 2002, people with diabetes incurred 18% of all healthcare costs, and per capita medical expenditures for people with diabetes were 2.4 times higher than for those without diabetes (Hogan, Dall, & Nikolov, 2003). Visscher and Seidell called diabetes "by far the most expensive public health consequence of obesity" (2001, p. 356). In 2007 the American Diabetes Association estimated that prevalence of diabetes had increased almost 50% since 2002, and costs had reached $174 billion (ADA, 2008).

Employers providing healthcare insurance have been severely affected by the increasing costs incurred to treat these chronic diseases. From 2001 to 2005, municipal employees' healthcare costs increased 63% at the same time that general budgets increased 15% (BMRB, 2007). For the population of interest, Salt Lake County employees, the increase in health care insurance costs from 2001 to 2008 was 95.2% (Townsend et al., 2008).

Because most of the adult population is employed, the worksite is an important setting where adults can be educated to reduce the prevalence and burden of overweight and obesity. According to a task force assembled by the Centers for Disease Control and Prevention (CDC), one important advantage to addressing health in the worksite is that these areas "allow access to employees in a controlled environment through existing channels of communication and social support networks" (Katz et al., 2005, p. 2). Larry

Chapman (2004) called the worksite one of the most influential settings where health education can take place and health behaviors can be improved.

Research into employer-provided wellness programs has shown that worksite programs can effectively improve employee health habits and reduce health risks. Examples of such research are a critical literature review of 72 data-based studies (Aldana, 2001), an expert panel review of 52 studies showing interventions with field-based data (Matson Koffman et al., 2005), and a meta-analysis of 24 studies, considering their intervention reach, adoption, implementation and maintenance (Bull et al., 2003). In a critical review of 12 studies on corporate wellness programs, Pelletier (2005) noted a decreasing trend from 2000 to 2004 in research which provided evidence-based outcomes, and advocated increased quality and quantity of such evaluations. Salt Lake County's HLIP has not been evaluated since 1996 (Poole, Kumpfer, & Pett, 2001).

Healthy People 2010, a national health promotion and disease prevention initiative, identified two specific goals for increasing health promotion programs in the worksite setting. Goal 7-5 is to "*Increase the proportion of worksites that offer a comprehensive employee health promotion program to their employees*" (USDHHS, 2000). A target of 75% was set, and the baseline in 1999 was 33-50% of worksites having such programs (Lusk & Raymond, 2002). In a 2004 survey of 730 worksites with more than 50 employees, 85% of larger worksites offered some type of health screening, and 65% hired full- or part-time staff responsible for health promotion, yet of all the programs they surveyed only 7% of the programs were considered comprehensive, meaning they incorporated all five key elements defined in Healthy People 2010 (Linnan et al., 2008). Goal 7-6 is to "*Increase the proportion of employees who participate in* *employer-sponsored health promotion activities*." Again the target was 75% and the baseline in 1999 was 61%, which included employees participating in any component of the employer's program.

The Healthy People 2010 report noted that the highest risk employees are least likely to participate in worksite wellness programs and that many such programs lack comprehensive design or sufficient duration. Even a large-scale study of the long-term impact of worksite wellness programs on health risks covered only a 2-year period (Goetzel et al., 2002). Similarly, Bull and colleagues reviewed 16 worksite studies, of which the longest follow-up was 2 years (Bull et al., 2003). They noted that lack of maintenance data was one of the most obvious weaknesses in the studies they reviewed.

Therefore, the specific aim of this study was to increase knowledge of the longer term effects of a comprehensive worksite program that also involves incentives. Now that the same worksite program has been in place for 18 years, this long-term study was used to test the effectiveness of the program on employees who have been involved for 10 years or more. The study sought to learn how HLIP has affected the health of employees, and to identify differences in results for various levels of participation in the program.

Two different research questions were asked to explore the effectiveness of HLIP participation: (1) whether participant outcomes after 10 years were different for those who participated continuously in the program compared to those who were intermittent or dropped out; and (2) whether participants' outcomes differed according to dosage, which was indicated by annual points and bonuses earned by participants. The hypotheses were that clients with higher dosage and continuous participation would have better outcomes.

Methods

Subject Recruitment

Enrollment in the HLIP as of the end of 2007 was 1495 employees. Of these, 475 had been enrolled in the program 10 years earlier in 1997, and 398 had participated for 10 consecutive years. Participants were all either employees of Salt Lake County with benefits including health insurance, or spouses of those employees. Files for each employee were kept by Health Department staff in locked cabinets. Data were extracted from the HLIP employee files for the standardized intake and annual screening measures, including the Carter Center for Emory University's *Health Risk Appraisal,* the Utah Department of Health's *Blood Pressure/Cholesterol Screening Form*, and HLIP's biometric intake form for each participant. Data were entered into spreadsheets where each participant was assigned a research code number and personal identifiers were removed to protect confidentiality.

Design

A longitudinal quasi-experimental retrospective study was conducted, using a post hoc subgroup analysis comparing dosage levels and outcomes. The indicator for participants' program dosage was the total of all points earned annually by participants for different activities. To study variations in results for different levels of involvement, cross-sectional assessments at baseline of three different groups were used. Of the sample size of 422 employees, 297 (70.4%) were enrolled continuously from 1997 to 2007, 69 (16.4%) were enrolled intermittently but participated in both 1997 and 2007, and 56 (13.3%) had dropped out of the program by 2007.

Intervention

The intervention consisted of participation in the HLIP between 1997 and 2007. At initial enrollment and again every year, employees completed a Health Risk Appraisal, answering questions about health behaviors such as smoking, fruit and vegetable intake, frequency of physical activity, and others. They also completed a Blood Pressure/Cholesterol Screening Form answering additional questions about family history of chronic diseases. At the time of assessment, clinical measurements were taken including blood pressure, weight, total cholesterol, and body fat using bioelectrical impedance. Each participant was counseled individually about personal health risks according to their answers to the Health Risk Appraisal, and given corresponding printed information.

During each year of involvement, participants tracked healthy behaviors on monthly logs, which included reports of physical activity, seat belt usage, and breast or testicular self-examination. Logs were submitted monthly along with additional health forms documenting special health interventions such as preventive medical examinations, smoking cessation, or weight loss classes. The HLIP staff presented periodic educational programs in brown-bag classroom settings, and conducted seasonal promotions to raise awareness of health topics. Recent examples included *Go Red for Women* activities in February to raise awareness of heart health, 10-week classes held at the worksite for weight loss and for smoking cessation, *Pink for October* to bring attention to breast cancer detection, and *Maintain. . . Don't Gain* to help prevent weight gain over holiday periods.

At the end of each year another assessment was done with another Health Risk Appraisal, screening form, and repeated clinical measurements.

Measures

Data entry staff recorded health behaviors from archival employee files. From each participant's record, self-reported answers to the following questions were noted:

Four questions from the Carter Center for Emory University's 43-item *Health Risk Appraisal* were included in this analysis because they involve key health behaviors:

1. Are you now taking medicine for high blood pressure?
2. How many cigarettes a day do you smoke?
3. Do you eat some food every day that is high in fiber, such as whole grain bread, cereal, fresh fruits or vegetables? 1=Yes, 2=No.
4. Do you eat foods every day that are high in cholesterol or fat, such as fatty meat, cheese, fried foods, or eggs? 1=Yes, 2=No.

The 14 questions from the Utah Department of Health's *Blood Pressure and Cholesterol Screening Form* are shown in Table 3.1. In addition to these self-reports, biometric values were recorded by health educator staff members on HLIP's biometric intake form: (a) weight, (b) blood pressure, (c) nonfasting total blood cholesterol, and (d) percent body fat.

From each participant's file, notations were made for total length of time enrolled in HLIP, and whether the participant's spouse was also enrolled. Demographics of participants were compared to gender and ethnicity of county employees eligible for the program (Townsend et al., 2007). Education level and smoking status of HLIP

Table 3.1

Data From the Blood Pressure and Cholesterol Screening Form

Item	Response
Date of birth	Date
Gender	1 = Male, 2 = Female
Self-reported height	Height in inches
Self-reported weight	Weight in pounds
Ethnic origin:	1=White, 2=Black, 3=American Indian, 4=Hispanic, 5=Asian, 6=Pacific Islander, 7=Other.
Education level:	1=Less than high school, 2=High school graduate, 3=Some college, 4=College graduate, 5=Technical, trade or business college.
Has your doctor ever said you have high blood pressure?	1=Yes, 2=No
Are you now under a doctor's care for high blood pressure?	1=Yes, 2=No
Are you now taking medications for high blood pressure?	1=Yes, 2=No
Has your doctor ever said you have high blood cholesterol?	1=Yes, 2=No
Are you now under a doctor's care for high blood cholesterol?	1=Yes, 2=No
Are you now taking medications for high blood cholesterol?	1=Yes, 2=No
How many servings of fruits and vegetables do you eat each day?	Number
In an average week, how many times do you engage in physical activity (*an accumulation per day of 30 minutes or more of physical activity such as brisk walking)*	1=less than one day/week, 2=1 or 2 days/week, 3=3 or 4 days/week, 4=5 days/week or more.

participants were compared to those of Salt Lake County residents gathered in a recent 5-year study by UDOH (2007).

BMI risk levels. Participants were divided into levels according to their risk at baseline, using categories outlined by NIH: (a) Normal = 18.5 to 24.9 kg/m^2, (b) Overweight = 25 to 29.9 kg/m^2, (c) Obesity (I and II) = 30 to 39.9 kg/m^2, and (d) Extreme Obesity (III) $\geq$ 40 kg/m^2 (Pi-Sunyer, 1998). Sturm (2003) advocated identifying the Extreme Obesity category, because prevalence in that category is increasing twice as fast as in the Obesity category.

Blood pressure risk levels. Participants were divided into levels according to their blood pressure risk at baseline, using categories identified by NIH: (a) Normal = systolic < 120 mmHg and diastolic < 80 mmHg, (b) Prehypertensive = systolic 120 to 139 mmHg or diastolic 80 to 89 mmHg, (c) Hypertensive Stages I & II = systolic $\geq$ 140 mmHg or diastolic $\geq$ 90 mmHg (Chobanian, 2003).

Blood cholesterol risk levels. Participants were divided into levels according to their blood cholesterol risk at baseline, using categories identified by NIH: (a) Desirable < 200 mg/dL, (b) Borderline high = 200-239 mg/dL, and (c) High $\geq$ 240 mg/dL (Grundy, 2001).

Statistical Analyses

Data were characterized using frequency distributions, means, and percentages. Analysis of variance (ANOVA) was used to determine if the changes from baseline to endpoint differed according to longevity (continuous, intermittent, or dropout). Effect size was calculated with $d = \text{Mean}_1 - \text{Mean}_2$ divided by the standard deviation (Cohen, 1988). Regression analysis was used to evaluate if participation in the HLIP program improved outcomes of BMI, blood pressure and cholesterol, and to assess the relationship between outcomes and total points earned, as an indicator of program dosage. Multiple regression was used to assess the simultaneous effect of several variables on outcomes.

Mean change scores in health behaviors and biometric variables were computed from baseline in 1998 to end point in 2006.

Pearson product-moment correlation coefficient calculations were done to assess the degree that changes in outcomes were related to dosage, which was measured by the total points earned each year. Participants were categorized as to level of risk for BMI, blood pressure, and total cholesterol. Mean change scores from baseline to end point were computed for these according to risk level groupings at baseline, to isolate participants who were at low risk from those at moderate and high risks.

Repeated measures, using multivariate analysis of variance and the Wilks' lambda statistic, evaluated the overall effect for time within each outcome variable. Analyses were performed using SAS software (version 9.1; SAS Institute Inc., Cary, NC). Statistical significance was set at 0.05.

Results

Demographics

Among employees who participated in HLIP, 60% were female and 40% were male, whereas in the pool of all employees eligible to participate, only 48% were female and 52% were male, ($p < 0.001$) as shown in Table 3.2.

Participants were 91% White, compared to eligible employees of whom 86% were White. Minority ethnic groups were underrepresented in the participant group

Table 3.2

Gender and Ethnicity Comparison

	Number (%)	Eligible employees	HLIP Participants	*p*
Gender	Male	2085 (52.4)	145 (39.7)	< 0.001*
	Female	1897 (47.6)	220 (60.3)	
Race/Ethnicity White, non-Hispanic		3425 (86.0)	374 (90.8)	
Black, non-Hispanic		47 (1.2)	3 (0.7)	
Amer Ind/Alaska Nat		18 (0.5)	1 (0.2)	0.003*
Hispanic		330 (8.3)	18 (4.4)	
Asian		74 (1.9)	16 (3.9)	

* Difference is significant at the 0.05 level

compared to the eligible group except for Asians, who accounted for 4% of the participant group but only 2% of the eligible employees ($p = 0.003$).

The overall education level of participants was high, with college graduates comprising 57% of all participants, compared to an estimated 31.6 % of Salt Lake County residents who are college graduates (UDOH, 2007). Self-reports of smoking status revealed that 78% of participants were nonsmokers, 17% had quit smoking, and only 5% of participants were still smoking compared to 13.5% of Salt Lake County residents who identify themselves as current smokers (UDOH, 2007). Eligible employees were given the option of inviting a spouse to join the program, and 24% of the participants had a spouse participating, while 76% did not. Table 3.3 shows breakdowns of education level, smoking status, and spouse participation.

Table 3.3

Characteristics of Participants

	Number (%)	All SLCounty residents
Education		
Less than high school	2 (0.6)	7.8%
High school graduate	33 (9.1)	28.2%
Some college	92 (25.3)	32.4%
Tech, trade or business	29 (8.0)	
College graduate	207 (57.0)	31.6%
Smoking status		
Never smoked	273 (78.2)	
Stopped smoking	58 (16.6)	
Still smoke	18 (5.16)	13.5%
Spouse in program		
Spouse participates	89 (24.4)	
No spouse participating	276 (75.6)	

Outcome Analysis

Results of the first analysis of variance (ANOVA) for differences in longevity for changes in BMI, cholesterol, body fat percent, blood pressure, or self-reported behaviors showed no significant differences in outcomes between 10-year continuous, intermittent and dropout groups. Tables 3.4 and 3.5 show these results.

A second ANOVA of 8-year continuous participants from 1998 to 2006 compared to intermittent enrolled participants in the same period also failed to show any significant association with change in BMI, cholesterol, body fat percent, or blood pressure (Table 3.6). Table 3.7 shows mean changes during the 8 years.

Table 3.4

Baseline to End Longevity ANOVA

			N	Means	Std Dev	*F*	*p*	*d*
BMI	Pre:	Continuous	296	26.02	4.97	2.916	0.055	-0.42
		Intermittent	69	26.51	6.35			
		Dropouts	55	27.34	5.19			
		Total	420	26.27	5.26			
	Post:	Continuous	296	28.43	6.03			
		Intermittent	62	28.58	7.04			
		Dropouts	53	28.46	4.44			
		Total	411	28.46	6.01			
BPS	Pre:	Continuous	297	119.47	13.37	1.095	0.335	-0.44
		Intermittent	69	120.25	12.39			
		Dropouts	56	124.43	12.71			
		Total	422	120.26	13.21			
	Post:	Continuous	297	126.03	14.00			
		Intermittent	69	123.96	14.32			
		Dropouts	56	129.29	13.25			
		Total	422	126.12	14.00			
BPD	Pre:	Continuous	297	77.17	10.108	2.905	0.056	0.24
		Intermittent	69	77.49	9.936			
		Dropouts	56	82.63	10.527			
		Total	422	77.95	10.278			
	Post:	Continuous	297	80.20	9.075			
		Intermittent	69	80.57	9.794			
		Dropouts	56	81.39	9.306			
		Total	422	80.42	9.213			
BF	Pre:	Continuous	293	24.26	7.05	2.389	0.093	-0.59
		Intermittent	69	24.81	8.16			
		Dropouts	54	23.93	7.29			
		Total	416	24.31	7.26			
	Post:	Continuous	293	27.93	7.44			
		Intermittent	68	28.21	7.97			
		Dropouts	54	26.28	6.84			
		Total	415	27.76	7.46			
FV	Pre:	Continuous	287	3.06	1.753	1.367	0.256	-0.17
		Intermittent	69	2.94	2.064			
		Dropouts	56	3.21	1.703			
		Total	412	3.06	1.799			
	Post:	Continuous	295	3.36	1.775			
		Intermittent	64	3.39	1.705			
		Dropouts	54	3.35	1.954			
		Total	413	3.36	1.785			

Table 3.4 continued

			N	Means	Std Dev	*F*	*p*	*d*
PA	Pre:	Continuous	297	2.57	0.680	2.208	0.111	-0.86
		Intermittent	69	2.42	0.812			
		Dropouts	56	2.71	0.530			
		Total	422	2.56	0.689			
	Post:	Continuous	297	3.17	0.730			
		Intermittent	61	2.10	0.790			
		Dropouts	54	3.07	0.723			
		Total	412	3.15	0.737			
HLTH	Pre:	Continuous	295	1.82	0.643	0.606	0.546	-0.02
		Intermittent	69	1.90	0.710			
		Dropouts	56	1.73	0.618			
		Total	420	1.82	0.651			
	Post:	Continuous	296	1.82	0.686			
		Intermittent	62	1.84	0.682			
		Dropouts	54	1.81	0.617			
		Total	412	1.83	0.675			
CHOL	Pre:	Continuous	296	200.31	41.901	1.202	0.302	0.08
		Intermittent	69	201.59	44.477			
		Dropouts	56	209.71	38.549			
		Total	421	201.77	41.928			
	Post:	Continuous	296	197.58	32.262			
		Intermittent	65	202.54	35.009			
		Dropouts	53	198.36	42.906			
		Total	414	198.46	34.181			

Table 3.5

Longevity Post Hoc: Tukey

Variable	*p*-values for Comparisons		
	Cont to Interm	Cont to Dropouts	Interm to Dropouts
BMI	0.325	0.079	0.766
BPS	0.350	0.729	0.910
BPD	0.075	0.083	0.999
BF	0.841	0.076	0.366
FV	0.666	0.274	0.816
PA	0.996	0.101	0.197
HLTH	0.959	0.576	0.567
CHOL	0.928	0.331	0.330

Table 3.6

Continuous Versus Noncontinuous Enrollment

	N	Mean	*F*	*p*
Baseline BMI	364	26.74	0.42	0.5173
Continuous	307	26.31		
Noncontinuous	57	26.82		
Baseline CHOL	364	207.09	.057	0.4504
Continuous	307	210.72		
Noncontinuous	57	206.41		
Baseline Body Fat Pct	364	26.45	0.04	0.8504
Continuous	307	26.29		
Noncontinuous	57	26.49		
Baseline Systolic BP	365	122.98	0.12	0.7307
Continuous	308	123.09		
Noncontinuous	57	122.40		
Baseline Diastolic BP	365	78.36	2.17	0.1420
Continuous	308	78.70		
Noncontinuous	57	76.51		
Change in BMI	359	1.59	1.37	0.2422
Continuous	305	1.66		
Noncontinuous	54	1.19		
Change in CHOL	352	-10.97	0.80	0.3712
Continuous	301	-11.84		
Noncontinuous	51	-6.04		
Change in Body Fat Pct	361	0.59	0.40	0.5250
Continuous	306	0.52		
Noncontinuous	55	0.97		

Table 3.7

Mean Changes, 1998 to 2006

	Pre (1998)		Post (2006)		
	Mean	Std Dev	Mean	Std Dev	*d*
Preassessment points	76.31	25.89	84.23	38.19	0.21
Total points	634.47	145.06	883.93	308.51	0.81
Weight	173.09	40.46	183.40	42.91	0.24
BMI	26.76	5.58	28.34	6.03	0.26
Body fat percent	26.42	7.46	26.95	7.54	0.07
Blood Pressure systolic	122.38	13.61	125.99	14.32	0.25
Blood Pressure diastolic	78.19	10.30	81.43	9.16	0.35
Fruit/Veg intake	3.10	1.77	3.42	1.78	0.18
Cholesterol	206.68	39.39	197.50	34.91	0.26

Focusing on those with continuous enrollment, comparing points earned at preassessment for the time period 1998 through 2006, the annual percent change was not significant at 0.18, $p = 0.89$. However, the annual percent change in total points earned at the end of each year was 2.63 ($p = 0.037$) for the time period 1998 through 2006.

Results of the Pearson correlation did show a significant inverse relationship between total points earned and certain outcome variables (Table 3.8). An increase in total points was significantly associated with a decrease in weight, BMI, body fat, and cholesterol, and an increase in physical activity. Of the variables with a significant correlation, the strongest was body fat, $r = -0.38, p < 0.0001, r^2 = 0.145$, so that 14.5% of the variance of the body fat decrease is accounted for by the increase in total points.

Table 3.8

Pearson Coefficients: Correlation With Total Points

Change Scores:	r	r^2	p value
Weight	-0.243	0.059	<0.0001*
BMI	-0.232	0.054	< 0.0001*
Body fat percent	-0.381	0.145	< 0.0001*
Blood Pressure sys	-0.046	0.002	0.3867
Blood Pressure dias	-0.045	0.002	0.3931
Fruit/vegetable intake	0.042	0.002	0.4875
Physical Activity	0.232	0.054	< 0.0001*
Cholesterol	-0.109	0.012	0.0403*
Spearman Correlation Coefficients			
Weight	-0.184	0.03	0.0005*
BMI	-0.181	0.03	0.0006*
Body fat percent	-0.354	0.13	< 0.0001*
Blood Pressure sys	-0.031	0.00	0.5549
Blood Pressure dias	-0.103	0.01	0.0504
Fruit/vegetable intake	-0.002	0.00	0.9713
Physical Activity	0.293	0.086	< 0.0001*
Cholesterol	-0.150	0.02	0.0047*

*Correlation is significant at the 0.05 level.

However, no significant correlation was found between total points earned and change in blood pressure or change in fruit and vegetable intake.

In a multivariate analysis of variance, change scores for weight, BMI, body fat and cholesterol were regressed on age, sex, education, smoking history, race/ethnicity, spouse support, preassessment points (1998), and change in total points. Only age, sex, change in total points, and preassessment points (1998) were significant, based on Wilk's Lambda.

The regression analysis indicated that after adjusting for baseline points, age and sex, total points were significantly associated with weight, BMI, body fat, and cholesterol (Table 3.9). Additionally it is observed that both change in weight and change in BMI

Table 3.9

Regression Coefficients for Several Variables **

Dependent Variable	Independent Variable	Slope Coefficient	Std error	t value	*p*
CWEIGHT	CTOT	-0.015	0.003	-5.42	< 0.0001*
CWEIGHT	AGE	-0.523	0.108	-4.83	< 0.0001*
CWEIGHT	PRPTS98	-0.100	0.035	-2.89	0.0041*
CBMI	CTOT	-0.002	0.0004	-5.23	< 0.0001*
CBMI	AGE	-0.0796	0.017	-4.74	< 0.0001*
CBMI	PRPTS98	-0.0174	0.0054	-3.24	0.0013*
CCHOL	Males	-15.915	4.524	-3.52	0.0005*
CCHOL	CTOT	-0.0175	0.007	-2.49	0.0132*
CCHOL	AGE	-0.473	0.267	-1.77	0.0771
CCHOL	PRPTS98	0.3853	0.085	4.52	< 0.0001*
CBF	Males	-1.165	0.483	-2.31	0.0213*
CBF	CTOT	-0.0061	0.0007	-8.19	< 0.0001*
CBF	AGE	-0.0728	0.0277	-2.63	0.0089*
CBF	PRPTS98	-0.001	0.009	-0.12	0.9053
CPHY	CTOT	0.0006	0.0001	4.53	< 0.0001*
CPHY	AGE	-0.002	0.005	-0.44	0.6587
CPHY	PRPTS98	-.0005	0.0016	-0.31	0.7551

*Correlation is significant at the 0.05 level. **Adjusted for baseline points, age, and sex.

decreased with increasing age and higher preassessment points in 1998. Change in body fat decreased with increasing age and was greater for males than females.

Change in cholesterol decreased with increasing age and higher preassessment points in 1998. Also, males had a significantly greater decrease than females. Change in physical activity was found to be significantly associated with change in total points (see Table 3.8). Change in total points continued to be significantly associated with change in physical activity even after adjusting for age, sex, and baseline points (see Table 3.9).

Results of another Pearson correlation, this time with change in physical activity, showed a significant inverse relationship between change in physical activity and change in both BMI and body fat percent (Table 3.10). No significant correlation was found between physical activity and change in blood pressure. Thus, an increase in physical activity was significantly associated with a decrease in BMI and body fat. The correlation with body fat was $r = -0.36, p < 0.0001$, and $r^2 = 0.126$, so that 12.6 % of the variance of the body fat decrease was accounted for by the increase in physical activity. Change in

Table 3.10

Pearson Coefficients: Correlation With Change in Physical Activity

Change Scores:	r	r^2	p value
BMI	-0.136	0.018	0.0118*
Body fat percent	-0.355	0.126	< 0.0001*
Blood pressure sys	0.051	0.003	0.3524
Blood pressure dias	0.091	0.008	0.0929
	Spearman Correlation Coefficients		
BMI	-0.1397	0.020	0.0096*
Body fat percent	-0.3284	0.108	< 0.0001*
Blood pressure sys	0.0044	< 0.001	0.9352
Blood pressure dias	0.0773	0.006	0.1545

*Correlation is significant at the 0.05 level.

physical activity significantly impacted the combination of health risk measures. In the univariate analysis, after adjusting for age, sex, and preassessment points in 1998, change in physical activity was significantly associated with change in weight, BMI, and body fat, but not with blood pressure, fruit and vegetable consumption, or cholesterol (Table 3.11).

Another regression was conducted, adjusting for BMI risk category, educational level, gender, ethnic group, smoking history, and presence of spouse in the program. Table 3.12 shows how change in BMI from baseline to end was significantly associated with BMI categories, age, and presence of spouse in the program, after adjusting for educational level, gender, ethnicity, and smoking history.

Additional regressions were conducted, adjusting for several variables. Table 3.13 shows that changes in systolic and diastolic blood pressure from baseline to end were

Table 3.11

Regression Coefficients: Weight, BMI, Body Fat **

Dependent Variable	Independent Variable	Slope Coefficient	Std error	t value	*p*
CWEIGHT	Gender (males)	-1.879	2.152	-0.87	0.3834
CWEIGHT	CPHY	-2.927	1.387	-2.11	0.0358*
CWEIGHT	AGE	-0.335	0.131	-2.56	0.0112*
CWEIGHT	PRPTS98	-0.109	0.040	-2.74	0.0067*
CBMI	Gender (males)	-0.359	0.300	-1.20	0.2325
CBMI	CPHY	-0.490	0.187	-2.62	0.0093*
CBMI	AGE	-0.064	0.174	-3.70	0.0003*
CBMI	PRPTS98	-0.018	0.006	-2.89	0.0042*
CBF	Gender (males)	-0.807	0.512	-1.58	0.1160
CBF	CPHY	-2.217	0.319	-6.95	< 0.0001*
CBF	AGE	-0.061	0.030	-2.07	0.0392*
CBF	PRPTS98	-0.003	0.011	-0.26	0.7917

*Correlation is significant at the 0.05 level.
** Adjusted for age, sex, and preassessment points in 1998.

Table 3.12

*Regression Coefficients: Change in BMI***

Dependent Variable	Independent Variable	Slope Coefficient	Std error	*t* value	*p*
CBMI	BMI 0	3.445	0.961	3.59	0.0004*
	BMI 1	3.486	0.969	3.60	0.0004*
	BMI 2	4.201	1.000	4.20	<0.0001*
	Edu2	-1.139	0.721	-1.58	0.1151
	Edu3	-1.131	0.586	-1.93	0.0543
	Edu4	-1.078	0.554	-1.95	0.0526
	Males	-0.279	0.313	-0.89	0.3730
	Ethn1	0.474	0.700	0.68	0.4987
	Ethn2	1.103	1.690	0.65	0.5145
	Ethn3	-0.474	2.739	-0.17	0.8627
	Ethn4	0.786	1.039	0.76	0.4506
	Smok1	-0.947	0.658	-1.44	0.1508
	Smok2	-1.251	0.719	-1.74	0.0829
	NoSpouse	0.800	0.341	2.34	0.0197*
	Age	-0.047	0.017	-2.68	0.0077*

*Correlation is significant at the 0.05 level.
** Adjusted for educational level, gender, ethnicity, and smoking history.

Table 3.13

Regression Coefficients: Change in Systolic and Diastolic Blood Pressure **

Dependent Variable	Independent Variable	Slope Coefficient	Std error	*t* value	*p*
CSBP	BPL0	25.348	2.853	8.89	< 0.0001*
(Change in	BPL1	17.088	2.719	6.29	< 0.0001*
Systolic	Educ 2	-2.860	3.880	-0.74	0.4615
Blood	Educ 3	-2.029	3.208	-0.63	0.5275
Pressure)	Educ 4	-3.273	3.062	-1.07	0.2859
	Male	4.274	1.722	2.48	0.0136*
	Ethn1	-0.152	3.824	-0.04	0.9684
	Ethn2	1.259	90.89	0.14	0.8899
	Ethn3	-4.040	14.839	-0.27	0.7856
	Ethn4	5.416	5.609	0.97	0.3350
	Smok1	-4.936	3.533	-1.40	0.1633
	Smok2	-4.298	3.867	-1.11	0.2673
	NoSpouse	-1.056	1.830	-0.58	0.5643
	Age	0.130	0.094	1.38	0.1675
CDBP	BPL0	15.826	1.679	9.42	< 0.0001*
(Change in	BPL1	8.321	1.716	4.85	< 0.0001*
Diastolic	Educ 2	0.058	2.636	0.02	0.9824
Blood	Educ 3	-0.100	2.201	-0.05	0.9637
Pressure)	Educ 4	0.334	2.096	0.16	0.8734
	Male	-0.686	1.168	-0.59	0.5576
	Ethn1	-2.157	2.596	-0.83	0.4066
	Ethn2	-0.840	6.200	-0.14	0.8924
	Ethn3	-11.223	10.138	-1.11	0.2691
	Ethn4	3.469	3.841	0.90	0.3671
	Smok1	-2.344	2.426	-0.97	0.3346
	Smok2	-1.557	2.659	-0.59	0.5586
	NoSpouse	-0.631	1.252	-0.50	0.6145
	Age	-0.119	0.064	-1.86	0.0637

*Correlation is significant at the 0.05 level.
** Adjusted for educational level, ethnicity, smoking history, age, and presence of spouse in the program

significantly associated with blood pressure risk level and gender, after adjusting for educational level, ethnicity, smoking history, age, and presence of spouse in the program.

Table 3.14 shows that greater decreases in cholesterol from baseline to end were significantly associated with higher cholesterol risk level. This was true after adjusting for gender, educational level, ethnicity, smoking history, age, and presence of spouse in the program.

Table 3.14

Regression Coefficients: Change in Cholesterol **

Dependent Variable	Independent Variable	Slope Coefficient	Std error	*t* value	*p*
CCHOL	CholL0	68.027	5.704	11.93	< 0.0001*
	CholL1	31.532	5.674	5.56	< 0.0001*
	Educ 2	-15.339	10.040	-1.53	0.1275
	Educ 3	-5.198	8.346	-0.62	0.5339
	Educ 4	-4.271	7.980	-0.54	0.5929
	Male	-11.164	4.135	-2.70	0.0073
	Ethn1	-0.141	9.427	-0.01	0.9881
	Ethn2	-1.178	22.507	-0.05	0.9583
	Ethn3	-21.686	36.762	-0.59	0.5557
	Ethn4	-4.253	13.917	-0.31	0.7601
	Smok1	5.380	8.820	0.61	0.5424
	Smok2	2.856	9.626	0.30	0.7669
	NoSpouse	2.173	4.649	0.47	0.6405
	Age	-0.275	0.234	-1.18	0.2404

* Correlation is significant at the 0.05 level.
** Adjusted for gender, educational level, ethnicity, smoking history, age, and presence of spouse in the program.

Table 3.15 shows that increase in total points from baseline to end was significantly associated with decreased BMI risk level after adjusting for gender, educational level, ethnicity, smoking history, age, presence of spouse in the program, and blood pressure and cholesterol risk levels.

Additional calculations were performed of change scores for the outcome variables over the 1998-2006 period, this time dividing the population into risk categories at baseline (Table 3.16).

For BMI, those in the normal range at baseline (BMI $\leq$ 24.9) increased in BMI more than those in overweight and obese categories. All categories increased over time in the 8-year period, except the extreme obesity category where subjects decreased by 1.82 kg/m^2. Participants in the normal and overweight categories who increased BMI by 1.62 to 1.66 kg/m^2, increased less than an average population as reported in the CARDIA study where average increases in BMI were 1.88 kg/m^2 in the same time period (Lewis et al., 2000).

A similar difference was seen in both systolic and diastolic blood pressure, comparing change scores for different levels according to risk. Blood pressure for participants at the normal or prehypertensive level increased over the 8-year period, but decreased in both systolic and diastolic for those who started in the hypertensive level. Cholesterol measurements for persons at the desirable level increased over the 8 years, but decreased for those who started at the borderline or high levels.

When comparing annual point total increases for participants at different BMI levels, those in the normal BMI range earned fewer points than those in the other ranges, with those in the extreme obesity range earning more than those in all other ranges.

Table 3.15

*Regression Coefficients: Change in Total Annual Points***

Dependent Variable	Independent Variable	Slope Coefficient	Std error	*t* value	*p*
CTOT	Educ 2	92.678	82.912	1.12	0.2645
	Educ 3	66.225	67.867	0.98	0.3299
	Educ 4	-15.712	64.528	-0.24	0.8078
	Male	48.062	37.799	1.27	0.2045
	Ethn1	129.020	81.808	1.58	0.1157
	Ethn2	-187.322	195.597	-0.96	0.3389
	Ethn3	78.898	315.939	0.25	0.8030
	Ethn4	30.236	120.018	0.25	0.8013
	Smok1	7.337	76.959	0.10	0.9241
	Smok2	18.294	83.886	0.22	0.8275
	NoSpouse	11.720	39.663	0.30	0.7678
	Age	-4.136	2.017	-2.05	0.0411*
	CholL0	4.336	50.162	0.09	0.9312
	CholL1	6.317	49.595	0.13	0.8987
	BPDL0	-23.697	62.098	-0.38	0.7030
	BPDL1	-17.086	57.889	-0.30	0.7676
	BPSL0	30.747	71.645	0.43	0.6681
	BPSL1	-50.626	63.585	-0.80	0.4265
	BMIL0	-619.929	112.011	-5.53	< 0.0001*
	BMIL1	-564.573	112.034	-5.04	< 0.0001*
	BMIL2	-526.834	115.312	-4.57	< 0.0001*

*Correlation is significant at the 0.05 level.
** Adjusted for gender, educational level, ethnicity, smoking history, age, presence of spouse in the program, and blood pressure and cholesterol risk levels.

Table 3.16

Mean Change by Risk Levels and Gender

	N	Change Score 1998-2006	*p*
Mean BMI Change			
Normal BMI	162	1.62	0.0004*
Overweight BMI 25 to 29.9	119	1.66	0.0004*
Obesity BMI 30 to 39.9	69	2.38	< 0.0001*
Extreme Obesity BMI ≥ 40	9	-1.82	< 0.0001*
Males	144	0.82	0.3730
Females	218	1.10	0.0822
Mean Systolic Blood Pressure Change			
Normal	149	13.744	< 0.0001*
Prehypertensive	233	5.485	< 0.0001*
Hypertension Stage I & II	30	-11.603	< 0.0001*
Males	144	4.679	0.4386
Females	218	0.405	0.0700
Mean Diastolic Blood Pressure Change			
Normal	149	8.29	< 0.0001*
Prehypertensive	233	0.79	< 0.0001*
Hypertension Stage I & II	30	-7.53	< 0.0001*
Males	144	0.17	0.4386
Females	218	0.86	0.0700
Mean Cholesterol Change			
Desirable	196	6.19	< 0.0001*
Borderline High	139	-30.30	< 0.0001*
High	75	-61.84	< 0.0001*
Males	144	-34.23	0.4386
Females	218	-23.07	0.0700
Mean Change in Total Points			
Normal BMI	198	119.82	0.0004*
Overweight BMI 25 to 29.9	133	175.17	0.0004*
Obesity BMI 30 to 39.9	71	212.91	< 0.0001*
Extreme Obesity BMI ≥ 40	9	739.75	< 0.0001*

*Change is significant at the 0.05 level.

Discussion

The demographic comparison showed that HLIP involves more females than males, even though the eligible population has slightly more males than females. Data were not divided by place of employment, so it is not known if the higher concentration of females in the central office building where many program activities are held may be a reason for higher numbers of females in the program.

The research sought to evaluate the effectiveness of HLIP intervention by examining various outcome comparisons. In brief, comparing levels of participation between continuous enrollees, intermittent enrollees, and dropouts resulted in no significant differences in outcome. Comparing different dosages using the indicator of total points did show certain differences in outcome.

Annual percent change in total points was significant, and indicated that participants increased in healthy behaviors and/or biometric outcomes on average 2.63% each year. Activities which could have earned increased points include losing weight, lowering blood pressure or cholesterol, increasing physical activity levels, stopping smoking, and seeking preventive medical exams. This suggests that encouraging longer participation is valuable in that healthy behaviors and outcomes continue to increase over length of time of participation.

Those behaviors which were significantly associated with an increase in total points were a decrease in BMI, decrease in body fat percent, and decrease in total blood cholesterol level. Further, after adjusting for baseline points, age and sex, increase in total points was still significantly associated with decreases in BMI, body fat, and cholesterol. This reaffirms that longer participation reaps greater health benefits.

Some additional observations were that the changes in weight, body fat percent, and cholesterol decreased with increasing age. This suggests that participants generally became more stable in those outcomes as they got older and had more years of involvement in the program. This is consistent with another longitudinal study which showed that over a period of 6 years, the increases in women's BMI lessened as the age of participants increased (Noppa et al., 1980).

When looking at BMI changes over 8 years for 386 participants, normal and overweight levels of BMI risk were shown to increase in BMI less than the average population in the CARDIA study, which compared over 5000 adults ages 18 to 30 at baseline, sampled in four different locations throughout the United States (Lewis et al., 2000). In that study, average white participants increased by 2.35 kg/m^2 in 10 years, or 1.88 kg/m^2 in 8 years (Table 3.17).

Therefore, although health risk would have been lowered more if those in overweight categories had lost weight, participation in HLIP apparently helped decrease weight gain which is also a significant health benefit. And for those most in need of health improvement, at the level of extreme obesity (BMI $\geq$ 40), participants did succeed

Table 3.17

Mean Change in BMI by Risk Level at Baseline

	kg/mm^2
Normal	1.62
Overweight	1.66
Obesity	2.38
Extreme Obesity	-1.82
Population *	1.88

* (from Lewis et al., 2000)

in losing weight, to lower BMI levels on average -1.82 kg/m^2. At an average female height of 65 inches, that decrease in BMI would be equal to an 11-pound weight loss. For an average male at 70 inches in height, that decrease in BMI would be equal to a 12.7-pound weight loss.

These potential weight loss figures can be used to predict related decreases in health risks, such as risks for diabetes. In a prospective cohort of 1929 overweight adults, Resnick and colleagues quantified the association of diabetes risk to weight gain or loss, and found that each kilogram of weight gained annually over 10 years was associated with a 49% increase in risk of developing diabetes in the subsequent 10 years [each pound of weight associated with 22% increase in diabetes risk] (Resnick et al., 2000). Losing weight also reduced diabetes risk, such that each kilogram of weight lost annually over 10 years was associated with a 33% lower risk of diabetes in the subsequent 10 years [each pound of weight loss decreased diabetes risk 15%]. This suggests that gaining just 4.5 pounds per year over 10 years doubles one's risk of developing diabetes, and losing 3.3 pounds per year over 10 years cuts the risk in half.

Applying those potential risks to the average increase in the CARDIA study suggests that an average man of height 70 inches would gain 16 pounds in 10 years and increase his diabetes risk 35%. An average woman of 65 inches would gain 20.6 pounds in 10 years, increasing her diabetes risk 45%. So the male HLIP participants in the highest weight ranges ended 10 years of participation with a 54% lower risk of diabetes, and females with 61% lower diabetes risk than the general population described by Resnick.

Participants in higher blood pressure risk levels showed more beneficial changes than those who began the program at normal blood pressure levels. Some increase in blood pressure is expected over time. In one cohort study of 1700 employees, average systolic/diastolic increase was 13.3/2.1 mmHg over 7 years (Miura et al., 2004). For participants in this study, those starting at normal risk level increased blood pressure an average of 13.7/8.3 mmHg, similar to the averages found in the Miura study. For those in the prehypertensive level at baseline, increases averaged only 5.5/0.8 mmHg, less than half the increase for the general public. Participants who started at the hypertension level decreased their blood pressure during the study period, by an average of -11.6/-7.5 mmHg.

The average population is expected to gradually increase in total blood cholesterol over time. Total cholesterol levels increase linearly through adulthood by approx 1 mg/dL per year (Kreisberg & Kasim, 1987). However for participants in this study, average cholesterol increases were only 6.2 mg/dL over 8 years for those starting in the desirable range. Those starting in a borderline high range lost 30 mg/dL over 8 years, and those in the high range lost 62 mg/dL in the same time period. Thus, HLIP participants in the higher risk levels for BMI, blood pressure, and cholesterol were the ones who benefitted most from the intervention. This confirms that benefits accrued to participants most in need of health interventions, and underscores the need to expand the program to more of the higher risk employees.

Limitations of Data Analysis

Various potential threats to validity exist in this retrospective study of existing client records. The data have been collected over 10 years time, and at this point true consistency of collection methods cannot be confirmed. Although the staff has been relatively stable, considerable turnover occurs over 10 years, with resulting variation in collection of biometric measures and storage of self-reports. This has been moderated by a consistent and detailed training program for all staff employed in annual screenings.

Cholesterol measurements have been done for all 10 years with the Cholestech LDX System which has been certified by the Cholesterol Reference Method Laboratory Network (CRMLN, 2007). This certification validates that the system meets the gold standard for accuracy and reproducibility developed by the Centers for Disease Control and Prevention (CDC) for the measurement of total cholesterol, consistent with the National Cholesterol Education Program (NCEP) analytic goals (Cholestech, 2006).

Weights have been taken on different scales over the years, which may introduce a small amount of inconsistency in the data collected. Another source of variation is that heights have been self-reported rather than measured in the clinic. Two different recent studies of self-reported heights and weights found weight was under-reported by 3.2 % but height was over-reported by less than 0.2% (Nyholm et al., 2005) and (Brunner Huber, 2007). A newer study of NHANES data found that men over-report their height significantly, especially after age 50, and women over-report height after age 60 (Merrill & Richardson, 2009). The HLIP program should therefore consider measuring heights, if not feasible for all participants then at least for those over age 50.

Future data collection could be done following more strict protocols and with consistent instruments. Collecting data each year on a similar cohort who do not participate in HLIP (such as temporary employees not eligible for HLIP) might provide a control group with similar demographics. The maturation effect, the natural changes that occur with the passage of time, were also threats to validity. These were controlled by comparing the subjects to national rates of increasing obesity, blood cholesterol and hypertension over the same 10-year period.

Conclusions

This research has shown various specific ways the HLIP has significantly impacted employee health risks, behaviors, and outcomes in the long-term. Participants in HLIP have lower increases in BMI than the general population had during the same time period, and lower resulting risks for diabetes and other chronic diseases. Blood pressure and cholesterol improvements were seen most markedly in those at highest hypertension and cholesterol risk levels at baseline.

Additional improvements to this worksite program are worth developing, to extend its reach to higher-risk employees and employees in population groups that participated in relatively lower numbers: males, Hispanics, and those without college educations. Since the wellness intervention is continuing at Salt Lake County, the potential exists for a case-control prospective cohort study. More specific results could be obtained by measuring both participants and a similar group of nonparticipants from the same worksite population.

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CHAPTER 4

ASSOCIATIONS BETWEEN SELF-REPORTS AND CLINICAL MEASURES IN A WORKSITE WELLNESS PROGRAM

Abstract

To help curtail the increasing prevalence of lifestyle-related chronic diseases, Salt Lake County has implemented an incentive-based health promotion program for its employees. Since the annual incentives are based largely on self-reported behaviors, this study sought to examine the relationship between self-reports and clinically measured indicators.

Archival data were examined for 422 employees who had participated in the Healthy Lifestyle Incentive Program (HLIP) for at least 10 years. Their self-reported levels of fruit and vegetables consumption, physical activity, intake of high-fat and high-fiber foods, overall health status, and their stated weights were compared to clinically measured body fat percent, blood pressure, total blood cholesterol, and weight, and calculated Body Mass Index.

Self-reported physical activity was shown to be associated with body fat percent and BMI but not with blood pressure and blood cholesterol. Self-reported food intake levels were not shown to be correlated with any biometric measures. Self-reported

weights were 1.7% lower on average than measured weights. Self-reported overall health status was consistent with blood pressure, body fat percent, and BMI.

Self-reports of physical activity, weight and overall health status, but not food intake levels, were shown to be useful self-report indicators and correlated to biometric results. Possibly, worksite incentive systems should be revised to depend less on self-reports in determining annual cash payments. Reports of food intake could be useful for self-monitoring purposes, but need a more complete measurement tool.

The lack of correlation of self-report measures to blood pressure or blood cholesterol could be associated with the use of prescription medications in addition to self-reported physical activity and food intake. Hence, self-reports of taking these medications as prescribed by a doctor should be added to the point system. Participants' ratings of their overall health status were highly correlated with many biometric outcomes, and appear to be a useful indicator to identify high risk employees for health interventions.

Introduction

In 2000, the U.S. Surgeon General called the health consequences of obesity among the most burdensome public health issues faced by the nation, and called on leaders from diverse groups to cooperate in addressing obesity (USDHHS, 2001). Since then, the rate of obesity has substantially increased nationally to an average of 26.3% of the population (NCCDP, 2008). As obesity has increased, so have associated chronic health problems which now impact an estimated 42% of the U.S. adult population (Wilper et al., 2008). Additionally, the prevalence of diabetes has increased almost 50% since 2002, and costs exceed $174 billion (ADA, 2008).

Because most of the adult population is employed, the worksite is an important setting where adults can be educated to reduce the prevalence and health care burden of overweight, obesity, and associated chronic health problems related to life style. According to a task force assembled by the Centers for Disease Control and Prevention (CDC), one important advantage to addressing health in the worksite is that these areas "allow access to employees in a controlled environment through existing channels of communication and social support networks" (Katz et al., 2005, p. 2). Chapman (2004) called the worksite one of the most influential settings where health education can take place and health behaviors can be improved.

The Salt Lake Valley Health Department established a worksite intervention called the Healthy Lifestyle Incentive Program (HLIP) in 1990. Key elements of the program are Health Risk Appraisals, annual screenings, and monthly reports by participants in which they record exercise behavior, seat belt usage, breast or testicular self-exams, and certain medical interventions such as mammograms and physical exams. At the end of each year, the reported activities are assigned points, and cash bonuses are given according to total points accrued in the year. With the reliance on self-reporting for the incentive of a monetary reward, the data are potentially biased.

After 4 years of this program's implementation, its impact on health risk factors was assessed (Poole, Kumpfer, & Pett, 2001) and the researchers found improvements in health risk indicators. Now that the same worksite program has been in place for 18 years, a longer-term case record study examined 10 years of data for both self-reported behaviors and the biometric results for the same employees (see Hyatt Neville et al., 2009). The data analysis revealed that 475 of the 1495 employees currently enrolled had participated for 10 years and 398 had every year. The long-term participants had significantly lower increases in BMI than the general population in the 10-year period. The largest improvements in BMI, blood pressure and cholesterol were found in those employees with the highest obesity, hypertension and cholesterol risk levels at baseline.

The study sought to compare and contrast what participants reported about their health behaviors to what their biometric results showed. Variables studied included self-reports of fruit and vegetable or high fiber dietary intake, high fat and cholesterol dietary intake, physical activity, and weight.

Fruit and Vegetable Intake

Studies have linked a high intake of fruits and vegetables with lower blood pressure, lower BMI, and lower heart disease risk (Alsonso et al., 2004; He et al., 2007). HLIP participants were asked in the annual Health Risk Appraisal, "*Do you eat some food every day that is high in fiber, such as whole grain bread, cereal, fresh fruits or vegetables?*" and the only possible answers were either *yes* or *no*. In addition, the screening form asked, "*How many servings of fruits and vegetables do you eat each day?*" with a blank for a number of servings.

If these two self-report questions were reliable and valid ways to measure eating behavior, a correlation could be expected between healthier BMI, blood pressure, and cholesterol readings for those who replied "yes" to eating daily high fiber foods, and reported eating more servings of fruits and vegetables, than for those who replied "no" and reported fewer fruit and vegetables. This would be consistent with a study of 1265 adults over 17 years that found that women's diets higher in fruits vegetables were found to be inversely associated with BMI, waist circumference and blood pressure (McNaughton et al., 2007).

Another food intake question was *"Do you eat foods every day that are high in cholesterol or fat, such as fatty meat, cheese, fried foods, or eggs?"* If answers to this accurately reflected fat intake, an association would be expected in respondents' blood cholesterol levels. As long ago as 1957, Ancel Keys showed that dietary fats increased blood cholesterol (Keys & Parlin, 1966). Genetic inheritance and stress levels also play a role in cholesterol levels. Recent studies (Sacks et al., 2009) have found the total amount of caloric intake daily is what matters in reducing weight and not the type of food eaten.

Physical Activity

The recommendation to engage in moderate physical activity at least 30 minutes on most days of the week has been linked to improvements in blood pressure, cholesterol and obesity (Pate et al., 1995). A Surgeon General's report acknowledged that more than 60% of American adults are sedentary and reiterated the numerous health benefits from physical activity (Manley, 1996). Researchers in various settings including an expert panel from the CDC (Pate et al., 1995) and a team at the Mayo Clinic (Chakravarthy, Joyner, & Booth, 2002) have concluded that increased physical activity would reduce blood pressure and cholesterol and resulting heart disease risks. More recently, 51% of Americans stated in a nationwide telephone survey that they exercised more than 30 minutes five times a week (Rosamond et al., 2008), and the same study reported that death rates from cardiovascular disease declined 25% from 1994 to 2004, but in 2005 still accounted for 35.2% of all deaths.

Participants in HLIP answered a general question about their exercise habits, "*In an average week, how many times do you engage in physical activity (an accumulation per day of 30 minutes or more of physical activity such as brisk walking)?*" Possible responses were *"less than 1 day/week, 1 or 2 days/week, 3 or 4 days/week, 5 days/week or more."* If answers to that question accurately reflected participants' exercise habits, an association would be expected to their blood cholesterol and blood pressure outcomes. One exception would be if the participants are taking prescription medications which would be an important topic for further study.

Health Risk Appraisals

Salt Lake County's HLIP has annually required a Health Risk Appraisal (HRA) of participants. When the HLIP was initiated in 1990, HRAs were commonplace and generally used for four purposes: (a) to motivate employees to join health promotion programs, (b) to increase employees' self-monitoring of healthy lifestyle behaviors and disease prevention efforts which alone could improve their healthy behaviors, (c) to help employers to identify major health risks, and (d) to identify health behavior patterns in the population (DeFriese & Fielding, 1990). HRAs were in use in 30% of all worksites, and in 66% of all worksites with at least 750 employees.

Researchers have used information from HRAs to draw conclusions about healthcare expenditures. Goetzel (1998) identified the main health behaviors tied to increased healthcare costs by accessing HRAs from 61,000 employees at six large employers (Goetzel et al., 1998). One review conducted by CDC cautioned about conclusions drawn from HRAs, because of the inherent threat to internal validity with their use (Anderson & Staufacker, 1996). More recent studies have questioned the value of HRAs if used without accompanying disease management strategies, and have found other interventions such as individualized health counseling more effective (Maron et al., 2008). One purpose of the current study is to determine if information from the HRA used by Salt Lake County's HLIP is consistent with biometric findings, and use the results in consideration of revising the role of the HRA.

Self-Reports

Most of the data collected for HLIP come from self-reports by the participants. Self-reported health information collected from individuals is known to be slightly less accurate than clinical measurements. However, self-reports of lifestyle behaviors are the only efficient and cost-effective way to measure employees' physical activity and nutrition behaviors. More detailed methods to measure these include using pedometers, accelerometers and computerized nutrition programs that require employees to log in their daily activities. However, these are expensive and even physical measurements can be inaccurate.

Flegal and colleagues (2002) compared self-reported data from the Behavioral Risk Factor Surveillance System (BRFSS) to clinical measurements from the National Health and Nutrition Examination Survey (NHANES). They concluded that clinical measurements of weight using scales showed the prevalence of obesity to be 30.5%, whereas during the same time frame the BRFSS had shown a prevalence of 19.8% obesity from self-reports of height and weight.

Because of this question in the field about the usefulness of self-report measures of health behaviors, the current study provides one way to compare clinical measurements with self-reports in a long-term intervention.

Methods

Subject Recruitment

Enrollment in the HLIP at the end of 2007 was 1495 employees. Of these, 475 were enrolled 10 years earlier in 1997, and 398 had participated for 10 consecutive years. Participants were all either employees of Salt Lake County with benefits including health insurance, or spouses of those employees. Files for each employee were kept by Health Department staff in locked cabinets. Data were gathered from the Carter Center for Emory University's *Health Risk Appraisal,* the Utah Department of Health's *Blood Pressure/Cholesterol Screening Form*, and HLIP's biometric intake form for each participant. Data were entered into spreadsheets where each participant was assigned a research code number and personal identifiers were removed.

Design

A quasi-experimental retrospective cohort study was conducted, comparing dosage levels and outcomes. The research question, to explore the differences between self-reports and biometric outcomes, was whether an association existed between self-reports of health behaviors and biometric outcomes for the same participants.

Intervention

The intervention consisted of participation in the HLIP between 1997 and 2007. At initial enrollment and again every year, employees completed a Health Risk Appraisal, answering questions about health behaviors such as smoking, fruit and vegetable intake, frequency of physical activity, and others. They also completed a Blood Pressure/Cholesterol Screening Form answering additional questions about family history of chronic diseases. At the time of assessment, clinical measurements were taken including blood pressure, weight, total cholesterol, and body fat using bioelectrical impedance. Participants were counseled individually about personal health risks according to their answers to the Health Risk Appraisal, and given corresponding printed information.

During each year of involvement, participants tracked healthy behaviors on monthly logs, which included reports of physical activity, seat belt usage, and breast or testicular self-examination. Logs were submitted monthly along with additional health forms documenting special health interventions such as preventive medical examinations, smoking cessation, or weight loss classes. The HLIP staff presented periodic educational programs in brown-bag classroom settings, and conducted seasonal promotions to raise awareness of health topics such as heart health, breast cancer, and prevention of weight gain over holiday periods. At the end of each year another assessment was done with another Health Risk Appraisal, screening form, and repeated clinical measurements.

Measures

Data entry staff recorded health behaviors from each participant's file, including self-reported answers from two different sources. Four questions were recorded, out of the 43 found in the Carter Center for Emory University's *Health Risk Appraisal*, which was validated by Gazmarian (1991). They are shown in Table 4.1. Fourteen responses were taken from the Utah Department of Health's *Blood Pressure and Cholesterol Screening Form* (Table 4.2).

Table 4.1

Responses From Health Risk Appraisal

Item	Response
How many cigarettes a day do you smoke?	Number
Do you eat some food every day that is high in fiber, such as whole grain bread, cereal, fresh fruits or vegetables?	1=Yes 2 = No
Do you eat foods every day that are high in cholesterol or fat, such as fatty meat, cheese, fried foods, or eggs?	1=Yes 2=No
Considering your age, how would you describe your overall physical health?	1=Excellent 2=Good 3=Fair 4=Poor

Table 4.2

Data From the Blood Pressure and Cholesterol Screening Form

Item	Response
Date of birth	Date
Gender	1 = Male, 2 = Female
Self-reported height	Height in inches
Self-reported weight	Weight in pounds
Ethnic origin:	1=White, 2=Black, 3=American Indian, 4=Hispanic, 5=Asian, 6=Pacific Islander, 7=Other.
Education level:	1=Less than high school, 2=High school graduate, 3=Some college, 4=College graduate, 5=Technical, trade or business college.
Has your doctor ever said you have high blood pressure?	1=Yes, 2=No
Are you now under a doctor's care for high blood pressure?	1=Yes, 2=No
Are you now taking medications for high blood pressure?	1=Yes, 2=No
Has your doctor ever said you have high blood cholesterol?	1=Yes, 2=No
Are you now under a doctor's care for high blood cholesterol?	1=Yes, 2=No
Are you now taking medications for high blood cholesterol?	1=Yes, 2=No
How many servings of fruits and vegetables do you eat each day?	Number
In an average week, how many times do you engage in physical activity (*an accumulation per day of 30 minutes or more of physical activity such as brisk walking)*	1=less than one day/week, 2=1 or 2 days/week, 3=3 or 4 days/week, 4=5 days/week or more.

In addition to these self-reports, biometric values were recorded by health educator staff members on HLIP's biometric intake form: (a) weight, (b) blood pressure, (c) nonfasting total blood cholesterol, and (d) percent body fat.

Statistical Analyses

Data were recorded from archival employee records from 1996 to 2007. BMI was calculated from weight as measured by the health educator and recorded on the biometric form and self-reported height, using the formula (weight in pounds) X 703 / (height in inches)^2 and is expressed in kg/m^2.

Pearson product-moment correlation coefficient calculations were done to assess the degree that self-reported variables of fruit and vegetable intake, physical activity, smoking activity and general perception of health status were related to biometric outcomes of blood pressure, BMI, and cholesterol. Variables of total years in the program and average points earned per year were also correlated with the other variables.

Mean change scores in health behaviors and biometric variables were computed from baseline in 1998 to end point in 2006, and annual percent change was computed with statistical significance based on an α level of 0.05. Multiple regression was used to assess the simultaneous effect of self reports of high fiber diets and high fat diets on outcomes.

One final linear regression was performed to control for cholesterol and blood pressure medication use, with post hoc Student-Newman-Keul's Test for differences between groups.

Analyses were performed using SAS software (version 9.1; SAS Institute Inc., Cary, NC). Statistical significance was set at .05.

Results

Self-Reported Weights

Of 4770 weight measurements recorded for 423 participants over a range of 12 years, 1310 (27%) self-reported weights were corrected by the screener if the self-report was 0.5 pounds different or more. Of the total, 872 (18%) were underestimates and 438 (9%) were overestimates. Of the incorrect self-reports, 438 (33%) over-estimated and 872 (67%) under-estimated their weight. Those who over-estimated guessed an average of 2.5% too high, while those who under-estimated were an average of 3.3% too low. Self-reports were an average of 1.7% lower than the correct weight (Table 4.3).

Of interest is that 24% of the men self-reported their weight as higher by an average of 3.5 pounds compared to only 15% of women who reported their weight too high by 3.2 pounds. By comparison, about the same percentage of women and men (9.4% and 9.6%, respectively) reported their weight as lower than it is by an average of 2.2 and 2.7 pounds. Rates of underestimating increased for higher obesity category participants. Those in the extreme obesity group (BMI $\geq$ 40) underestimated by 7% compared to the normal weight group who underestimated by only 2.9%.

When comparing how different age groups estimated their weight, both males and females gave more frequent incorrect estimates as they grew older (Table 4.4). Accuracy decreased from 85% for those under age 30 to about 50% after age 50. In all age and gender groups participants underestimated more than they overestimated, except for males under age 30 whose overall estimates were an average of 7.5% higher than the measured values.

Table 4.3

Self-Reports of Weight Compared to Physical Weight Measurements

	Total	Correct	Under-estimated	Over-estimated
Number	4770	3460 (73%)	872 (18%)	438 (9%)
Mean estimated wt of particpnts	174.97	177.70	178.02	179.79
Mean measured wt of particpnts	178.0	177.70	184.10	175.40
Estimated – Measured	-3.03	0	-6.08	4.39
Percent difference	-1.7 %	0	-3.3 %	+2.5%
Participants Divided by Gender				
Males (Mean BMI = 26.1)	1839	1222 (66 %)	444 (24%)	173 (9 %)
Mean estimated wt	194.63	197.00	193.00	199.24
Mean measured wt	198	197	200	194
Est – Meas	-3.37	0.00	-7.00	5.24
Percent difference	-1.7 %	0	-3.5 %	+2.7 %
Females (Mean BMI = 25.6)	2782	2090 (75%)	426 (15%)	266 (10%)
Mean estimated wt	161.21	164.00	161.66	166.75
Mean measured wt	163	164	167	163
Est – Meas	-1.79	0.00	-5.34	3.75
Percent difference	-1.1 %	0	-3.2 %	2.3 %
Participants Divided by BMI Risk Category				
Normal BMI ≤ 24.9	1694	1254 (74%)	266 (16%)	174 (10%)
(39 % of participants)				
Mean estimated wt	141.01	142.00	143.71	144.81
Mean measured wt	142	142	148	141
Est – Meas	-0.99	0.00	-4.29	3.81
Percent difference	-0.7 %	0	-2.9%	+2.7 %
Overweight BMI=25-29.9	1481	989 (67%)	340 (23%)	152 (10%)
(34 % of participants)				
Mean estimated wt	177.12	181.00	175.99	182.27
Mean measured wt	180	181	182	178
Est – Meas	-2.88	0.00	-6.01	4.27
Percent difference	-1.6 %	0	-3.3 %	+2.4 %

Table 4.3 continued

	Total	Correct	Under-estimated	Over-estimated
Obese BMI = 30-39.9	1008	688 (68%)	234 (23%)	86 (8.5%)
(23 % of participants)				
Mean estimated wt	212.11	216.00	210.81	217.69
Mean measured wt	216	216	218	213
Est – Meas	-3.89	0.00	-7.19	4.69
Percent difference	-1.8 %	0	-3.3 %	+2.2 %
Extreme Obese BMI ≥ 40	176	128 (73%)	23 (13%)	25 (14%)
(4 % of participants)				
Mean estimated wt	265.74	270.00	258.54	281.05
Mean measured wt	272	270	278	275
Est – Meas	-6.26	0.00	-19.46	6.05
Percent difference	-2.3 %	0	-7.0 %	+2.2 %

Table 4.4

Self-Reports of Weight by Age Group

	Total	Correct	Under-estimated	Over-estimated
Males Divided by Age Group				
Age 16 to 29	65	55 (85%)	8 (12%)	2 (3%)
(3.8% of participants)				
Mean estimated wt	185.2	188.2	168.5	170.0
Mean measured wt	172.3	188.2	173.9	166.0
Est – Meas	12.9 lb	0	-5.4 lb	4.0 lb
Percent difference	7.5%	0	-3.1%	+2.4%
Age 30 to 39	279	201 (72%)	50 (18%)	28 (10%)
(16.1% of participants)				
Mean estimated wt	195.1	195.7	195.4	190.9
Mean measured wt	195.7	195.7	201.8	185.6
Est – Meas	-0.6 lb	0	-6.4 lb	5.4 lb
Percent difference	-0.3%	0	-3.2%	+2.9%
Age 40 to 49	600	427 (71%)	130 (22%)	43 (7%)
(34.7% of participants)				
Mean estimated wt	199.9	199.7	196.9	210.1
Mean measured wt	203.0	199.7	202.7	203.9
Est – Meas	-3.1 lb	0	-5.8 lb	6.2 lb
Percent difference	-1.5%	0	-2.9%	+3.1%
Age 50 to 59	659	381 (58%)	204 (31%)	74 (11%)
(38.1% of participants)				
Mean estimated wt	197.5	198.9	193.7	200.73
Mean measured wt	199.0	198.9	199.9	196.0
Est – Meas	-1.5	0	-6.2 lb	4.7 lb
Percent difference	-0.8%	0	-3.1%	+2.4%
Age 60 to 69	126	59 (47%)	48 (38%)	19 (15%)
(7.3% of participants)				
Mean estimated wt	191.8	193.7	191.9	186.0
Mean measured wt	193.3	193.7	197.9	182.6
Est – Meas	-1.5 lb	0	-6.1 lb	3.4 lb
Percent difference	-0.8%	0	-3.0%	+1.9%

Table 4.4 continued

	Total	Correct	Under-estimated	Over-estimated
Females Divided by Age Group				
Age 16 to 29	129	110 (85%)	11 (9%)	8 (6%)
(5.0% of participants)				
Mean estimated wt	158.2	157.7	167.0	154.4
Mean measured wt	162.9	157.7	173.1	148.4
Est – Meas	-4.7 lb	0	-6.1 lb	6.0 lb
Percent difference	-2.9%	0	-3.5%	+4.0%
Age 30 to 39	507	407 (80%)	51 (10%)	49 (10%)
(19.5% of participants)				
Mean estimated wt	158.3	158.4	156.4	159.3
Mean measured wt	158.8	158.4	161.9	155.5
Est – Meas	-0.5 lb	0	-5.5 lb	3.8 lb
Percent difference	-0.3%	0	-3.4%	+2.4%
Age 40 to 49	1025	783 (76%)	149 (15%)	93 (9%)
(39.4% of participants)				
Mean estimated wt	164.9	165.3	160.9	168.1
Mean measured wt	165.4	165.3	166.1	164.2
Est – Meas	-0.4 lb	0	-5.2 lb	3.9 lb
Percent difference	-2.6%	0	-3.2%	+2.4%
Age 50 to 59	821	541 (66%)	183 (22%)	97 (12%)
(31.6% of participants)				
Mean estimated wt	167.2	168.2	162.5	170.2
Mean measured wt	167.7	168.2	168.2	166.9
Est – Meas	-0.5 lb	0	-5.7 lb	3.3 lb
Percent difference	-0.3%	0	-3.4%	+2.0%
Age 60 to 69	120	62 (52%)	36 (30%)	22 (18%)
(4.6% of participants)				
Mean estimated wt	167.8	167.5	166.9	170.3
Mean measured wt	168.9	167.5	170.4	166.6
Est – Meas	-1.1 lb	0	-3.5 lb	3.7 lb
Percent difference	-0.7%	0	-2.1%	+2.2%

Self-Reports and Total Points

Results of the Pearson correlation did show a significant positive relationship between total points earned and increased self-reported physical activity ($r = 0.232$. $p < 0.0001$). Conversely, no significant correlation was found between total points earned and self-reported change in fruit and vegetable intake (Table 4.5).

Change in total points continued to be significantly positively associated with change in physical activity even after adjusting for age, sex, and preassessment points (Table 4.6).

Table 4.5

Pearson Coefficients: Correlation With Total Points

Change Scores:	r	r^2	p value
Fruit/vegetable intake	0.042	0.002	0.4875
Physical Activity	0.232	0.054	< 0.0001*
Spearman Correlation Coefficients			
Fruit/vegetable intake	-0.002	0.00	0.9713
Physical Activity	0.293	0.086	< 0.0001*

*Correlation is significant at the 0.05 level.

Table 4.6

Adjusted Regression Coefficients by Age, Gender, and Baseline Points

Dependent Variable	Independent Variable	Slope Coefficient	Std error	t value	p value
CPHY	CTOT	0.0006	0.0001	4.53	< 0.0001*
CPHY	AGE	-0.002	0.005	-0.44	0.6587
CPHY	PRPTS98	-.0005	0.0016	-0.31	0.7551

*Correlation is significant at the 0.05 level.

After conducting another Pearson Correlation with several variables it was found that some self-report measures were correlated with biometric outcomes. Physical activity showed a significant negative correlation with body fat percent (r = -0.371, p < 0.001, r^2 = 0.14) and BMI (r = -0.133, p = 0.006, r^2 = 0.02), as well as a positive significant correlation with the other self-report measure of fruit and vegetable intake (r = 0.143, p = 0.003, r^2 = 0.02), but a negative correlation with health perception (r = -0.383, p < 0.001, r^2 = 0.15). Physical activity was also significantly correlated with total points earned (r = 0.525, p < 0.001, r^2 = 0.28), but not with blood pressure or cholesterol (Table 4.7).

Health perception as self-reported was positively correlated with both systolic (r = 0.120, p = 0.014, r^2 = 0.01) and diastolic (r = 0.188, p < 0.001, r^2 = 0.04) blood pressure, body fat (r = 0.439, p < 0.001, r^2 = 0.19), and BMI (r = 0.317, p < 0.001, r^2 = 0.10); was negatively correlated with self reports for fruit and vegetable intake (r = -0.126, p = 0.010, r^2 = 0.02) and positively correlated with smoking (r = 0.101, p = 0.039, r^2 = 0.01), but had no significant correlation with points earned or cholesterol (Table 4.7).

Some self-reports correlated mainly with other self-report measures rather than with biometric outcomes. Fruit and vegetable intake was significantly positively correlated with physical activity (r = 0.143, p = 0.003, r^2 = 0.02) and negatively with health perception (r = - 0.126, p = 0.010, r^2 = 0.02), but had no significant correlation with blood pressure, BMI, or cholesterol (Table 4.7).

In a linear regression, after adjusting for other variables (Table 4.8), the only variables found significant for change in cholesterol were male gender, use of cholesterol medication, and normal BMI category. For change in systolic and diastolic blood

Table 4.7

Pearson Correlation Coefficients

		r	r^2	p
Years in Program	BPS	-0.059	0.0035	0.224
	BPD	-0.044	0.0019	0.368
	BF	-0.106	0.0112	0.030*
	POINTS	0.044	0.0019	0.369
	CHOL	-0.055	0.0030	0.263
	BMI	-0.089	0.0079	0.068
	FV	0.067	0.0045	0.168
	PA	0.088	0.0077	0.071
	SMOKE	0.001	0.0000	0.991
	HLTH	-0.094	0.0088	0.054
BPSystolic	YEARS	-0.059	0.0035	0.224
	BPD	0.724	0.5242	< 0.001*
	BF	0.107	0.0114	0.028*
	POINTS	-0.025	0.0006	0.606
	CHOL	0.069	0.0048	0.157
	BMI	0.305	0.0930	< 0.001*
	FV	-0.005	0.0000	0.920
	PA	-0.003	0.0000	0.945
	SMOKE	0.008	0.0001	0.873
	HLTH	0.120	0.0144	0.014*
BPDiastolic	YEARS	-0.044	0.0019	0.368
	BPS	0.724	0.5242	< 0.001*
	BF	0.120	0.0144	0.014*
	POINTS	-0.024	0.0006	0.628
	CHOL	0.121	0.0146	0.013*
	BMI	0.352	0.1239	< 0.001*
	FV	-0.053	0.0028	0.281
	PA	-0.006	0.0000	0.898
	SMOKE	-0.027	0.0007	0.581
	HLTH	0.1880	0.0353	< 0.001*
Body Fat Percent	YEARS	-0.106	0.0112	0.030
	BPS	0.107	0.0114	0.028*
	BPD	0.120	0.0144	0.014*
	POINTS	-0.160	0.0256	0.001*
	CHOL	0.072	0.0052	0.139
	BMI	0.590	0.3481	< 0.001*
	FV	0.056	0.0031	0.248
	PA	-0.371	0.1376	< 0.001*

Table 4.7 continued

		r	r^2	*p*
Body Fat Percent	SMOKE	0.012	0.0001	0.799
	HLTH	0.439	0.1927	< 0.001*
	YEARS	0.044	0.0019	0.369
POINTS	BPS	-0.025	0.0006	0.606
	BPD	-0.024	0.0006	0.628
	BF	-0.160	0.0256	0.001
	CHOL	-0.087	0.0076	0.076
	BMI	-0.006	0.0000	0.904
	FV	0.081	0.0066	0.095
	PA	0.525	0.2756	< 0.001*
	SMOKE	-0.028	0.0008	0.569
	HLTH	-0.123	0.0151	0.012*
Cholesterol	YEARS	-0.055	0.0030	0.263
	BPS	0.69	0.4761	0.157
	BPD	0.121	0.0146	0.013*
	BF	0.072	0.0052	0.139
	POINTS	-0.087	0.0076	0.076
	BMI	0.069	0.0048	0.155
	FV	-0.045	0.0020	0.352
	PA	-0.012	0.0001	0.811
	SMOKE	0.027	0.0007	0.575
	HLTH	0.046	0.0021	0.344
BMI	YEARS	-0.089	0.0079	0.068
	BPS	0.305	0.0930	< 0.001*
	BPD	0.352	0.1239	< 0.001*
	BF	0.590	0.3481	< 0.001*
	POINTS	-0.006	0.0000	0.904
	CHOL	0.069	0.0048	0.155
	FV	-0.015	0.0002	0.754
	PA	-0.133	0.0177	0.006*
	SMOKE	0.035	0.0012	0.468
	HLTH	0.317	0.1005	< 0.001*
Fruits & Veg	YEARS	0.067	0.0045	0.168
	BPS	-0.005	0.0000	0.920
	BPD	-0.053	0.0028	0.281
	BF	0.056	0.0031	0.248
	POINTS	0.081	0.0066	0.095
	CHOL	-0.045	0.0020	0.352
	BMI	-0.015	0.0002	0.754

Table 4.7 continued

		r	r^2	p
Fruits & Veg	PA	0.143	0.0204	0.003*
	SMOKE	-0.069	0.0048	0.159
	HLTH	-0.126	0.0159	0.010*
Phys Activity	YEARS	0.088	0.0077	0.071
	BPS	-0.003	0.0000	0.945
	BPD	-0.006	0.0000	0.898
	BF	-0.371	0.1376	< 0.001*
	POINTS	0.525	0.2756	< 0.001*
	CHOL	-0.012	0.0001	0.811
	BMI	-0.133	0.0177	0.006*
	FV	0.143	0.0204	0.003*
	SMOKE	0.001	0.0000	0.981
	HLTH	-0.383	0.1467	< 0.001*
Smoking	YEARS	0.001	0.0000	0.991
	BPS	0.008	0.0001	0.873
	BPD	-0.027	0.0007	0.581
	BF	0.012	0.0001	0.799
	POINTS	-0.028	0.0008	0.569
	CHOL	0.027	0.0007	0.575
	BMI	0.035	0.0012	0.468
	FV	-0.069	0.0048	0.159
	PA	0.001	0.0000	0.981
	HLTH	0.101	0.0102	0.039*
Health Perception	YEARS	-0.094	0.0088	0.054
	BPS	0.120	0.0144	0.014*
	BPD	0.188	0.0353	< 0.001*
	BF	0.439	0.1927	< 0.001*
	POINTS	-0.123	0.0151	0.012
	CHOL	0.046	0.0021	0.344
	BMI	0.317	0.1005	< 0.001*
	FV	-0.126	0.0159	0.010*
	PA	-0.383	0.1467	< 0.001*
	SMOKE	0.101	0.0102	0.039*

*Correlation is significant at the 0.05 level.

Table 4.8

Linear Regression, Coefficient Estimates **

Independent Variable	Model 1 DepVar: Cholesterol	Model 2 DepVar: Systolic BP	Model 3 DepVar: Diastolic BP	Model 4 DepVar: BMI	Model 5 DepVar: Tot Points
Gender Male	- 16.90 *	0.99	-3.91 *	- 0.52	-6.48
Cholesterol Medication	46.87 *				
Blood Pressure Medication		- 8.08 *	-6.48 *		
Fruit/Vegetable Consumption		- 0.39	- 0.35		
BMI Category Normal	39.47 *	5.02		2.07	-583.5 *
BMI Category Overweight	17.51	1.93		2.01	-549.9
BMI Category Obesity	10.11	1.03		2.10	-487.4
BMI Category Extreme Obesity	0.00	0.00		- 0.42 *	0.00

* Significant at $p < 0.05$
** Estimates adjusted for other variables in table

pressure, only use of blood pressure medication and male gender were found significant. For change in BMI, only the extreme obesity category was significantly different from the other BMI categories.

Increases in physical activity were significantly correlated to reductions in BMI and body fat percent ($r = -0.36, p < 0.0001$ and $r^2 = 0.126$), so that 12.6 % of the variance of the body fat decrease is accounted for by the increase in physical activity. No significant correlation was found between physical activity and change in blood pressure (Table 4.9).

Table 4.9

Pearson Coefficients: Correlation With Change in Physical Activity

Change Scores:	r	r^2	p value
BMI	-0.136	0.018	0.0118*
Body fat percent	-0.355	0.126	< 0.0001*
Blood Pressure sys	0.051	0.003	0.3524
Blood Pressure dias	0.091	0.008	0.0929
	Spearman Correlation Coefficients		
BMI	-0.1397	0.020	0.0096*
Body fat percent	-0.3284	0.108	< 0.0001*
Blood Pressure sys	0.0044	< 0.001	0.9352
Blood Pressure dias	0.0773	0.006	0.1545

*Correlation is significant at the 0.05 level.

Change in physical activity significantly impacted the combination of health risk measures (Table 4.10). In the univariate analysis, after adjusting for age, sex, and pre-assessment points in 1998, change in physical activity was significantly associated with change in weight, BMI, and body fat, but not with blood pressure, fruit and vegetable consumption, or cholesterol.

The frequency of participants reporting that they ate high fiber foods made a significant change from baseline in 1998 to endpoint in 2006. The reported intake increased from 93% to 98% (p = 0.0006). Those who reported eating high fat foods did not change significantly from baseline in 1998 to end in 2006 (Table 4.11).

Additional tests showed that high fiber diets as reported at the end of the 8-year period had no significant association with change in BMI, body fat percent or cholesterol, after adjusting for age, sex, and high fiber diet reported at baseline (data not shown).

Table 4.10

*Regression Coefficients: Change in Physical Activity ***

Dependent Variable	Independent Variable	Slope Coefficient	Std error	*t* value	*p* value
CWEIGHT	CPHY	-2.927	1.387	-2.11	0.0358*
CBMI	CPHY	-0.490	0.187	-2.62	0.0093*
CBF	CPHY	-2.217	0.319	-6.95	< 0.0001*

*Correlation is significant at the 0.05 level.
** Adjusted for age, sex, and preassessment points

Table 4.11

Change in Reported Dietary Intake

	Baseline 1998		End 2006		McNemar Test
	No.	%	No.	%	P value
Hi Fiber	326	93.14	342	97.71	0.0006*
Hi Fat	165	48.10	164	47.81	0.9174

*Change is significant at the 0.05 level.

Discussion

Self-Reported Weight

These results show that when given the opportunity to estimate weight, participants underestimated at least twice as often as they overestimated. Only 27% of the participants recorded a weight estimate different from the measured weight, but there was no consistency in requiring each employee to make an estimate. Many participants simply left a blank and waited for the screener to record their actual weight, instead of filling in their estimate. Therefore we cannot conclude that only 27% of participants were unaware of their correct weight. However, of the 1310 participants who did record an incorrect estimate, guesses were more often too low than too high, and the underestimates were of greater magnitude than the overestimates. Overall, the estimates were 1.7% lower than measured weights.

When comparing how different groups estimated weights, males overestimated at about the same frequency as females but males underestimated 60% more often than females did. The gap between males' underestimates and the correct weights was 9% wider than that of the females. One study by other researchers agreed that males underestimated weights more than females (Madrigal et al., 2000), but saw contrasting results with another study where inaccuracies in self-reports were greater for females than males (Rowland, 1990).

Dividing the participants by BMI risk categories revealed that people underestimated weights progressively more in higher BMI groups. Those in the extreme obesity category estimated weights overall at 2.3% lower than actual weights, which was a 35% wider gap than the overall average. This is intuitively logical, as individuals are likely to want to normalize their own situations.

When participants were divided by age group, some of the results were consistent with a recent study of NHANES measures. Merrill and Richardson (2009) found that men over-report their weight on average while women tend to under-report their weight. In the HLIP study, men over-estimated only in the under-30 age group, and women under-estimated in all age groups.

Other studies have similarly found the systematic tendency for overweight and obese subjects to underestimate their weight, resulting in incorrect BMI category assignment in up to 30% of cases (Kuskowska-Wolk et al., 1989). More recently the tendency was found to be specific to restrained eaters, those more conscious of desiring weight loss (Shapiro & Anderson, 2003). However some researchers concluded there was reasonably good agreement between reported and measured weight (Schmidt et al., 1993), and that despite limitations, self-reports were the most efficient way to obtain BMI information (Basterra-Gortari et al., 2007).

In one study researchers concluded self-reported weights were valid and reliable for groups, but not for individuals (Rossouw, Senekal, & Stander, 2001). Using that rationale, the self-reports collected by HLIP could be considered accurate enough for reporting trends over the population, but not necessarily representative in personal situations, such as calculating individual bonus earnings.

Physical Activity

Despite the nonspecific nature of answers on the Health Risk Appraisal and the potential for exaggeration in self-report, the physical activity variable was shown to be significantly associated with certain biometric outcomes. Change in total points earned was significantly associated with change in physical activity even after adjusting for age, sex, and preassessment points. This would be a logical association, since the majority of points earned came from self-reports of monthly exercising activity. The association confirms that participants' annual assessments of their general exercise patterns were consistent with what they reported on monthly activity logs.

Physical activity correlated negatively with BMI and body fat, meaning that as participants reported more average days of physical activity per week, their BMI and body fat percent decreased. After adjusting for age, sex, and preassessment points, the same association held true. When each participant's mean physical activity value over 12 years was correlated with other mean variables, again a negative relationship was found between physical activity and both BMI and body fat percent. The associations between reported physical activity and weight measures of BMI and body fat percent are consistent with studies of the National Weight Loss Registry which concluded that daily activity was the best predictor of maintaining weight loss long term (Wing & Hill, 2001).

These significant associations suggest that self-reports accurately reflected exercise habits, but no correlation was found between physical activity and blood pressure or cholesterol, which would have been expected (Pate et al., 1995).

A positive relationship was found between physical activity and fruit and vegetable intake, and there was a significant inverse relationship with self-reports of perceived overall health. The relationship between these self-reports is logical. As participants are more health-conscious they seem to be both exercising more and eating more fruits and vegetables. At the same time, their scored description of overall physical health decreases, which reflects a healthier value for a corresponding lower score.

Health Perception

On the Health Risk Appraisal, the question was asked, *"Considering your age, how would you describe your overall physical health?"* and options for answers are 1 = Excellent, 2 = Good, 3 = Fair, 4 = Poor. These values were positively correlated with body fat percent, BMI, and with both systolic and diastolic blood pressure. This is consistent, because as body fat percent, BMI and blood pressure decrease, the lower perceived health score is also lower, meaning more favorable. Also logical is that as fruit and vegetable intake increased, the overall health score decreased, again meaning better with a lower score. As smoking behavior increased, overall health score increased, meaning health was worse. These correlations indicate that self-described overall health status as reported on the HRA accurately reflected some clinical findings. Their self-reported health was consistent with smoking and healthy food intake, and consistent with biometric outcomes of blood pressure, body fat percent and BMI. The only variables without any significant correlations to perceived health were total points earned and blood cholesterol level.

Food Intake Questions

The variable for the number of servings eaten daily of fruits and vegetables was associated as expected with self-reported physical activity and overall physical health perception, but no significant associations were found to any biometric outcomes of blood pressure, BMI, or cholesterol. This suggests that the self-reports reflected individuals' knowledge rather than their behavior, which is consistent with other studies. Despite evidence cited by Smith from 14 studies showing how whole grain food intake is associated with decreased chronic diseases, 92% of Americans fail to eat recommended amounts of whole grains (Smith et al., 2003). Hornick (2008) also found that 96-97% of Americans do not follow current dietary guidelines.

When use of blood pressure medication was included in a linear regression which also adjusted for fruit and vegetable intake, changes in both systolic and diastolic blood pressure were found significantly different with medication use, but not with fruit and vegetable intake. This suggests that medication did affect blood pressure readings, so another study stratifying participants by medication use may give more insight into possible effects from fruit and vegetable intake.

Two other variables indicated intake of healthy high-fiber foods and less healthy high-fat foods. Respondents to the HRA were asked, "*Do you eat some food every day* *that is high in fiber, such as whole grain bread, cereal, fresh fruits or vegetables?*" and "*Do you eat foods every day that are high in cholesterol or fat, such as fatty meat, cheese, fried foods, or eggs?*" and possible answers for both were 1 = Yes and 2 = No. When annual percent change was calculated from baseline in 1998 to end in 2006, no significant change had occurred for high fat foods, but high fiber foods had significantly increased from 93% at baseline to 98% after the intervention period.

This may reflect that participants in HLIP learned of the value of high fiber foods via the health messages provided throughout the intervention, or simply that general awareness of the value of high fiber foods increased in the entire population during those same years. While this seems a desirable outcome, in that 98% of respondents reported eating high fiber foods daily after the intervention period, no association was found to any biometric outcomes of BMI, body fat percent or cholesterol.

Participants may have merely been influenced to report on what they felt was expected, rather than their actual intake. This is a frequent finding with self-reports, known as the reactivity effect, where "respondents' answers are designed to present them in a socially favorable way and/or to promote their personal interests" (Harrell, 1985, p. 13). If the favorable healthy eating self-reports had reflected true changes in intake, blood pressure and cholesterol would have been improved as they have been in other studies. Abundant evidence has shown that increased fruit, vegetable and fiber intake have improved blood pressure (Alonso et al., 2004; Miura et al., 2004; Radhika et al., 2008; Utsugi et al., 2008), blood cholesterol (Toft et al., 2007), and other heart disease risk factors (He et al., 2007). Other possible explanations for the lack of correlation is that potential confounders of blood pressure and cholesterol medications were not controlled for in this study, and that the two-item scale in the Health Risk Appraisal may have been too short to be valid.

Studies show that many consumers are unaware of the health consequences of their food intake. A Canadian study concluded that although consumers are now more aware of nutrition terms, they do not understand them any better than in the past (Reid, Conrad, & Hendricks, 1996). Even if consumers are aware, some indicators suggest average intake has grown less healthy (Casagrande et al., 2007; Mellen et al., 2008), and a new study published this month reaffirmed that nutrition knowledge does not regulate eating behavior (Noureddine & Stein, 2009).

More evidence that the typical American diet is deficient in fiber came from Eaton who estimated that the human ancestral diet consisted of 100 grams of fiber per day, mostly from fruits and vegetables, compared to the current American diet which averages 15 grams per day (Eaton, 2006). In a recent position paper, the American Dietetic Association stated that current fiber intake in America is about half the recommended level, and increasing fiber intake would help prevent chronic diseases and reduce the prevalence of obesity (Slavin, 2008). In addition, the position paper reported that knowledge of fiber needs is inadequate. The National Health and Nutrition Examination Survey (NHANES) found that 73% of consumers who eat a low fiber diet believe their fiber intake is sufficient (Alaimo et al., 1994).

This also suggests that food intake would need a validated survey in order to provide a reliable reflection of health status on a self-reported appraisal. Recall methods are considered the least accurate for assessing dietary intake (Schoeller, 1995), and recalling habits over a year's period are especially nonspecific. A reliable assessment of healthy food intake would require a validated Food Frequency Questionnaire such as one developed in India with 224 items (Sudha et al., 2006), or one used recently in a large Swedish study (Berg et al., 2008) containing 92 food items, or more in-depth 24-hour recall methods as used by NHANES (Casagrande et al., 2007).

Total Points

The only significant correlation found between the point totals for the year and other variables was with self-reported physical activity. This is a critical finding because the cash bonuses used as incentives are based on the accumulation of points by participants, and an underlying assumption is that point totals represent healthy behaviors which will produce more favorable health outcomes. A potential testing bias exists, in that participants might have been motivated to over-report, due to the incentive of higher cash bonus for higher exercise totals. The lack of significant associations between total points and biometric outcomes suggests that self-reported physical activity and other methods of accumulating points do not accurately represent participants' health behaviors.

A limitation to the accuracy of these reports is the inclusion of household work among reportable physical activities. One cross-sectional study of almost 15,000 adults failed to find an association between household work and obesity risk, but the same study did find brisk walking and sports associated to decreased obesity risk (Stamatakis, Hillsdon, & Primatesta, 2007). The authors concluded that most household work was likely to be over-reported, and was not sufficiently rigorous to reduce health risk.

Conclusion

Some self-reported measures were associated with biometric outcomes and probably justify the reduced costs of use in worksite wellness programs unless research quality measures are needed. For instance, self-reported weights were only 1.7% lower on average than measured weights. If these self-reports are consistent from pre- to posttest measures or annual measurements, they would be reasonable approximations of reductions or increases in weight.

Of all of the self-reported measures only increases in physical activity were shown to be associated with decreased obesity measures of body fat percent and BMI. However, increased physical activity was not correlated with reduced blood pressure or cholesterol. Conversely, self-reported food intake levels on the brief 2-question scale were not shown to be correlated with any biometric measures. Reasons for this lack of correlation could include that the scale was not valid or individuals have a harder time understanding the questions related to portion size or do not monitor their food intake well. Self-reported overall health status was consistent with many biometric measures including blood pressure, blood fat percent, and BMI. This suggests that asking participants to evaluate their own health may help to quickly identify higher-risk individuals.

The HRA could be updated with newer validated tools, now often called *Personal Health Assessments* (OFW, 2008). Consistent with a review from the Centers for Disease Control and Prevention, the HRA could be used more as a tool for health education, awareness and increasing self-monitoring as part of the program, but not used as much to measure program outcomes (Anderson & Staufacker, 1996). This study is consistent with recent reports showing that HRAs are most valuable when used with feedback and consultation (Faghri et al., 2008). A conclusion from The *Community Guide to Preventive Services* advised that there is insufficient evidence of benefits of an HRA when used alone, but that if used in conjunction with health education, client behavior monitoring or logging, it has potential to change employee health behaviors (CDC, 2009).

Salt Lake County can use these findings to consider revisions to their HLIP as it has been in existence mostly unchanged for 18 years. The incentive system could be revised to rely less on self-reported food intake or a more valid way of measuring food intake could be incorporated like a 3- to 7-day food log. Additionally 7-day pedometers measures could be incorporated. HRAs could be used as a tool for feedback and health education.

Recommendations for Future Research

These findings suggest that additional studies would be helpful to give more insight into potential improvements to HLIP. A qualitative study with focus groups and surveys on barriers to participation would help discover how to recruit high risk employees who do not participate. A prospective study would allow for a control group of nonparticipants to better understand the effects of participation. A study of healthcare costs and absenteeism of participants compared to nonparticipants could reveal more about the return on investment for program expenditures.

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CHAPTER 5

SUMMARY AND CONCLUSIONS

Summary

This study was undertaken to evaluate the worksite intervention called the Healthy Lifestyle Incentive Program (HLIP), which has been in operation for 18 years for employees of Salt Lake County in Utah. The program consists of annual assessments and monthly progress reports from the participants, with a system for accumulating points by demonstrating healthy behaviors and outcomes. Employees earn cash awards based on the number of points earned yearly. Healthy behaviors include physical activity, wearing seatbelts, breast and testicular self-exams, and medical screenings. Health outcomes including weight, body fat percent, blood pressure, and blood cholesterol levels are measured. Out of 4000 eligible employees, about 1500 (38%) were involved in HLIP at the end of 2007.

HLIP's initial impact on health risk factors was evaluated in 1996. Poole, Kumpfer, and Pett (2001) found significant improvements in the 304 participants in body fat, cholesterol, blood pressure, physical activity, smoking prevalence, and seat belt use, by using a prospective cohort design. The current report discusses several facets of the program from three different studies, from the perspective of its 18-year history.

The first study was a qualitative review and process evaluation, comparing program components to best practices identified by experts in health education and industry. Five different sets of guidelines were synthesized, and HLIP was reviewed using the resulting 10 elements as criteria. The second and third studies were quantitative evaluations using a quasi-experimental retrospective cohort to measure effectiveness of outcomes for long-term program participants. In the second study, effectiveness of HLIP was measured by comparing health outcomes to dosage, using points earned as an indicator of dose. The third study was a comparison between self-reports of health behaviors and the participants' biometric outcomes over 10 years, as an evaluation of the association between outcome measures and the self-reports upon which most of the program's incentive-award system is based.

Conclusions

In the process evaluation, HLIP's greatest strengths were found in comprehensive screening, a well-developed incentive plan, and multiple health issues addressed. Weaknesses were found in involving stakeholder partners in program planning and in building cultural and social supports. Other areas needing improvement included management and environmental supports, communication of health messages, individual focus, referrals to other health services, and program evaluation.

In the quantitative analysis, a demographic summary showed that long-term participants in the Healthy Lifestyle Incentive Program were more likely to be female, college educated, and White or Asian. Degree of participation (indicated by annual points earned) increased on average 2.63% each year, reflecting increases in self-reported healthy behaviors and/or improvements in biometric outcomes. Decreasing BMI, body fat percent, and total blood cholesterol were significantly associated with increased intervention dosage. Participants had lower increases in BMI than the general population had during the same time period. BMI, blood pressure and cholesterol improvements were seen most markedly in those who were at highest obesity, hypertension and cholesterol risk levels at baseline.

In the study of self-reports, only a limited correlation was found to the biometric results one would expect if health behaviors were accurately reported. Self-reported physical activity was shown to be associated with body fat percent and BMI but not with blood pressure and blood cholesterol. Self-reported food intake levels were not shown to be correlated with any biometric measures. Self-reported weights were 1.7% lower on average than measured weights. Self-reported overall health status was highly correlated with blood pressure, body fat percent, and BMI.

Applications

These findings can be used by program administrators to further develop the HLIP and enhance its strengths. Its long-term success would be improved by involving stakeholder partners with an advisory council representing divisions throughout the county, which could help build the needed social and cultural supports. In addition to top management approval, middle managers and supervisors should be encouraged to support their employees' healthy efforts.

The comprehensive annual screenings which address multiple health issues could be strengthened by developing a more individual focus, following-up after each employee's annual screening with education, behavior coaching, and referrals to other health services. Health messages could be communicated in more ways, through emails, posters, and employee newsletters. Environmental supports could be enhanced with better collaboration from food suppliers for vending machines and in the employee cafeteria.

Since health outcomes were found to be most pronounced for participants in high health risk categories, the program can extend its impact by targeting those employees, and those in population groups that participated in relatively lower numbers: males, Hispanics, and employees without college educations. Since self-reports of overall health status correlate well with blood pressure and weight, these could be used to identify employees at higher risk who are ready for additional interventions. The *Health Risk Appraisal* could be updated with one of the many validated *Personal Health Assessments* now available, and information found in them could be used in targeted follow-ups.

With the limited correlations found between many self-reports of behavior and biometric outcomes, the incentive-reward system could be reevaluated. More emphasis could be considered for measurable results rather than depending on employees' biased reports about themselves.

Future Research and Innovations

To reach specific return-on-investment conclusions, additional quantitative research is needed. Since HLIP continues to operate and is supported by county administration, a prospective study could be done to compare participants with similar employees from the same worksite population who did not participate. More in-depth qualitative research is also needed with individual employees. Focus groups and surveys could identify employee perceptions, especially from those who have not joined the voluntary program or have dropped out.

New and creative programs should be considered. Innovative programs have the potential of making greater impacts as they create interest in novel ways. Newer approaches could include more use of technology, including emails, interactive websites, distance learning, and cell phone text messages. More allied health professionals should be included, with messages about substance abuse, resiliency, and mental health.

As we approach the end of the Healthy People 2010 decade, fresh approaches will be needed, to build on proven successes of the past while adjusting to inevitable future changes in the workplace. Because so much of the prevalent chronic illness is preventable, and employees are a critical audience for health messages, health promotion in the workplace has the opportunity to change lives and reverse negative health trends in America.

APPENDIX A

HEALTH RISK APPRAISAL

Healthier People Health Risk Appraisal
Carter Center of Emory University

HEALTH RISK APPRAISAL

The health risk appraisal is an educational tool, showing you choices you can make to keep good health and avoid the most common causes of death (for a person of your age and sex). This health risk appraisal is not a substitute for a check-up or physical exam that you get from a doctor or nurse; however, it does provide some ideas for lowering your risk of getting sick or injured in the future. It is NOT designed for people who already have HEART DISEASE, CANCER, KIDNEY DISEASE, OR OTHER SERIOUS CONDITIONS; if you have any of these problems, please ask your health care provider to interpret the report for you.

DIRECTIONS: To get the most accurate results, answer as many questions as you can. If you do not know the answer leave it blank

Please write your answers in the boxes provided.

1. SEX 1 □ Male 2 □ Female

2. AGE ________Years

3. HEIGHT (Without shoes) ___Feet___Inches (No fractions)

4. WEIGHT (Without shoes) ___Pounds (No fractions)

5. Body frame size 1 □ Small
   2 □ Medium
   3 □ Large

6. Have you ever been told that you have diabetes (or sugar diabetes)? 1 □ Yes 2 □ No

7. Are you now taking medicine for high blood pressure? 1 □ Yes 2 □ No

8. What is your blood pressure now?____Systolic (High No.) ____Diastolic (Low No.)

9. If you do not know the numbers, check the box that describes your blood pressure.
   1 □ High
   2 □ Normal or Low
   3 □ Don't Know

10. What is your TOTAL cholesterol level (based on a blood test)? ______mg/dl

11. What is your HDL cholesterol (based on a blood test)? ______ mg/dl

12. How many cigars do you usually smoke per day? _____cigars per day

13. How many pipes of tobacco do you usually smoke per day? _____pipes per day

14. How many times per day do you usually use smokeless tobacco? (Chewing tobacco, snuff, pouches, etc.) _____times per day

15. CIGARETTE SMOKING: How would you describe your cigarette smoking habits?
1 ☐ Never smoked * Go to 18
2 ☐ Used to smoke * Go to 17
3 ☐ Still smoke * Go to 16

16. STILL SMOKE: How many cigarettes a day do you smoke?
_____cigarettes per day * GO TO QUESTION 18

17. USED TO SMOKE
a. How many years has it been since you smoked cigarettes fairly regularly? ____ years

b. What was the average number of cigarettes per day that you smoked in the 2 years before you quit? ____cigarettes per day

18. In the next 12 months, how many thousands of miles will you probably travel by each of the following? (NOTE: U.S. average = 10,000 miles)
a. Car, truck, or van: _____ ,000 miles
b. Motorcycle: ______ ,000 miles

19. On a typical day, how do you USUALLY travel? (Check one only)
1 ☐ Walk
2 ☐ Bicycle
3 ☐ Motorcycle
4 ☐ Sub- or compact car
5 ☐ Mid-size or full-size car
6 ☐ Truck or van
7 ☐ Bus, subway, or train
8 ☐ Mostly stay home

20. What percent of time do you usually buckle your safety belt when driving or riding? ___ %

21. On the average, how close to the speed limit do you usually drive?
1 ☐ Within 5 mph of limit
2 ☐ 6-10 mph over limit
3 ☐ 11-15 mph over limit
4 ☐ More than 15 mph over limit

22. How many times in the last month did you drive or ride when the driver had perhaps too much alcohol to drink? ___times last month

23. How many drinks of an alcoholic beverage do you have in a typical week? (Write the number of each type of drink)
___Bottles or cans of beer
___Glasses of wine
___Wine coolers
___Mixed drinks or shots of liquor

WOMEN ONLY:

24. At what age did you have your first menstrual period? ____years old

25. How old were you when your first child was born? ___years old (If no children, write 0)

26. How long has it been since your last breast x-ray (mammogram)?
1 ☐ Less than 1 year ago
2 ☐ 1 year ago
3 ☐ 2 years ago
4 ☐ 3 or more years ago
5 ☐ Never

27. How many women in your natural family (mother and sisters only) have had breast cancer?
__Women

28. Have you had a hysterectomy operation? 1 □ Yes
2 □ No
3 □ Not sure

29. How long has it been since you had a pap smear test?
1 □ Less than 1 year ago
2 □ 1 year ago
3 □ 2 years ago
4 □ 3 or more years ago
5 □ Never

H30. How often do you examine your breasts for lumps?
1 □ Monthly
2 □ Once every few months
3 □ Rarely or never

H31. About how long has it been since you had your breasts examined by a physician or nurse?
1 □ Less than 1 year ago
2 □ 1 year ago
3 □ 2 years ago
4 □ 3 or more years ago
5 □ Never

H32. About how long has it been since you had a rectal exam?
1 □ Less than 1 year ago
2 □ 1 year ago
3 □ 2 years ago
4 □ 3 or more years ago
5 □ Never

MEN ONLY: H33. About how long has it been since you had a rectal or prostate exam?
1 □ Less than 1 year ago
2 □ 1 year ago
3 □ 2 years ago
4 □ 3 or more years ago
5 □ Never

H34. How many times in the last year did you witness or become involved in a violent fight or attack where there was a good chance of a serious injury to someone?
1 □ 4 or more times
2 □ 2 or 3 times
3 □ 1 time or never
4 □ Not sure

H35. Considering your age, how would you describe your overall physical health?
1 □ Excellent 3 □ Fair
2 □ Good 4 □ Poor

H36. In an average week, how many times do you engage in physical activity (exercise or work which lasts at least 20 minutes without stopping and which is hard enough to make you breathe heavier and your heart beat faster)?

1 □ Less than 1 time per week
2 □ 1 or 2 times per week
3 □ At least 3 times per week

H37. If you ride a motorcycle or all-terrain vehicle (ATV), what percent of the time do you wear a helmet?

1 □ 75% to 100%
2 □ 25% to 74 %
3 □ Less than 25%
4 □ Does not apply to me

H38. Do you eat some food every day that is high in fiber, such as whole grain bread, cereal, fresh fruits or vegetables? 1 □ Yes 2 □ No

H39. Do you eat foods every day that are high in cholesterol or fat, such as fatty meat, cheese, fried foods, or eggs? 1 □ Yes 2 □ No

H40. In general, how satisfied are you with your life?

1 □ Mostly satisfied
2 □ Partly satisfied
3 □ Not satisfied

H41. Have you suffered a personal loss or misfortune in the past year that had a serious impact on your life? (For example, a job loss, disability, separation, jail term, or the death of someone close to you.)

1 □ Yes, 1 serious loss or misfortune
2 □ Yes, 2 or more
3 □ No

H42a. Race

1 □ Aleutian, Alaska native, Eskimo or American Indian
2 □ Asian
3 □ Black
4 □ Pacific Islander
5 □ White
6 □ Other
7 □ Don't know

H42b. Are you of Hispanic origin, such as Mexican-American, Puerto Rican, or Cuban?

1 □ Yes 2 □ No

H43. What is the highest grade you completed in school?

1 □ Grade school or less
2 □ Some high school
3 □ High school graduate
4 □ Some college
5 □ College graduate
6 □ Post graduate or professional degree

APPENDIX B

BLOOD PRESSURE AND CHOLESTEROL SCREENING FORM

UTAH DEPARTMENT OF HEALTH AND LOCAL HEALTH DISTRICTS
BLOOD PRESSURE/CHOLESTEROL SCREENING FORM

PLEASE PRINT INFORMATION AND CHECK THE APPROPRIATE RESPONSE FOR EACH QUESTION

PLEASE READ AND SIGN CONSENT ON BACK OF FORM

LEGAL NAME ____________ (Last) ____________ (First) ____________ (Middle Initial) EIN#____________ TODAY'S DATE ____/____/____ (Mo. Day Year)

ADDRESS ____________ (Street) ____________ (City) ____________ (State) ____________ (Zip) PHONE ____________

WEIGHT ________lbs. HEIGHT______ft.______in. BIRTHDATE ____/____/____ (Mo. Day Year) AGE ________

GENDER	ETHNIC ORIGIN		EDUCATION LEVEL	
	1.______White	4.______Hispanic	1.______Less than high school	4.______College graduate
1.______Male (≥ 45*)	2.______Black	5.______Asian	2.______High school graduate	5.______Technical, Trade or Business College
2.______Female (≥ 55*)	3.______American Indian	6.______Pacific Is.	3.______Some college	
		7.______Other		

PLEASE MARK THE APPROPRIATE ANSWERS ABOUT YOUR BLOOD CHOLESTEROL AND BLOOD PRESSURE IN THE COLUMN INDICATED:

	BLOOD PRESSURE	BLOOD CHOLESTEROL
Has your doctor ever said you have high	1.____*Yes 2.____No	1.____Yes 2.____No
Are you now under a doctor's care for high	1.____Yes 2.____No	1.____Yes 2.____No
Are you now taking medications for high	1.____Yes 2.____No	1.____Yes 2.____No
If taking medication(s), Write name of medication(s) for high	____________	____________

List medication(s) you are taking for other conditions: ____________

DO YOU HAVE HISTORY OF:

Diabetes	1.____*Yes	2.____No
Heart Attack	1.____*Yes	2.____No
Other Heart Disease (Angina, Coronary Bypass, Occluded Arteries)	1.____*Yes	2.____No
Stroke	1.____Yes	2.____No
Kidney Disease	1.____Yes	2.____No

DO YOUR PARENTS, BROTHERS, SISTERS, OR CHILDREN HAVE A HISTORY OF:

Diabetes	1.____Yes	2.____No
Heart Attack (Before Age 55 For Males and Age 65 For Females)	1.____*Yes	2.____No
Heart Attack or other Heart Disease (Angina, Coronary Bypass, Occluded Arteries)	1.____Yes	2.____No
High Blood Pressure	1.____Yes	2.____No
Stroke	1.____Yes	2.____No
Kidney Disease	1.____Yes	2.____No
High Blood Cholesterol	1.____Yes	2.____No

ARE YOU ON ANY KIND OF EATING PLAN (PRESCRIBED BY A PHYSICIAN OR SELF DIRECTED)?
1.___Yes 2.___No
If yes, what is your purpose?
1.______To lose weight 3.______To reduce dietary fats
2.______To control diabetes 4.______To reduce dietary sodium
HOW MANY SERVINGS OF FRUITS AND VEGETABLES DO YOU EAT EACH DAY?______
DO YOU SMOKE CIGARETTES? 1.______*Yes 2.______No
Have you ever been advised by a physician to stop smoking? 1.______Yes 2.______No
DO YOU USE CHEWING TOBACCO? 1.______Yes 2.______No

IN AN AVERAGE WEEK, HOW MANY TIMES DO YOU ENGAGE IN PHYSICAL ACTIVITY,
(An accumulation per day of 30 minutes or more of physical activity such as brisk walking)
1.____ Less than one day/week
2.____ 1 or 2 days/week
3.____ 3 or 4 days/week
4.____ 5 days/week or more
IF YOU ARE FEMALE:
Are you pregnant or have you been during the past six months? 1.______Yes 2.______No
Are you currently breast-feeding? 1.______Yes 2.______No
Are you taking oral contraceptives or pills to regulate periods? 1.______Yes 2.______No
Are you taking estrogens or other hormones? 1.______Yes 2.______No

ORGANIZATION CODE
_____ COUNTY _____ CLINIC

SCREENER USE ONLY
EDUCATION PROVIDED: 1. ☐ BLOOD PRESSURE 2. ☐ CHOLESTEROL 3. ☐ SMOKING 4. ☐ PHYSICAL ACTIVITY 5. ☐ NUTRITION

BLOOD PRESSURE

Obtain at least 2 readings

	systolic	4th sound	diastolic
1st Reading:	______ /	______ /	______
2nd Reading:	______ /	______ /	______
Average of 1st and 2nd Reading:	______ /	______ /	______

If readings differ more than 5mm, obtain additional readings:

systolic	4th sound	diastolic
______ /	______ /	______
______ /	______ /	______

Is blood pressure elevated? . . . . 1.______Yes 2.______No
Is follow-up necessary? . . . . . 1.______Yes 2.______No
Referred to physician? . . . . . . 1.______Yes 2.______No
Referred to county of residence? . 1.______Yes 2.______No

Return to Clinic:
1.______ Within 1 Week 3.______ 1 Year
2.______ 2 Months 4.______ 2 Years

Screener ID______________

BLOOD CHOLESTEROL

*Items in red color with asterisks represent coronary heart disease risk factors

Check all that apply

		Desirable	Borderline	High Risk (or borderline with 2 risk factors)
Total Cholesterol	______ mg /dl	______	______	______
HDL (less than 35 mg/dl)*	______ mg /dl	______	______	______
LDL	______ mg /dl	______	______	______
Triglycerides	______ mg /dl	______	______	______
Glucose	______ mg /dl	______	______	______

*If HDL is greater than 60 mg/dl, deduct a risk factor from the total risk factors.

Is follow-up necessary? . . . . 1.______Yes 2.______No
Referred to physician? . . . . 1.______Yes 2.______No
Referred to county of residence 1.______Yes 2.______No

Return to clinic within:
1.______ 1-8 Weeks 2.______ 3 Months 3.______ 12 Months

Instrument No.____________ Screener ID____________

I hereby give my consent to have my (or my child's) blood pressure taken and/or blood lipid drawn. If either is elevated, I may be contacted by a representative of the program to see if I have sought medical attention.

I understand the information provided will be kept private and I hereby release this organization and employees from any and all liability resulting from or in any way connected to blood drawing for my (or my child's) blood cholesterol measurement or from the value(s) derived therefrom.

I understand that:

1. These procedures are considered only as screening tests and the results are preliminary and are not to be considered diagnostic.
2. The responsibility for obtaining a follow-up exam to confirm high blood pressure and/or high blood lipid, and for advice and treatment, is mine and not that of my physician or the organization associated with this screening.

Signature ______________________________