EVALUATION OF THE BEHAVIORAL, BIOMETRIC, AND FINANCIAL OUTCOMES OF AN EMPLOYER LIFESTYLE MANAGEMENT PROGRAM

by

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(Under the Direction of Mark G. Wilson)

ABSTRACT

Although evidence suggests that workplace health promotion (WHP) programs are effective at improving health and reducing health care costs, little is known about the relative effectiveness of programs when delivered via different modalities. This study evaluated the effectiveness and return on investment (ROI) of mail, Internet, and telephone modalities of WHP programs. A quasi-experimental design was used to test the hypotheses. Selection bias was addressed using propensity scores and missing data were handled via multiple imputation. Hypotheses regarding health risks were tested using a pre/post design in repeated measure ANCOVAs and logistic regressions. Hypotheses regarding health care costs were tested using a difference-in-difference design in generalized estimating equations over 12 and 22 month horizons. Participants in the telephonic program improved their health behaviors, but were not able to consistently change their biometric risks. Though they were also effective at reducing health care costs over 12 months, the effect was not lasting and the program cost were higher than the benefits. Participants in the mail and Internet programs improved a few health behaviors: physical inactivity, elevated stress, and poor back care (mail only); however, they generally did not reduce their medical claims costs or biometric health risk factors. Results comparing modalities generally showed no differences. The literature base supported most of

the findings for the telephone modality, but was in conflict with the lack of change in some of the outcomes by the mail or Internet participants and the comparison of the telephone or Internet to the mail modality. This study, despite noted limitations, was a contribution to the literature with regards to the effectiveness of different modalities of program delivery, changes in some less published health risk outcomes, methodological approaches to missing data and ROI analyses, as well as the importance of theory based programs and process evaluations.

INDEX WORDS: workplace health; lifestyle management; return-on-investment; ROI; health behavior change; modality; telephone; mail; Internet; behavior change.

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CHAPTER 1 – INTRODUCTION

Background

Health Insurance Costs

Employer sponsored health insurance (ESHI) is the leading source of health care insurance in the United States, covering about 159 million people (Kaiser Family Foundation, 2008). These ESHI premiums have increased by 131% from 1999 and now stand at an average annual cost of $13,375 for family coverage. Employers are responsible for about 73% of this amount (Kaiser Family Foundation & Health Research & Educational Trust, 2009). This increase is despite efforts made by employers to control costs through changes to insurance plan designs, such as increased deductibles, copayments, and coinsurance, and requiring employees to contribute more to premiums (Kaiser Family Foundation, 2007; Kaiser Family Foundation & Health Research & Educational Trust, 2009). In response, employers have been implementing employee health management interventions at an increasing rate (Childress & Lindsay, 2006; Kaiser Family Foundation & Health Research & Educational Trust, 2009). Unlike the previous cost containment strategies, health promotion interventions address a root cause of the increasing health costs. Thus it comes as no surprise that employers report implementing these programs primarily to improve the health of employees and reduce health care costs (Kaiser Family Foundation & Health Research & Educational Trust, 2009).

Workplace Health Promotion Programs

Workplace health promotion (WHP) programs can be generally defined as any combination of programs, either at or administered through the workplace, that enhance awareness, change behavior, and create environments that support people in changing their

lifestyle toward a state of optimum health (Centers for Disease Control and Prevention, 2009a; O'Donnell, 1989). Typically, health risk assessments (HRAs), which include a range of questions on medical history, health status, and lifestyle behaviors, are a part of these WHP programs. They are used partially as an health education tool, but in many cases more so as a gateway or identification mechanism for lifestyle management (LM) programs that are designed to focus on a range of health topics (e.g., weight management or smoking cessation). Sixteen percent of employers offering ESHI indicate offering a HRA (Kaiser Family Foundation & Health Research & Educational Trust, 2009). This number differs significantly by firm size such that 14% of small firms (3-199 employees) compared to 55% of large firms (200 or more employees) providing ESHI offer HRAs (Kaiser Family Foundation & Health Research & Educational Trust, 2009). Among those, the prevalence of firms offering financial incentives to complete an HRA (11%) is higher among large firms (34%) than small firms (7%) (Kaiser Family Foundation & Health Research & Educational Trust, 2009). Among large firms offering incentives, reduced premium share and merchandise, travel, gift cards, or cash were the two most popular (27%) forms of incentives (Kaiser Family Foundation & Health Research & Educational Trust, 2009).

More than half (58%) of employers that offer ESHI also offer at least one of the following wellness programs: weight loss programs, gym membership discounts, on-site exercise facilities, smoking cessation programs, personal health coaching, classes in nutrition or healthy living, Web-based resources for healthy living, or a wellness newsletter (Kaiser Family Foundation & Health Research & Educational Trust, 2009). As of 2009, these programs were more prevalent among large firms (93%) compared to small firms (57%) and increased in

prevalence among large firms (88% in 2008) (Kaiser Family Foundation & Health Research & Educational Trust, 2009).

Effectiveness

The general consensus on the effectiveness of WHP programs is that there is sufficient evidence to indicate that they are promising but that the quality or availability of the study findings is limited (Harden, Peersman, Oliver, Mauthner, & Oakley, 1999). A series of literature reviews by Wilson and colleagues (1996; 1996) found that WHP programs for a number of risk factors demonstrate at least suggestive evidence that they are effective at reducing risk factors. Subsequent studies and reviews have found further support for the effectiveness of WHP programs across a number of risk factors (smoking, diet, alcohol, physical activity, overweight, and sun exposure) (Glanz et al., 1998; Goetzel, Ozminkowski, Bruno et al., 2002; Janer, Sala, & Kogevinas, 2002; Katz et al., 2005; Moher, Hey, & Lancaster, 2003; Ozminkowski & Goetzel, 2000).

Furthermore, research indicates that these programs generally have a positive return on investment. Specifically, the most recent review by Chapman (2005) was a meta-evaluation of 56 studies, half of which were published after 1994, that provided individual and average savings and ROI ratios. It found that there is a wide range of ROI ($2.05 to $19.41 :$1.00) and an average ROI of $5.81:$1.00 over an average period of 3.6 years.

As is the case with much of the workplace health promotion literature, the challenge prohibiting a conclusive conclusion is the lack of well-designed controlled studies. Unfortunately, the evaluation of WHP programs presents unique challenges such as quasi- or non-experimental research designs, data confidentiality and privacy concerns, limited data access, limited statistical knowledge, complex data format, high turnover rates, program

immaturity, small population size, high cost of analyses, and simple translation of complex results (Anderson, Serxner, & Gold, 2001).

Modalities

WHP programs can be administered at the workplace or through the workplace. Those that are delivered through, but not at, the workplace require the use of so called distance interventions. Distance interventions utilize various modalities to reach the employee wherever they may chose (e.g., at home, work, or elsewhere). Three commonly used modalities include mailed print material, telephonic counseling, and the Internet. Distance interventions defined as mailed print material for this study are considered those that are printed materials, such as manuals and newsletters, delivered through the mail; furthermore, tailored print materials are computer generated personalized print interventions that are sent via the mail. Distance interventions defined as telephonic counseling for this study are considered those that are primarily telephonic, proactive, one-on-one calls with qualified health coaches. Thus, some printed *support* materials may also be mailed as part of the telephonic interventions. Distance interventions defined as Internet for this study are considered those that make use of "second generation" computer technologies that utilize interactive applications with immediate feedback and use screen based delivery via the Internet (Owen, Fotheringham, & Marcus, 2002).

Empirical evidence indicates that these distance interventions are effective means to creating behavior change across a number of health areas (Dishman & Buckworth, 1996; Gold, Anderson, & Serxner, 2000; Hillsdon & Thorogood, 1996; Jenkins, Christensen, Walker, & Dear, 2009; Myung, McDonnell, Kazinets, Seo, & Moskowitz, 2009; Norman et al., 2007), with theory based, tailored interventions being the most effective (Cardinal, 1995; Cardinal & Sachs, 1995; Marcus, Bock et al., 1998; Marcus, Emmons, Simkin-Silverma, & et al, 1998; Marcus et

al., 2007). Among studies evaluating the effectiveness of these modalities, there are very few studies that include economic evaluations or that are conducted through a workplace (Parker et al., 2007; Sevick et al., 2007).

Research on the differential effectiveness of these distance LM interventions (i.e., mail, telephone, and Internet) is limited. No publications have been identified that directly compare all three modalities in a single study. Some studies and literature reviews investigate two of these modality types; however, only a few of the studies included in literature reviews are workplace based (Jenkins et al., 2009; Myung et al., 2009; Norman et al., 2007; Pan, 2006; van Wier et al., 2006; Wantland, Portillo, Holzemer, Slaughter, & McGhee, 2004). These studies suggest that Internet and telephonic plus print material interventions should be more effective than mail only interventions, but little is known about the effectiveness of Internet versus telephone modalities for the delivery of LM interventions (Health Management Vendor, 2009; Jenkins et al., 2009; Myung et al., 2009; Norman et al., 2007; Pan, 2006; Wantland et al., 2004). Furthermore, little is known about the efficiency of these different intervention modalities from a cost perspective. This is highlighted in a review by Dunn and colleagues (1998) on intervention modalities for physical activity interventions that calls for further research on their cost effectiveness.

Building the Business Case

Employers who are considering implementing new health management programs, continuing with existing programs, or modifying existing programs need to establish a business case for their proposed action. When convincing employers to invest in employee health promotion programs, there are five key steps that should be undertaken (Goetzel & Ozminkowski, 2006). First, it must be established that health risks, diseases, and conditions are costly. Second, one must establish that many diseases and conditions are preventable via modifiable health risks. Thirdly, the argument must be made that workplaces offer an ideal

setting for health promotion. Fourth, it should be demonstrated that WHP can positively influence employees' health risks. Fifth, and lastly, it must be shown that WHP produce benefits that outweigh the costs when expressed either as a return on investment ratio (ROI) or as benefits less costs (net present value).

All of the steps require collecting evidence from the companies health care data or the published literature. The last two steps of this process focus specifically on evaluations of WHP programs and are critical steps in deciding which WHP programs to invest in and implement. The evidence suggests that distance WHP programs are effective; however, it is not completely clear as to their relative effectiveness and it is unclear as to their economic efficiency. Thus, it is critical that research evaluating the relative effectiveness of distance interventions at producing health and financial outcomes be undertaken to fill this gap in the literature to facilitate building the business case and informed decision making for investing in distance WHP programs.

Purpose

This study evaluated the effectiveness and return on investment of various modalities of distance workplace LM interventions, specifically, mail, telephone, and Internet. The evaluation utilized data from an employer's LM program and implemented methods that balance methodological and statistical rigor with the challenges facing WHP research. These data regarding program performance can inform future decisions to invest in and implement LM programs, both by this employer and others.

Specific Aims

AIM 1

Evaluate the effects of participation via different modalities (mail, Internet, or telephone) in the LM program on the proximal outcome measures of eating habits, back care, alcohol use, physical activity/exercise, tobacco use, stress risk factors, and depression risk; and distal

outcome measures of weight, body mass index (BMI), blood pressure, cholesterol, triglycerides, and blood glucose.

Hypothesis 1A.1: Within each modality, those who participate in the LM program will demonstrate a higher likelihood of decreased risk of proximal risk factors compared to similar LM non-participants. These proximal risk factors include: eating habits, back care, alcohol use, physical activity/exercise, tobacco use, stress, and depression.

Hypothesis 1A.2: Within each modality, those who participate in the LM program will demonstrate a higher likelihood of decreased risk or more positive changes, defined as less increase or more decrease, in distal risk factors compared to similar LM non-participants. These distal risk factors include: weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose.

Hypothesis 1B.1: Those who participate in the telephone- or Internet-based LM program will demonstrate a higher likelihood of decreased risk of proximal risk factors compared to similar participants in the mail-based LM program. These proximal risk factors include: eating habits, back care, alcohol use, physical activity/exercise, tobacco use, stress, and depression.

Hypothesis 1B.2: Those who participate in the telephone- or Internet-based LM program will demonstrate a higher likelihood of decreased risk or more positive changes, defined as less increase or more decrease, in distal risk factors compared to similar participants in the mail-based LM program. These distal risk factors include: weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose.

Hypothesis 1C.1: There will be no differences between similar participants in the telephone- or Internet-based LM program on changes in proximal risk factors. These

proximal risk factors include: eating habits, back care, alcohol use, physical activity/exercise, tobacco use, stress, and depression.

Hypothesis 1C.2: There will be no differences between similar participants in the telephone- or Internet-based LM program on changes in distal risk factors. These distal risk factors include: weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose.

AIM 2

Assess the effects of dose of the LM program received on the proximal outcome measures of eating habits, back care, alcohol, physical activity, tobacco use, and stress risk factors; and distal outcome measures of weight, BMI, blood pressure risk, and cholesterol risk.

Hypothesis 2A: Within each modality, those who complete the LM program will demonstrate a higher likelihood of decreased risk of proximal risk factors compared to similar participants who discontinue the LM program. These proximal risk factors include: eating habits, back care, alcohol use, physical activity/exercise, tobacco use, stress, and depression.

Hypothesis 2B: Within each modality, those who complete the LM program will demonstrate a higher likelihood of decreased risk or more positive changes, defined as less increase or more decrease, in distal risk factors post-intervention compared to similar participants who discontinue the LM program. These distal risk factors include: weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose.

AIM 3

Examine the return on investment (ROI) and net present value (NPV) of the LM program.

Hypothesis 3A.1: Within each modality, LM program participants will demonstrate greater decreases in their medical claims cost over time compared to similar non-participants.

Hypothesis 3A.2: Within all three modalities of the LM program, the program benefits will be greater than program costs for participants compared to non-participants. Program benefits are represented by changes in medical claims costs; program costs are represented by LM vendor program fees, incentive costs, data management fees, and consultant fees; and the summary measures comparing program benefits to costs are ROI and NPV.

Hypothesis 3B.1: Those who participate in the telephone- or Internet-based LM program will demonstrate greater decreases in their medical claims cost over time compared to similar participants in the mail-based LM program.

Hypothesis 3B.2: The incremental program benefits will be greater than the incremental cost of the program for those who participate in the telephone- or Internet-based LM program compared to similar participants in the mail-based LM program. Program benefits are represented by changes in medical claims costs; program costs are represented by LM vendor program fees, incentive costs, data management fees, and consultant fees; and the summary measures comparing program benefits to costs are ROI and NPV.

Hypothesis 3C.1: There will be no difference in changes in medical claims cost over time between similar participants in the telephone- or Internet-based LM program.

Hypothesis 3C.2: The incremental program benefits will not be greater than the incremental cost of the program for those who participate in the telephone-based LM

program compared to similar participants in the Internet-based LM program. Program benefits are represented by changes in medical claims costs; program costs are represented by LM vendor program fees, incentive costs, data management fees, and consultant fees; and the summary measures comparing program benefits to costs are ROI and NPV.

Hypothesis 3D.1: Within each modality, those who complete the LM program will demonstrate greater decreases in their medical claims cost over time compared to similar participants who discontinue the LM program.

Hypothesis 3D.2: Within each modality, the incremental program benefits will be greater than the incremental cost of the program for those who complete the LM program compared to similar participants who discontinue the LM program. Program benefits are represented by changes in medical claims costs; program costs are represented by LM vendor program fees, incentive costs, data management fees, and consultant fees; and the summary measures comparing program benefits to costs are ROI and NPV.

CHAPTER 2 – WORKPLACE HEALTH PROMOTION

When convincing employers to invest in employee health promotion programs, there are five key steps that should be undertaken (Goetzel & Ozminkowski, 2006). First, it must be established that health risks, diseases, and conditions are costly. Second, it is necessary to establish that many diseases and conditions are preventable via modifiable health risks. Third, the argument must be made that workplaces offer an ideal setting for health promotion. Fourth, it should be highlighted that WHP can positively influence employees health risks. Fifth it should be shown that that WHP can achieve an ROI.

Financial Impact of Health Risk Factors, Diseases, and Conditions

Health risk factors, diseases, and conditions have tremendous economic consequences to both employers and employees. This impact is felt in the form of medical costs and lost productivity. As for medical costs, one study found that modifiable health risk factors account for 24.9% of total medical expenditures, including employer and employees costs (Anderson et al., 2000). In addition to the health care costs, reduced levels of productivity are costly byproducts of unhealthy behaviors (Brouwer & Koopmanschap, 2005; Burton, Chen, Conti, Schultz, & Edington, 2006; Conti & Burton, 1995; Gates, Succop, Brehm, Gillespie, & Sommers, 2008; Goetzel, Hawkins, Ozminkowski, & Wang, 2003; Goetzel et al., 2004). Health risk factors can also be costly to employees due to loss of wages for lost hours of work or loss of bonuses and commissions due to low productivity (Jason et al., 1987). The following sections review, though not systematically, the financial impact of some of the most prevalent and costly health risk factors, diseases, and conditions affecting employers. This review focused on costs

from an employer perspective versus other perspectives (e.g., societal, health care system) of cost of illness studies.

Health Risk Factors

Stress. Those with high levels of stress had 46.35% higher medical claims costs compared to those at low risk (Goetzel et al., 1998).

Weight and obesity. Those with extreme high or low weight had 21.41% higher medical claims costs compared to those at low risk (Goetzel et al., 1998). Additionally, obese individuals cost $506 per employee per year in lost productivity (Gates et al., 2008).[1]

Tobacco use. Former tobacco users have 19.74% higher medical claims costs compared to those who never used tobacco (Goetzel et al., 1998). Current tobacco users have 14.46% higher medical claims costs compared to those who never used tobacco (Goetzel et al., 1998). This somewhat counter-intuitive finding that former smokers have higher health care costs than current smokers is supported in the literature, but can be better explained by the time since cessation attempt (Fishman, Khan, Thompson, & Curry, 2003). However, a study found that former smokers are have higher health care costs in the first two years following cessation and then have less health care costs compared to current smokers through at least 6 years post cessation (Fishman et al., 2003).

Blood pressure. Those with high blood pressure had 11.65% higher medical claims costs compared to those at low risk (Goetzel et al., 1998). Furthermore, hypertension is the second most costly condition to employers costing a total of $160.23 (in 1999 dollars) per employee per year[2] (Goetzel et al., 2003). This breaks down into $91.44 in medical costs,

[1] Base year for dollar figures was not specified

[2] The metric of "per employee per years" means that the total annual cost of the condition has been divided by the total number of employees in the company.

$60.52 in absence, and $8.27 in short-term disability costs (Goetzel et al., 2003). Additionally, an estimated $392.31 is lost in productivity costs (Goetzel et al., 2004).

Physical activity. Those with low levels of physical activity had 10.35% higher medical claims costs compared to those at low risk (Goetzel et al., 1998). The astounding rate of inactivity in the United States contributed $75 billion to excess medical costs in 2000 (World Health Organization, 2003). Many of these medical costs are related to premature mortality and chronic conditions that can all be prevented or reduced through physical activity.

Cholesterol. Those at with high cholesterol had .79% lower medical claims costs compared to those at low risk (Goetzel et al., 1998). These costs may be slightly higher among those at low risk for cholesterol as a result of the prescription drug cost associated with those that report low risk for cholesterol resulting from the assistance of medication.

Alcohol consumption. Those with high levels of alcohol consumption had 3.01% *lower* medical claims costs compared to those at low risk (Goetzel et al., 1998). This finding is common in the literature and is not because there are minimal health problems in this population, but because heavy drinkers are less likely to seek medical care for their health problems (Bertera, 1991; Goetzel et al., 1998).

Nutrition. Those with poor nutrition had 9.25% lower medical claims costs compared to those at low risk (Goetzel et al., 1998). This finding may be due to the fact that this represents the cost related to nutrition behaviors alone. Thus the impact of health eating may have already been accounted for in other areas such as blood pressure, blood glucose, and other correlated measures.

Diseases and Conditions

Heart disease. The prevalence of heart disease in the United States was 11.3% during the 2006 to 2008 period (Centers for Disease Control and Prevention, 2009c). Furthermore, Goetzel

and colleagues (2004) found heart disease to be the most costly health condition. The related prevalence-based medical costs are $265.71 (in 1999 dollars) per employee per year and the morbidity costs in absence ($19.21), short-term disability ($4.17), and presenteeism ($368.34) were notable (Goetzel et al., 2004). Thus, a total of $657.43 dollars were spent on coronary heart disease each year.

Back disorders. Back disorders are a costly form of musculoskeletal conditions affecting employers. Specifically, low back disorder is the fourth most costly form of back conditions with prevalence-based costs indicating $90.24 (in 1999 dollars) per employee per year, with $52.83 of that amount originating from medical costs and the remainder coming from absence and short-term disability costs (Goetzel et al., 2003). Other forms of back disorders (i.e., those not specified as lower back) are also costly. The prevalence-based cost of these disorders are $63.50 per employee per year, of which $39.49 originates from medical costs (Goetzel et al., 2003).

Diabetes. The incidence of diabetes is rapidly increasing in the United States, most recently (2007) at 7.8 age-adjusted incidents per 1,000 population, which is up from 3.5 in 1980 (Centers for Disease Control and Prevention, 2009b). The prevalence of diabetes is was 7.7% of the United States adult population during the period 2006 to 2008 (Centers for Disease Control and Prevention, 2009c). The prevalence-based cost of this disease includes $74.75 (in 1999 dollars) worth of medical costs per employee per year (Goetzel et al., 2004). Furthermore, it includes $23.41 in absence and short-term disability costs as well as $256.91 in reduced presenteeism (Goetzel et al., 2004).

Cancer. Similarly, the prevalence of cancer is rising dramatically (Centers for Disease Control and Prevention, 2009c). When all forms of cancer are lumped together, the prevalence-

based cost is $61.38 (in 1999 dollars) in medical expenses per employee per year (Goetzel et al., 2004). The cost then continues to increase with $6.91 in absence and short-term disability costs as well as $144.01 in presenteeism costs (Goetzel et al., 2004).

Depression. Depression, sadness, or related mental illness has a prevalence rate of 2.9% during the 2006 to 2008 period (Centers for Disease Control and Prevention, 2009c). Prevalence-based costs estimates of such psychological distress has been found to be $54.19 (in 1999 dollars) in medical costs per employee per year (Goetzel et al., 2004). The greatest impact of this disease on cost is on the productivity side. It costs $47.85 in absence and short-term disability and an astounding $348.04 in presenteeism costs (Goetzel et al., 2004).

Arthritis. The age adjusted prevalence of arthritis in the United States was 21.0% during the 2006 to 2008 period (Centers for Disease Control and Prevention, 2009c). The chronic maintenance of arthritis is quite costly, in fact, it is the 19th most costly condition reported by employers. The estimated prevalence based cost for arthritis is $46.20 (in 1999 dollars) per employee per year in medical costs (Goetzel et al., 2004). While, the costs for absence and short-term disability ($28.73) and presenteeism ($326.88) make an even greater impact (Goetzel et al., 2004).

Migraine and headaches. Migraine headaches are the most prevalent among young women (18-44 years of age), with a prevalence of 25% and, among the working aged population, this decreases to a low of 8% among older men 55-64 years old (Centers for Disease Prevention and Prevention, 2006). Migraine headaches are costly (prevalence-based) to employers for medical ($17.08, in 1999 dollars, per employee per year) and absence and short-term disability costs ($7.47, in 1999 dollars, per employee per year) (Goetzel et al., 2004). However, the

greatest cost of migraine headaches comes from the reduced on-the job productivity, which costs $213.78 (in 1999 dollars) per employee per year (Goetzel et al., 2004).

Renal failure. Kidney disease is the ninth leading cause of death in the United States (Arias, Anderson, Kung, Murphy, & Kochanek, 2003). This disease costs employers a total of $43.92 (in 1999 dollars) per employee per year, with nearly all of the cost ($41.80) originating from medical costs and the remainder being due to absence and short-term disability payments (Goetzel et al., 2003).

Lifestyle Behaviors as Precursors

There is little question about the association between modifiable health risks and their connections to disease and conditions. The epidemiological literature is ripe with studies demonstrating this relationship. The following section presents some of this evidence for many of the modifiable health risks linked to the previously discussed health conditions.

*Stress. C*hronically elevated levels of stress hormones (e.g., cortisol and adrenaline) activate the sympathetic nervous system, which can have deleterious effects on the heart including high blood pressure and heart disease (Dimsdale, 2008; Goetzel, Ozminkowski, Sederer, & Mark, 2002; Hamer, Molloy, & Stamatakis, 2008). Stress has also been linked to other negative impacts such as increases in substance use, including alcohol (Lê et al., 1998), smoking (Matheny & Weatherman, 1998), and illicit drugs (Sinha, Fuse, Aubin, & O'Malley, 2000). Furthermore, stress can lead to headache, back pain, decreased immunity, sleep problems, and over or under eating (DA., 2008; Ohman, Bergdahl, Nyberg, & Nilsson, 2007).

Weight and obesity. Research indicates that as weight increases to the point of overweight (BMI of 25 or higher) or obese (BMI of 30 or higher), the risk for various diseases and conditions also increases (NIH NHLBI Obesity Education Initiative, n.d.). These diseases

and conditions include: coronary heart disease, type 2 diabetes, cancers (endometrial, breast, and colon), hypertension, dyslipidemia (e.g., high total cholesterol or high levels of triglycerides), sleep apnea and respiratory problems, low back pain, and osteoarthritis (Leboeuf-Yde, 2000; Moghaddam, Woodward, & Huxley, 2007; NIH NHLBI Obesity Education Initiative, n.d.).

Tobacco use. Smoking is linked to a number of health conditions including cancer, heart disease, and respiratory health. Specifically, smoking causes 90% of all lung cancer deaths in men, 80% of such deaths in women, and 90% of all deaths from chronic obstructive lung diseases, such as chronic bronchitis and emphysema (U.S. Department of Health and Human Services, 2004). Furthermore, smoking increases the risk for coronary heart disease (2-4 times), stroke (2-4 times), development of lung cancer in (men 23 times and women 13 times), and dying from chronic obstructive pulmonary disease (12-13 times) (U.S. Department of Health and Human Services, 2004). Smoking causes the following cancers: acute myeloid leukemia, kidney cancer, cancer of the pancreas, bladder cancer, cancer of the larynx (voice box), cancer of the pharynx (throat), cancer of the cervix, lung cancer, stomach cancer, cancer of the esophagus, cancer of the oral cavity (mouth), and cancer of the uterus (U.S. Department of Health and Human Services, 2004).

Physical activity. Examples of chronic conditions related to insufficient physical activity are coronary heart disease, Type 2 diabetes, colon cancer, hypertension, obesity, osteoporosis and other musculoskeletal conditions, and mental health conditions such as depression and anxiety (Bouchard, Shephard, & Stephens, 1994; U.S. Department of Health and Human Services, 1999). Specifically, physical activity can reduce the risk of dying from coronary heart disease and of developing high blood pressure, colon cancer, and diabetes (Bouchard et al., 1994; U.S. Department of Health and Human Services, 1999). It can also help reduce blood pressure in

some people with hypertension and help maintain healthy bones, muscles, joints, and weight (Bouchard et al., 1994; U.S. Department of Health and Human Services, 1999). Additionally, it reduces symptoms of anxiety and depression and fosters improvements in mood and feelings of well-being (O'Sullivan, Gilbert, & Ward, 2006; Smith, 2006).

Nutrition. Nutrition is a key factor in the development of many disease and conditions. Dietary factors are associated with four of the 10 leading causes of death: coronary heart disease, some types of cancer, stroke, and Type 2 diabetes (National Center for Health Statistics, June 12, 1997). Dietary factors also are associated with osteoporosis, which affects more than 25 million persons in the United States (National Institutes of Health, 1994).

Blood pressure. High blood pressure can be a silent killer as it usually does not have noticeable warning signs or symptoms; therefore, often goes undiagnosed (Centers for Disease Control and Prevention, 2007a). This is a noteworthy problem because high blood pressure is a major risk factor for heart disease (angina, heart attack, and heart failure), the leading cause of death in the United States, and stroke, the third leading cause of death in the United States (Centers for Disease Control and Prevention, 2007a). This occurs because it can lead to hardened or stiffened arteries, which causes a decrease of blood flow to the heart muscle and other parts of the body (Centers for Disease Control and Prevention, 2007a). High blood pressure can also result in eye damage, including blindness, and kidney disease and failure (Centers for Disease Control and Prevention, 2007a).

Cholesterol. Cholesterol is a major risk factor for heart disease, the leading cause of death in the United States (Centers for Disease Prevention and Prevention, 2007).

Alcohol consumption. There are many short-term health risks from excessive alcohol consumption including violence and miscarriage, but the longer-term health risks are related to

the conditions discussed previously. Specifically, neurological problems (including dementia, stroke and neuropathy) (Corrao, Bagnardi, Zambon, & La Vecchia, 2004; Corrao, Rubbiati, Zambon, & Arico, 2002), cardiovascular problems (including myocardial infarction, cardiomyopathy, atrial fibrillation and hypertension) (Rehm, Gmel, Sepos, & Trevisan, 2003), psychiatric problems (including depression, anxiety, and suicide) (Castaneda, Sussman, Westreich, Levy, & O'Malley, 1996), cancer (mouth, throat, esophagus, liver, colon, and breast) (Baan, Straif, Grosse, Secretan, & et al on behalf of the WHO International Agency for Research on Cancer Monograph Working Group, 2007), liver disease (alcoholic hepatitis and cirrhosis) (Heron, November 20, 2007), and other gastrointestinal problem (Kelly et al., 1995; Lesher & Lee, 1989). In fact, the risk of cancer increases with increasing amounts of alcohol (Baan et al., 2007) and cirrhosis is one of the top 15 leading causes of death in the United States (Heron, November 20, 2007).

Why the Workplace

It is apparent that health risks factors, diseases, and conditions are costly, and that modifiable health risk factors are associated with these diseases and conditions. These facts indicate that interventions to address modifiable health risk factors are necessary; however, the question of where these interventions should take place remains to be answered. One channel for intervention delivery is the workplace, either through onsite workplace activities or interventions that are administered elsewhere but employees are granted access to these interventions through ESHI or other components of the benefits package.

Workplaces offer a unique opportunity to promote health behavior change and the adoption of healthier lifestyles (Katz et al., 2005; U.S. Department of Health and Human Services, 2001). Most adults spend the majority of their waking hours at the workplace, which

therefore creates an opportunity to provide individual, group, and organizational level interventions to a large number of adults in one setting. The workplace also provides an opportunity to integrate social support into intervention strategies, which has been shown to be an important part of health promotion (Ball, Mishra, & Crawford, 2003; Berkman, 1995). Additionally, employers have a financial interest in providing health promotion programs for their employees given the potential ROI from the lowering health care costs and increasing productivity levels. Therefore, using the workplace as a channel for implementation of health promotion interventions is consistent with theoretical concepts of social cognitive theory (Bandura, 1986) and is consistent with the recommendations established by the Institutes of Medicine, which states that interventions should link multiple levels of influence (Institute of Medicine, 2000).

Workplace Lifestyle Modification Interventions

Impact on Health Risks

The general consensus on the effectiveness of workplace health promotion programs is that there is sufficient evidence to indicate that they are promising, but that the quality or availability of the study findings is limited (Harden et al., 1999). A series of literature reviews by Wilson and colleagues (1996; 1996) found that workplace health promotion interventions for a number of risk factors demonstrate at least suggestive evidence that they are effective at reducing risk factors. As is the case with much of the workplace health promotion literature, the challenge prohibiting a conclusive conclusion is the lack of well-designed controlled studies.

Specifically, the reviews found that there was conclusive evidence for hypertension programs that provide screening, treatment, and monitoring, or education and training (Wilson, 1996). These programs produced decreases in blood pressure (systolic and diastolic) and increases in knowledge (Wilson, 1996). There were a number of well-designed studies with

strong effectiveness results, but these results are considered weaker due to the lack of randomized controlled study design. These favorable interventions effectiveness results included: cholesterol (counseling, education, and media), weight control (behavior modification, education, and incentive), and stress management (relaxation, meditation, biofeedback, and cognitive behavioral skills) (Wilson, 1996). These studies of these interventions found improved levels of cholesterol, weight, diet, blood pressure, anxiety, and job satisfaction (Wilson, 1996). The results for the interventions addressing remaining topic areas (i.e., exercise, nutrition, and alcohol consumption) provided consistently positive outcomes, but did so using weak study designs. Exercise interventions (self-regulation, fitness classes, and compliance strategies) documented decreases in body mass index, skin folds, percent body fat, blood pressure, total cholesterol, smoking level, and absenteeism; and increases in muscle strength and endurance, life satisfaction, and well-being (Wilson, 1996). The nutrition interventions (education, counseling, cafeteria changes) found positive changes in attitude, diet, and cholesterol level (Wilson, 1996). Finally, the alcohol interventions (education and assessment, referral, and follow-up) reported decreases in alcohol and drug consumption, and increases in job performance and attitude change (Wilson, 1996).

Since these literature reviews, there have been subsequent studies and literature reviews that strengthen the evidence base regarding the effectiveness of workplace health promotion. Ozminkowski and colleagues found in a study of a health promotion intervention at the Citibank Group that eight out of 10 targeted risk factors were reduced over a 2 year period (Ozminkowski & Goetzel, 2000). This reduction in risk factors included seatbelt use, exercise habits, fiber intake, stress levels, fat intake, salt intake, cigarette use, and diastolic blood pressure (Ozminkowski & Goetzel, 2000). Similarly, a study about the impact of the Johnson & Johnson

health promotion program found that the program effectively reduced the prevalence of the targeted risk factors that included: high fat intake, high body weight, poor aerobic exercise habits, presence of risk factors for diabetes, high cholesterol, and high blood pressure (Goetzel, Ozminkowski, Bruno et al., 2002). Additionally, a study by Glanz and colleagues (1998) found that a workplace health promotion program focused on diet was successful at moving people along the stages of change, which was then associated with decreases in fat intake and increases in fiber, fruit, and vegetable intake.

Based on a review of the literature, the Task Force on Community Preventive Services recommends workplace health promotion programs for overweight and obesity, specifically those that focus on both physical activity and nutrition (Katz et al., 2005). A separate review that focused on workplace interventions for the prevention of cancer found that interventions on the following risk factors for cancer were effective: smoking, diet, alcohol, physical activity, overweight, and sun exposure (Janer et al., 2002). Furthermore, they found that though the positive changes were modest, they were more effective than comparable community-based interventions (Janer et al., 2002). A review by Moher and colleagues (2003) found similar results for smoking cessation interventions at the workplace.

Financial Impact

Great effort has been made among a few select reviewers in the field of workplace health management to review the ROI of these interventions (Chapman, 2003; Chapman, 2005; Pelletier, 1999, 2001, 2005, 2009). The most recent review by Chapman (2005) was a meta-evaluation of 56 studies, half of which were published after 1994, that provided individual and average savings and ROI ratios. It concluded that there is a wide range of ROI ($2.05 to $19.41 :$1.00) reported in the literature and the average ROI for workplace health management interventions is $5.81:$1.00 over an average period of 3.6 years (Chapman, 2005). The more

recent studies and interventions using newer prevention technologies[3] tend to have higher average savings and ROI, in fact three times higher ($6.30:$1.00) than those using more traditional programming ($3.30:$1.00) (Chapman, 2005). These ROI figures were driven by a 26.8% average decrease in sick leave, 26.1% average decrease in health care costs, and 32.0% average decrease in worker's compensation costs (Chapman, 2005).

A rigorous ROI analysis included in this review is the Citibank study that was cited previously for its effectiveness at reducing risk factors. This study reported a savings of $8.9 million in medical expenditures from their health promotion program as compared to their $1.9 million investment on the program (Ozminkowski et al., 1999). This translates into an ROI of $4.56:$1.0 (Ozminkowski et al., 1999). A more recent study that was not included in the above review reported on Highmark Inc.'s employee health promotion program. This WHP program focused on nutrition, weight management, stress management, as well as smoking cessation; and it demonstrated a $1.65:$1.00 ROI ratio (Naydeck, Pearson, Ozminkowski, Day, & Goetzel, 2008).

Modalities

Workplace lifestyle management programs are often offered as distance interventions, which indicates that the programs are not face-to-face group or individual counseling sessions. Instead, these distance programs reach the employees through one or more modality typically including mail, telephone, or Internet. There is evidence from meta-analyses that distance programs are more effective (Hillsdon & Thorogood, 1996) and have larger effect sizes (Dishman & Buckworth, 1996) than face-to-face interventions. These distance interventions provide the advantages of reach, accessibility, low cost, and convenience compared to traditional

[3] Transtheoretical model, Internet-provided health information, tailoring, benefits-linked financial incentives, telephonic high-risk intervention coaching, self-directed change, and annual required morbidity-based health risk appraisals used for targeting of interventions.

face-to-face models (Lando, Hellerstedt, Pirie, & et al, 1992; Lichtenstein, Glasgow, Lando, & et al, 1996; Mermelstein, Hedeker, & Wong, 2003; Zhu, Tedeschi, Anderson, & et al, 1996). Furthermore, they present the possibility of greater levels of cost effectiveness (Jenkins et al., 2009; Napolitano & Marcus, 2002; van den Berg, Schoones, & Vliet Vlieland, 2007).

Print and Mail Interventions

Print- and mail-based behavior change interventions utilize a basic form of technology but have demonstrated success as a modality for behavior change interventions. An unpublished study of tailored, theory-based, mail interventions available for multiple health topic areas (back care, exercise, nutrition, stress, smoking, weight control, cholesterol, blood pressure) found evidence of its effectiveness, specifically that the total number of possible health risks[4] among participants decreased significantly (7.8%) compared to non-participants (Health Management Vendor, 2009). This unpublished study is the most pertinent to this present study because it examined the same interventions used herein. However, the following studies provide further support for the effectiveness of mail or print as a modality for behavior change across a number of health areas.

Physical activity. The literature shows that physical activity materials delivered through the mail are effective at increasing the stage of readiness to change as well as increasing levels of physical activity (Cardinal, 1995; Cardinal & Sachs, 1995; Jenkins et al., 2009). A recent review of the literature by Jenkins and colleagues (2009) found that among the nine studies that examined print interventions compared with no intervention or attention control intervention (i.e., control group was contacted via mail about topics unrelated to intervention content), the majority (five) showed a positive effect on physical activity outcomes. A study specifically of a

[4] Possible health risks included: alcohol consumption, back care, blood pressure control, cholesterol control, driving safety, eating habits, exercise and activity, mental health, preventive screening examinations, self-care, stress management, tobacco use, and weight control

workplace health promotion program found that mailed physical activity interventions were successful at increasing self-reported levels of physical activity at 3 and 6 months; however, tailored interventions via the mail were more effective than untailored mail interventions (Marcus, Bock et al., 1998; Marcus, Emmons et al., 1998).

Smoking. In a review of 10 randomized controlled trials of computer-tailored smoking cessation materials that were printed and delivered by mail, Strecher (1999) found a significant, positive impact in a majority of studies (six out of nine studies). Specifically, these studies found that there were significant cessation effects at 3, 6, 12, and 18 months (Strecher, 1999). One of these studies found that the effect was only for light to moderate smokers and not heavy smokers (Strecher, 1999). Furthermore, the two studies with stage of change as an outcome variable indicated significant, forward movement through stages of change in the tailored print material group (Strecher, 1999).

A review of the literature, which did not overlap with the previous review, found similar evidence (Lancaster, Stead, Silagy, & Sowden, 2000). Specifically, print self-help materials that were not tailored had a small effect on smoking cessation (1.23 odds ratio) and print materials that were individually tailored had a significantly greater effect (1.41 odds ratio) (Lancaster et al., 2000). A study comparing multiple types of printed smoking cessation materials that was not included in either review found that all versions were successful at significantly increasing smoking abstinence rates (increase of 11 to 25.2 percentage points) and that the tailored versions, based on the transtheoretical model, were the most effective (increase of 18 to 25.2 percentage points) (Velicer et al., 1993).

Nutrition. A randomized controlled trail by Brug and colleagues (1996) of employees at a major oil company (n = 347) specifically looked at tailored versus untailored print-based diet

interventions and found that those in both groups significantly reduced their dietary fat intake and increased their fruit and vegetable consumption. The tailored group reduced their dietary fat intake significantly more than the untailored group (Brug et al., 1996). A more recent, non-workplace study utilizing a larger sample (n = 1,205) supported these findings; however, as part of this intervention a single motivational telephone call was made in addition to the mailed intervention components (HRA feedback, tailored self-help manual, and newsletters) (Kristal, Curry, Shattuck, Feng, & Li, 2000). Specifically, this study found that a tailored, primarily mail-based diet intervention was successful at reducing dietary fat intake (0.8 percentage point reduction in percent calories from fat) and increase fruit vegetable consumption (increase of 0.46 servings per day) compared to a control group receiving no intervention (Kristal et al., 2000).

Telephone Interventions

Telephone-based LM interventions are another type of distance intervention that can be used to create health behavior change. A study of the tailored, theory-based LM telephone program used in this project was conducted for multiple health topic areas (back care, exercise, nutrition, stress, smoking, weight control, and cholesterol) and found that the intervention was effective (Gold et al., 2000). This study found that participants were 1.8 to 3.5 times more likely than non-participants to reduce their risk for the health topic on which they were being counseled. Furthermore, this study found that the intervention was effective at reducing the total number of possible risks factors[5] for which participants were at risk compared to non-participants. This supports the idea that learning behavior change techniques in one topic area can have effects on other health behaviors. Another study, though unpublished, of these interventions found corroborating evidence, with the total number of health risks decreasing

[5] Possible health risks included: alcohol consumption, back care, blood pressure control, cholesterol control, driving safety, eating habits, exercise and activity, mental health, preventive screening examinations, self-care, stress management, tobacco use, and weight control

significantly (10.7%) for participants in the telephone intervention (Health Management Vendor, 2009). The following studies provide further support for the effectiveness of telephonic coaching as a modality for behavior change across a number of health areas.

Physical activity. A study by Chen and colleagues (1998) found that an 8-week behavioral intervention delivered by telephone was effective at increasing self-reported walking time among a group of minority women at all follow-up assessments up to 30 months. Another study implemented a 3 month telephonic intervention based on the transtheoretical model and found that it was effective at increasing levels of self-reported exercise at 6 months compared to the control group (Green et al., 2002). A review of the literature by Eakin and colleagues (2007) combined the above two studies with 14 other physical activity studies and concluded that there is a solid evidence base supporting the efficacy of physical activity behavior change interventions with the telephone as the primary intervention modality. This conclusion was made after determining that the majority (69%) of the 16 physical activity interventions only addressing physical activity produced positive outcomes (effect sizes: range = 0.24 – 1.19, mean = 0.50, n = 8) (Eakin et al., 2007). A review by Williams and colleagues (2008) supports these findings with evidence indicating that telephonic physical activity interventions were more successful when they were based in theory and were tailored to the participants needs.

Nutrition. Similar conclusions were found for eating behavior change as were found for physical activity in the review of the literature by Eakin and colleagues (2007). Specifically, this review concluded that there is a solid evidence base supporting the efficacy of eating behavior change interventions with the telephone as the primary intervention modality since 83% of the six eating interventions only addressing eating behavior produced positive outcomes (effect sizes: range = 0.40 – 1.10, mean = 0.74 n = 4). Another meta-evaluation of the literature on

telephonic nutrition counseling, which contained some overlapping studies with the precious review and weighted the studies by quality, found that telephonic counseling resulted in significantly greater fruit and vegetable consumption (effect size = .41) and lower dietary fat intake (effect size = .22) (VanWormer, Boucher, & Pronk, 2006).

A randomized controlled trail not included in these reviews examined the effectiveness of telephonic counseling on long term changes in eating habits among women at risk for breast cancer who had adopted health eating behaviors (Pierce et al., 2007). This study found that at 1 year post baseline, the intervention group consumed 38% more vegetable servings (100% when including juice) than the comparison group, 20% more fruit, 38% more fiber, 50% more legumes, and 30% more whole grain foods, and a 20% lower intake of energy from fat than the control group (Pierce et al., 2007). At 4 years post baseline the differences decreased by were still significantly different from the control group: 65% more vegetables (including juice), 25% more fruit, 30% more fiber, 40% more legumes, 30% more whole grain foods, and 13% lower intake of energy from fat (Pierce et al., 2007). (Pierce et al., 2007)

Weight management. Weight management programs differ from nutrition programs in that they target physical activity as well as nutrition, per the recommendations by the Centers for Disease Control and Prevention (2007b). The review of the literature by Eakin and colleagues (2007) also covered studies that incorporated physical activity and nutrition interventions using the telephone as the primary intervention modality, and they found that 75% of the four studies produced positive behavioral (diet and physical activity) or biometric (BMI, blood pressure, and cholesterol) outcomes. The effectiveness of weight loss programs delivered by telephone has been supported further by other studies not included in the above review.

Specifically, a study of a telephone-based counseling intervention for weight management not included in the above review found the intervention to be effective not only at producing weight loss (-6.1 kg) and reductions in BMI (-2.2 km/m^2), but also at producing high levels of satisfaction with the quality of service (92% very satisfied) and convenience (91% very satisfied) (Boucher et al., 1999). Sherwood and colleagues (2006) found that a telephone-based weight loss intervention produced significant weight loss all the way through a 24 month follow-up period; however, it was not significantly different from the weight loss experienced by the usual care group who had access to the other weight management services generally available through the health plan. Yet another telephone counseling weight loss intervention, which further integrated telemonitoring scales, found that the treatment group lost significantly more weight (-7.5 pounds) during the first 6 months of the program compared to the delayed start group (+1.3 pounds) (VanWormer et al., 2009). This pattern continued until the last measurement period (18 months) where the intervention group lost a total of 6.9 pounds during the intervention compared to the delayed group whose weight was about the same as it was at the start of the intervention period (-0.1 pounds) (VanWormer et al., 2009). Finally, a recent study by Kim and colleagues (Kim et al., 2010) tested the effectiveness of telephonic weight management LM program consisting of 6-weekly calls and self-help materials compared to those only receiving self-help materials. Among telephone participants compared to self-help only participants, they found significant reductions in fruit and vegetable consumption but no significant changes in physical activity, weight, or BMI after a 6-month follow-up (Kim et al., 2010). Interestingly, they found that obese and overweight individuals, regardless of participant group, lost a significant amount of weight over the timeframe, but normal weight participants did not (Kim et al., 2010).

Smoking cessation. Reviews of the literature have found that smoking cessation interventions delivered by the telephone produce significantly higher cessation rates than self-help materials alone and increase the likelihood of resumed abstinence among relapsed smokers (McBride & Rimer, 1999; Stead, Lancaster, & Perera, 2004). An even more recent review of the smoking cessation intervention literature supported these findings, concluding that telephonic counseling is an effective intervention modality (cessation odds ratio = 1.56, 95% confidence interval = 1.38-1.77) (Valery, Anke, Inge, & Johannes, 2008). A study by Parker and colleagues (2007), which was not included in the above reviews, found that among a population of pregnant smokers who completed the three call intervention, a telephone-based smoking cessation intervention produced a significantly higher cotinine-confirmed quit rate (23%) for those who completed all three calls of the intervention compared to those who received no calls (9.6%). Furthermore, among those who completed the intervention, the intervention produced a positive net present value and a cost effectiveness ratio of $84 per successful quit (Parker et al., 2007).

Cholesterol. There has been limited research regarding the effectiveness of telephonic cholesterol reduction interventions. Interventions with cardiac patients that have used telephone counseling as a component of interventions have shown significant reductions in dietary cholesterol (DeBusk et al., 1994; Hyman, Herd, Ho, Dunn, & Gregory, 1996). Furthermore, a review of the literature concluded that behavioral interventions for cholesterol with minimal contact are effective at reducing cholesterol, though face-to-face interventions were slightly more effective than telephone and mail (Wilson, 1991). Though these studies suggest that interventions with a telephonic component are effective, these studies did not include any strictly telephonic interventions.

Internet Interventions

The Internet has dramatically changed the possibilities for communication, including communication about health behavior and behavior change (Eng, Gustafson, Henderson, Jimison, & Patrick, 1999). It is a very attractive modality for the delivery of behavior change interventions since it provides the option of delivering sophisticated versions of individualized, computer-tailored interventions; holds the promise of reaching large numbers of people; and provides a level of anonymity (Cassell, Jackson, & Cheuvront, 1998; Marshall, Leslie, Bauman, Marcus, & Owen, 2003b; Napolitano et al., 2003; Weinstein, 2006). The anonymity of the Internet is important as people tend to be more willing to admit vulnerabilities to a computer versus a person (Robinson, Patrick, Eng, & Gustafson, 1998). Since the Internet is already identified as an important source of health information by more than half of its users, it may be an appropriate delivery medium for health behavior change interventions (Marshall, Eakin, Leslie, & Owen, 2005). Furthermore, access or use of the Internet is not likely to be a major barrier to the reach of Internet interventions since an estimated 79% of American adults use the Internet and 67% of all adults have looked online for health information in 2009 (Taylor, 2009). The following studies provide evidence for the effectiveness of Internet delivered behavior change interventions across a number of health areas.

Smoking. A meta-evaluation of 22 randomized controlled computer- or Internet-based smoking cessation programs found that, despite some mixed results, there is sufficient evidence that these programs are effective at inducing smoking cessation among adult smokers (Myung et al., 2009). This supports the previous conclusions made in reviews by McDaniel and Stratton (2006) and Walters and colleagues (2006). Also notable was the call from Walters and colleagues (2006) for more evaluations of computer tailored smoking cessation studies that

include economic evaluations. The intervention cessation effect was found in the short term (6 months, 14.8% abstinence rate), midterm (6-10 months, 11.7%), and long-term (12 months, 9.9%) (Myung et al., 2009). Similarly, another recent meta-evaluation of smoking cessation interventions found that Internet-based, tailored self-help interventions are effective at inducing abstinence from cigarettes (odds ratio = 1.42, CI = 1.26-1.61) (Valery et al., 2008). Furthermore, these Internet interventions were found to be equally as effective as the more resource intensive face-to-face counseling services for smoking cessation (Myung et al., 2009). The effect of these interventions was maintained regardless of the quality of the randomized study, the use of the program in isolation or with other programs, and the rate of loss to follow-up (Myung et al., 2009).

Stress. There has been limited research regarding the effectiveness of Internet stress reduction interventions. However, one randomized controlled trail of a Internet stress reduction intervention found that the intervention was successful at reducing stress, depression, and anxiety scores (Zetterqvist, Maanmies, Strom, & Andersson, 2003). Another study found that a 4-week Internet self-help intervention designed to reduce depression, anxiety, and work related stress (burnout) was successful at reducing levels of depression and anxiety and increasing quality of life and recovery from burnout (odds ratio = 4.0) (van Straten, Cuijpers, & Smits, 2008). An interesting study described in the literature by Matano and colleagues (2000) is designed to test an Internet stress and alcohol program for employees; however, the results have not been published.

Physical activity. The literature presents mixed evidence regarding the effectiveness of Internet-based physical activity interventions. A review of Internet-based physical activity interventions found that just over half (eight out of 15) of the studies produced positive

outcomes, of which there was a small effect size (.44) (Vandelanotte, Spathonis, Eakin, & Owen, 2007). A smaller literature review by van den Berg and colleagues (2007) found similar results, with about half of the studies finding the Internet physical activity interventions to be more effective than control groups.

Another review of the literature found that only three out of 10 studies indicated support for the physical activity Internet interventions, while six studies found no difference, and one study favored the control group (Norman et al., 2007). Among interventions that combined physical activity, diet, and weight loss messages, six out of 17 favored the Internet-based interventions for physical activity outcomes and the rest found no difference (Norman et al., 2007). Among these, four out of six workplace specific physical activity interventions found positive results, two of which did not utilize a control group, and the others found no difference (Norman et al., 2007). The results were split among the two workplace specific studies the delivered multiple messages, with one producing favorable outcomes and the other finding no differences (Norman et al., 2007). A study by Marcus and colleagues (2007) that was not included in this literature review found that Internet physical activity interventions were effective at increasing levels of physical activity at 6 months, but that the effect was somewhat, but not completely, attenuated by 12 months.

Nutrition. A review of the literature indicated that for eating behavior Internet interventions, seven out of 13 studies indicated support for the Internet interventions, while five studies found no differences, and one study found weekly in-person meeting to produce better outcomes (Norman et al., 2007). Out of the four workplace specific studies, three found positive results, one of which did not utilize a control group, and the other found no difference (Norman et al., 2007). Among interventions that combined physical activity, diet, and weight loss

messages, six out of 17 favored the Internet-based interventions for nutrition outcomes and the rest found no differences (Norman et al., 2007). The results were split among the two workplace specific studies, with one producing favorable studies and the other finding no differences (Norman et al., 2007). Another review that focused on Internet-based nutrition programs found that when compared to meetings with health professionals, the Internet-based interventions produced significantly higher levels of knowledge about healthy diet, intervention satisfaction, participation, and intervention adherence (Nakade, Muto, Hashimoto, & Haruyama, 2006).

A study that was published after these reviews found support for the use of Internet-based interventions in creating dietary behavior change (Oenema, Brug, Dijkstra, de Weerdt, & de Vries, 2008). The Internet-based intervention in this study was tailored per the precaution adoption process model (PAPM), which is a stage based model like the transtheoretical model (Oenema et al., 2008; Weinstein, 1988). They found that the intervention had a significant effect on the intake of saturated fat compared to the control group in the short term (1 month) (Oenema et al., 2008). Unfortunately, long term outcomes are not reported.

Weight management. Among interventions that combined physical activity, diet, and weight loss messages, four out of 11 favored the Internet-based interventions for weight change outcomes, two were found to be less effective than an in-person therapist, and the rest found no differences (Norman et al., 2007). The one workplace specific study demonstrated favorable weight change outcomes (Norman et al., 2007). A recent WHP program tested an Internet version of the National Heart, Lung, and Blood Institute's *DASH (Dietary Approaches to Stop Hypertension*) dietary intervention (Appel et al., 1997; Moore et al., 2008). This interventions was originally designed to reduce high blood pressure but has since been adopted by the United States Department of Agriculture (USDA) as a recommended eating pattern by adults (Appel et

al., 1997; Katz et al., 2005). This program found significant weight loss of 3.1 pounds at 12 months post intervention for participants, which was driven primarily by overweight or obese employees (Moore et al., 2008). This study also found significant changes in blood pressure at 12 months among those who were at risk at baseline, reducing it by 6.8 mmHg for systolic and 2.1 mmHg for diastolic blood pressure (Moore et al., 2008). Unfortunately, this study did not utilize a control group, so its results are somewhat tempered by the poor study design.

Comparison Studies

Surprisingly, there are very few studies in the literature that directly compare the effectiveness of these intervention modalities and next to none that do so in a workplace setting. The following section describes some studies and reviews of the literature that compare intervention modalities. However, none of these compare all three modalities in a single study of intervention effectiveness. A fairly recent review of the mental health literature only found one study investigating the effectiveness of Internet-based stress reduction interventions and it was compared to a wait list group; therefore, no information is available regarding a comparison to other modalities (Griffiths & Christensen, 2006).

Print or mail versus telephone. A recent study examining the relative effectiveness of a tailored and theory-based (social cognitive theory and transtheoretical model) physical activity intervention delivered by mail versus purely by telephone, claims to be the first to directly compare these modalities within the physical activity literature, which indicates that such comparisons are just beginning to emerge (Marcus et al., 2007). At 6 months, both interventions were equally effective at raising levels of physical activity compared to attention controls; however, at 12 months the print intervention was significantly more effective than the telephone intervention and the attention control (Marcus et al., 2007). Furthermore, the study found that

the print program was more cost-effective compared to the phone intervention at 6 months ($0.57 versus $1.56 /month/minute of improvement in physical activity) and 12 months ($0.35 versus $3.53 /month/minute of improvement in physical activity) (Sevick et al., 2007).

On the other hand, studies examining the relative effectiveness of print or mail versus telephone interventions that also incorporate supportive mailed materials indicates that the telephonic intervention is more effective than the mail only intervention. A meta-evaluation of the literature by Pan and colleagues (2006) looked at the relative effects of telephonic smoking cessation interventions when used as adjuncts to minimal interventions (i.e., print self-help materials) and they were compared to interventions just using the minimal interventions. This meta-evaluation found that the participants in the telephone counseling intervention were 64% more likely than those in the comparison group to stop smoking. As mentioned previously, similar results were found for physical activity in a review by Jenkins and colleagues (2009), which found that the most effective modality was the combination of print media with telephonic counseling. Another study by Ball and colleagues (2005) not included in this review supported this finding with similar significant increases in reported physical activity at 12 weeks in both groups, but significantly greater physical activity levels in the telephone with print group than the print only group at 16 weeks. A comparison of weight management interventions examined a mailed intervention with a telephonic intervention that also included supportive mailed materials, specifically lessons and homework exercises (Jeffery et al., 2003). This study found that at 6 months those in the telephone intervention lost significantly more weight than the usual care group, but the mail only intervention participants did not differ from the usual care group (Jeffery et al., 2003). Unfortunately, the intervention effect for the telephonic group dissipated

over time, indicated by finding no significant difference between the treatments at the remaining follow-up periods (12, 18, and 24 months) (Jeffery et al., 2003; Sherwood et al., 2006).

The most relevant study for the purposes of this study is an unpublished work that examined the mail only intervention and telephone intervention, which also incorporated supportive mailed materials, used in this project. This study found that across all of the topic areas (nutrition, back care, alcohol use, exercise, tobacco use, and stress), that there was significantly greater reduction in the total number of health risks[6] among participants in the telephone (10.7%) versus mail (7.8%) interventions (Health Management Vendor, 2009). Those who were enrolled in the LM program reduced the health risk for which they were receiving the counseling significantly more in the telephone group compared to the mail intervention for the following risk factors: back care, physical activity, stress management, and weight management (Health Management Vendor, 2009). The programs showed similar reduction in the following risk factors: blood pressure, cholesterol, nutrition, and tobacco (Health Management Vendor, 2009).

Print or mail versus Internet. A randomized controlled trial on the effectiveness of print versus Internet intervention for physical activity found that, despite using interventions previously found to be effective, neither intervention produced behavior change. However, an interesting finding from this study was that those who participated in the print program had better information recall and use of the intervention materials than those in the Internet version (Marshall, Leslie, Bauman, Marcus, & Owen, 2003a). A recent review of the literature on Internet programs for physical activity and nutrition examined the use of Internet versus face-to-

[6] Possible health risks included: alcohol consumption, back care, blood pressure control, cholesterol control, driving safety, eating habits, exercise and activity, mental health, preventive screening examinations, self-care, stress management, tobacco use, and weight control

face interventions; however, it did not examine the use of Internet versus other distance interventions such as telephone or mail (Norman et al., 2007).

Despite this seemingly lack of research on print versus Internet LM interventions, there are two reviews that shed some light on the subject. A review by Myung and colleagues (2009) found that the overwhelming majority of the studies testing Internet smoking cessation interventions outperformed print self-help interventions. One meta-evaluation of Internet-based health management interventions covering a range of health outcomes found that 16 out of the 17 studies reviewed demonstrated better results for Internet verses print interventions, with six of these differences being significant (Wantland et al., 2004). These results included: increased exercise time, increased knowledge of nutritional status, increased knowledge of asthma treatment, increased participation in healthcare, slower health decline, improved body shape perception, and 18-month weight loss maintenance (Wantland et al., 2004).

Telephone versus Internet. A workplace based intervention for weight management testing the relative effectiveness of telephone and Internet programs has been described in the literature; however, the results have yet to be published (van Wier et al., 2006). As mentioned previously, little can be said about the use of Internet versus telephone interventions since a recent review of the literature on Internet physical activity and nutrition interventions, which included a section on modality, only included a comparison of Internet versus face-to-face interventions (Norman et al., 2007). Thus, to my knowledge, there is a large gap in the literature related to the comparison of telephone to Internet interventions, either directly or through literature reviews. This area is particularly ripe for elaboration.

Summary

In summary, there is support for the use of distance interventions to create behavior change across a number of health areas. Among these interventions there is evidence that theory-based, tailored interventions are most effective. Among studies testing the effectiveness of each modality, there are very few studies that also include economic evaluations or that are examine workplace interventions. Findings on the differential effectiveness of mail, telephone, and Internet LM interventions are limited. No publications were found that directly compare all three modalities in a single study. Instead, some studies and literature reviews were available investigating two of these modality types; however, only a few studies included in literature reviews were workplace based. In short, the literature suggests that Internet and telephonic plus print material interventions should be more effective than mail only interventions and little is known about the effectiveness of Internet versus telephone modalities for the delivery of LM interventions. Furthermore, little is known about the efficiency of these different intervention modalities from a cost perspective. This is highlighted in a review by Dunn and colleagues (1998) on intervention modalities for physical activity interventions that calls for further research on their cost effectiveness. This dissertation study begins to address all of these gaps in the literature.

CHAPTER 3 – METHODS

This study utilized a quasi-experimental design with a rolling cohort, which allowed for a 24 month period of LM program participation, to test the effectiveness and ROI of the employer's LM program by modality. Participation in the LM program was voluntary and was available to all employees in the self-insured medical plans. The effectiveness portion of this study is a multiple group pre-post design and the ROI analysis is from the employer perspective with a 12 month baseline period and 12 and 22 month analytic horizons (Figure 3.1). All statistical analyses were conducted in SAS v.9.2 and used $\alpha = .05$ for statistical significance criterion.

Study Sample

Corporate Partner

The employer has evolved from a regional hardware store operator into a nationwide chain of home improvement superstores. They are one of the largest US home improvement chains and home appliance retailers with over $47.2 billion in sales in their fiscal year ending January 2010. Furthermore, they paid over $475,000,000 in medical claims April 2008 – March 2009. The employer has about 1,640 superstores in 50 states and about a dozen outlets in Canada. The company's stores sell about 40,000 products for do-it-yourselfers and professionals for home improvement and repair projects, such as gardening products, home fashion items, lumber, millwork, plumbing and electrical supplies, and tools, as well as appliances and furniture.

Study Participants

Data were collected for all employees during the study period, including those who voluntarily participated in the health risk assessment and the LM program. This study implemented the following eligibility criteria, which was applied annually (Disease Management Association of America, 2009).

- *Employees only*. Only employees were eligible for the LM program.
- *Enrolled in the self-insured medical plans*. The employer's health insurance plan options include multiple self-insured plans and fully-insured HMO plans. The nature of fully-insured HMO plans restricts the availability of medical claims data to the employer; therefore, it was not possible to include fully-insured HMO members in the analysis.
- *At least age 18 years*, on the last month of the period (Disease Management Association of America, 2009; Serxner, Baker, & Gold, 2006)
- *Not pregnant during study period.* As is common with lifestyle management studies, the interventions were not designed to target pregnant women since their health needs and reasons for health behavior change are different from the general population (Anderson et al., 2000; Goetzel et al., 1998).
- *Participation in the LM intervention via a single modality.* The aims of this study were to examine the independent effectiveness of the modalities. This effect was isolated from a potentially synergistic effect of participating in multiple modalities by excluding such participants.

Intervention

The employer's LM program (see Table 3.1) was a health promotion program containing interventions that addresses the following health risk factors: back care, exercise, nutrition, stress, smoking, weight control, cholesterol, blood pressure. The HRA and LM program were implemented October 24, 2005; however, both were plagued with low levels of participation throughout 2005 and 2006 and increased notably in 2007 and 2008.

Health Risk Assessment

The HRA used to assess time one (T_1) and time two (T_2) health risks was developed in 1987 and contained 59 items primarily related to self-reported health habits and practices. A copy of the HRA is not provided because it is a proprietary tool. The HRA was available to employees throughout the year; however, it was promoted and linked to medical plan open enrollment. Thus, the highest rates of participation each year were in November during open enrollment. The HRA could be completed on paper or online and in English or Spanish. Employees were incentivized to participate in the HRA through the opportunity to enroll in a better value health insurance plan (i.e., more coverage per each dollar they pay of the premium) upon completion of the HRA. Additionally, they received 10,000 points (valued at $25.00) for the completion of the HRA, which could then be exchanged for a variety of items. The HRA included questions covering the following topics: demographics (gender, birth date, job function), physical activity and exercise patterns, alcohol consumption, nutrition, tobacco use, stress and depression, sleep, safety, driving habits, self-care, health history, biometric measurements (e.g., height, weight, blood pressure), and lifestyle change (stage of change, barriers to change, self-efficacy, and importance of change). Additional information regarding the HRA is provided in the *Study Measures and Data Collection* section.

Lifestyle Management Program

After the participant completed the HRA, the HRA was scored and employees who had at least one high risk were invited to participate in the LM program. Employees were invited via multiple modalities including an outbound phone call or an invitation through email or traditional mail. Employees selected and enrolled into the LM program of their choice based on individualized feedback they receive about their health risks. Once the employee had registered for the program, then the intervention commenced.

These recruitment efforts were aided somewhat by incentives. Participants in the LM program received incentives for participation and completion. The LM incentive program was points-based such that participants accumulate a number of points, valued at $.0025 per point, that could then be exchanged for a variety of items. Participant in the LM program received 2,000 points ($5.00) for registering for the LM program and an additional 2,000 points for the completion of the LM program.

The LM program covered a number of topics and could be participated in via three different modalities. As mentioned previously, the program covers the following topics: back care, exercise, nutrition, stress, smoking, weight control, cholesterol, blood pressure. Each of these topics could be participated in via mail or telephone and there were Internet-based programs for nutrition, exercise, stress, tobacco, and weight control. All of these programs were tailored (primarily using the transtheoretical model) and aimed to set goals (short- and long-term), identify benefits and barriers, build skills for overcoming barriers, make progress on new behaviors, strategize self-rewards, and motivate. The logic model for this study, which is based on the following theoretical basis, is summarized in Figure 3.2.

Theoretical Basis for Intervention

The interventions in this study were evidence- and theory-based, tailored interventions. Specifically, they target determinants of the health behaviors based on three empirically supported health behavior theories: transtheoretical model (TTM), social cognitive theory (SCT), and health belief model (HBM). Furthermore, they use evidence-based strategies to target the constructs of these health behavior theories: motivational interviewing (MI) and tailoring interventions. This approach of targeting determinants of health behavior change using a theory-driven program that is implemented per evidence based strategies is consistent with best practice recommendations (Bartholomew, Parcel, Kok, & Gottlieb, 2006; Green, 2000).

Transtheoretical model. Prochaska's TTM is a stage model initially designed in the late 1970s to treat addictive behaviors, smoking in particular, and integrates constructs from other theories (Figure 3) (Weinstein, Rothman, & Stuuon, 1998). The TTM has five major constructs: stages of change, processes of change, self-efficacy, decisional balance, and temptation (Prochaska, Redding, & Evers, 2002; Prochaska & Velicer, 1997).

The TTM asserts that behavior is achieved by moving through five stages of change: precontemplation, contemplation, preparation, action, and maintenance (Prochaska et al., 2002; Prochaska & Velicer, 1997). Movement through these stages is facilitated by ten processes of change, each of which has a distinct influence in various stages of change: consciousness raising, dramatic relief, environmental re-evaluation, self-re-evaluation, self-liberation, counter-conditioning, helping relationships, contingency management, stimulus control, and social liberation. The processes can be segregated into two categories: experiential (first five processes) and behavioral (last five processes) (Prochaska et al., 2002; Prochaska & Velicer, 1997). These processes of change were integrated from various theories such as Freudian theory

(consciousness raising) and Skinnerian theory (contingency management) in such a way that instead of conflicting (as they had historically) they complement each other by being paired with the stage of change at which they are most useful (Prochaska et al., 2002; Prochaska & Velicer, 1997).

The construct of decisional balance, the individual's weighing of pros and cons, was adapted from Janis and Mann's (1977) model of decision making and describes how individuals move through stages (Prochaska et al., 2002). The self-efficacy construct was adapted from Bandura's SCT (Bandura, 1977, 1982) and represents the situational belief that one can cope with situations without relapsing to their negative behavior (Prochaska et al., 2002). Finally, temptation is the inverse of the self-efficacy construct and reflects the intensity of urges to engage in the negative behavior in challenging situations; however, it primarily used in research on addictive behaviors (Prochaska et al., 2002).

Social cognitive theory. Bandura's SCT, which began development in 1962, posits that there is a triadic, reciprocal relationship between the environment, person, and behavior (Bandura, 1962; Bandura, 1986). The environment is composed of two constructs, the environment itself and observational learning (Bandura, 1986). The person is composed of the following constructs: behavioral capability, self-control, self-efficacy, emotional coping responses, outcome expectations and expectancies, and situations (Bandura, 1986). Reinforcements, responses to a person's behavior that increase or decrease the likelihood of reoccurrence, can be a component of both the environment and the person (Baranowski, Perry, & Parcel, 2002; Dzewaltowski, 1994).

The self-control construct proposed by Bandura (1991) incorporates many aspects of self-regulation theory (Kanfer, 1970) and goal setting theory (Latham & Locke, 1991). The self-

control system has the following functions: setting goals, monitoring of one's own behavior and its determinants and effects, comparison of behaviors to goals or standards, and administering self reward (Bandura, 1991). The goal setting aspect of the self-control process is heavily influenced by one's self-efficacy to make the change (Bandura, 1991).

Health belief model. The HBM, a value-expectancy theory, was originally developed in the 1950s (Hochbaum, 1958) and was influenced by stimulus response theory (Hull, 1943; Thorndike, 1898; Watson, 1925) and cognitive theory (Lewin, 1935; Tolman, 1932). In short, the theory posits that people will take action to prevent, screen for, or control health conditions if they believe that they are susceptible to the condition (perceived susceptibility), it would have potentially serious consequences (perceived severity), a course of action exists to reduce their susceptibility to or severity of the condition (perceived benefits), and the anticipated barriers do not outweigh the benefits of taking action (perceived barriers) (Hochbaum, 1958). Thus, these comprise the four core constructs of the theory, and two additional constructs have been added to the model: cues to action and self-efficacy (Janz, Champion, & Strecher, 2002). These cues to action, such as a bodily or environmental event, instigate action from the above perceptions (Hochbaum, 1958). Rosenstock, Strecher, and Becker (1988) suggested that self-efficacy, which was discussed in the SCT section, be added to the HBM.

Motivational interviewing. Motivational interviewing (MI) is a technique for participant-centered approaches in therapeutic interactions that has been extended to health behavior research and practice (Miller & Rollnick, 1991; Rollnick, Mason, & Butler, 2000). Furthermore, this technique aligns with the referent power and participatory, participant-centered approaches to health behavior change proposed by Carl Rogers (1957) over 50 years ago. It is a directive but non-confrontational communication technique that elicits behavioral change by helping

participants explore and work through ambivalence about changing their behavior (Emmons & Rollnick, 2001; Miller & Rollnick, 1991) that has been shown to help advance participants stage of change and create behavior change (Miller & Rollnick, 1991).

The technique has counselors utilize empathetic and reflective listening and directive questioning to help participants focus on their hesitancy about the health behavior change. Furthermore, the participants' values are considered in terms of their consistency or inconsistency with the health behavior change. In IM, participants and not the counselors are seen as the experts in evaluating their behaviors and generating potential solutions for their problem behaviors. Thus, the counselors' role involves offering participants facts and pointing out discrepancies between the participants' goals and behavior, but the participant is responsible for interpreting the implications of these facts and discrepancies and generating subsequent self-motivating strategies or statements. In this way, the counselor avoids confrontation and advice giving.

Tailoring. Tailoring health behavior interventions refers to designing and implementing many individually designed versions of the intervention, whether it be mail, telephonic, or Internet-based. The tailoring can be done according to sociodemographics such as age, sex, and education as well as according to theories. Multiple theories have been used in the literature to tailor interventions, including SCT, TTM, and HBM (Rakowski, 1999). The tailoring approach has been shown to increase the probability of the material being read, retained, and considered as well as creating behavior change (Brinberg & Axelson, 1990; Brug et al., 1996; Rimer & Glassman, 1999; Skinner, Strecher, & Hospers, 1994).

The most common application of the TTM in the literature is its use in tailoring communications (Prochaska et al., 2002). Tailoring per the TTM involves matching intervention

messages to an individual's particular needs according to their stage of change (Kreuter & Strecher, 1999). Thus, those in a specific stage of change would receive an intervention targeting the appropriate processes of change required to move from one stage to the next. Interventions tailored per the TTM have been utilized across a range of health behaviors with smoking cessation (Dijkstra, De Vries, Kok, & Rouackers, 1999; Prochaska et al., 2008; Strecher, 1999; Strecher, Wang, Derry, Wildenhaus, & Johnson, 2002; Velicer et al., 1993) and physical activity (Cardinal & Sachs, 1995; Marcus, Bock et al., 1998; Marcus, Emmons et al., 1998) being the two most prevalent (Prochaska et al., 2002).

Mail-based

Description. The mail-based program was the lowest contact intervention modality and included six personalized, serial monthly mailings of educational materials related to the topic area of interest. The first five mailings were similarly structured but specifically designed to address one of the five stages of readiness to change. Additionally, these materials were written in the voice of MI to the extent possible, such as providing facts and exercises to guide the exploration of participants' ambivalence about behavior changing. The final mailing included a program evaluation survey and a postage-paid return envelope. Additionally, a toll-free telephone number was included with each mailing to allow individuals to call with questions about the content of the educational materials or request additional supportive materials.

Each mailing was tailored per the TTM to a certain stage of readiness for behavior change. For example, the general characteristics of a person in each stage of readiness were considered along with the primary tasks and change processes necessary to move through that stage. The type of information, tools and resources necessary to move through each stage were also considered in the development of the program. For instance, individuals in the pre-

contemplation stage may lack intention to change or may be resistant to change; therefore, the primary task highlighted in the mailing would focus on learning more about the issue or behavior while the change processes would focus on consciousness-raising and providing the individual with information, such as information intended to increase levels of perceived susceptibility and severity. Tools provided as part of this mailing would include a consciousness-raising self-assessment and an assessment of his or her stage of readiness to change.

Completion criteria. The completion criteria, as defined by the LM vendor, are as follows. "Registered" participants were considered any eligible employee who has registered for the mail-based program. "Completed" participants were participants who were sent six mailings. Finally, "discontinued" participants were participants who chose to discontinue participation in the program prior to shipment of the sixth mailing.

Telephone-based

Description. The telephonic program was the highest contact modality and was comprised of approximately five one-on-one calls with a health coach over a 6 to 8 month period. The telephonic program began with a mailing of TTM tailored education materials (welcome letter and educational booklet) to the participant, and was followed by a series of counseling contacts by a health coach. Health coaches were matched with participants based on their professional preparation and work experience, such as registered dieticians being matched with participants who wanted to primarily work on nutrition, exercise science professionals being matched with participants who wanted to work on physical activity, and psychology professionals being matched with participants who wanted to work on stress management.

The health coach utilized MI techniques to target the appropriate constructs per the individuals stage of change; thus, they provided information, telephone counseling, and feedback

to facilitate change in the risk behavior selected by the participant. Employees who participated in the program were contacted by a health coach about a week after the mailing of the educational material and then at monthly intervals thereafter. At the start of all calls the health coach determined the level of support required to match the participants' stage of change and self-efficacy. Key elements of the initial health coaching calls included the assessment of stage of change, perceived benefits and barriers for behavior change, previous behavior change attempts, family and social support. Furthermore, these coaches guided participants in their setting of short- and long-term "SMART" (specific, measurable, achievable, rewarding, and trackable) goals intended to assist them in their health behavior change efforts. Subsequent contacts were used to monitor progress, address barriers to change, discuss social support, and acknowledge success. To support the maintenance of lifestyle changes, the same health educator contacted participants at the 6 and 12 month points of the program to provide maintenance support. Throughout the program, the length of calls varied based on participants needs but averaged 10 minutes. In addition to the scheduled calls, a toll-free telephone service that provides access to the health educator was available to all participants throughout the program.

The role of the health educator was a key component of the LM program. The program called for the counselor to utilize MI approach by taking a facilitative versus a directive role. In facilitation, it is the participant who defines how and when to make behavioral changes along with a health educator who plays a supportive role by helping the participant develop change skills and organize the change process. The health coach also responded to specific questions and concerns and helped the participant develop an individualized behavior change plan. This facilitative process was intended to increase commitment by moving decision making responsibility to the participant and increasing assimilation of general behavior change skills that

can be applied across a range of health risk behaviors. Empowering participants by helping them develop behavioral and change process skills was viewed as crucial to their long-term success in achieving and maintaining an optimally healthy lifestyle.

Completion criteria. The completion criteria, as defined by the LM vendor, are as follows. "Registered" participants were considered any eligible employee who has registered for the telephone-based program. "Completed" participants were participants who have received a minimum of three calls or met their program goal. Finally, "discontinued" participants were participants who chose to discontinue participation in the program prior to completing their third call.

Internet-based

Description. The TTM tailored, Internet-based programs entailed moderate contact and were comprehensive on-line experiences that helped individuals take action to change health-related behaviors. Program participants received a fully personalized experience tailored to their individual needs and health objectives. The interventions were 6 week online programs that entailed the completion of six comprehensive modules that address the key constructs of health behavior change identified in SCT, TTM, and HBM. The use of the Internet technology provided a unique method by which to target observational learning by showing short video clips. Similar to the mail-based intervention, these modules used MI techniques to the extent possible, such as in the text of the intervention as well as through interactive tools. In fact, program participants benefited from a wealth of interactive tools such as:

- a personalized Meal Planner and Diet Tracker,
- a 28-day Walking Program with a built-in, personalized Walking Tracker,
- healthy makeovers of favorite foods,

- ways to integrate exercise into daily life, and
- techniques for reducing stress.

Completion criteria. The completion criteria, as defined by the LM vendor, are as follows. "Registered" participants were considered any eligible employee who has registered for Internet-based program. "Completed" participants were participants who have completed the post-assessment. Finally, "discontinued" participants were participants who have not completed the post-assessment or who have been inactive on the site for at least 44 days.

Impact of Program Description on Methods

Black box effect. Rossi , Lipsey, and Freeman (2004) discuss the term "black box evaluation" as an assessment of outcomes that is made with minimal insight into what is actually causing those outcomes. Program evaluations should be conducted on programs with sound theoretical basis because without such a basis, the evaluation results are ambiguous. Specifically, if the program theory is not well defined, then it is nearly impossible to define what the program is supposed to be doing. This results in an inability to identify the appropriate process measures to be evaluated to determine if the program is being delivered as intended. Additionally, if the program theory is not well defined, it may be possible to identify the impact outcomes; however, it will be very difficult to identify the intervening variables. These intervening variables in conjunction with the process evaluation results should be used to interpret why the program did or did not produce the desired outcomes; therefore, the ability to draw conclusions is greatly limited when conducting a black box evaluation.

The evaluation of this LM program could, *in part*, be considered a black box evaluation due to the limited amount of information regarding the program theory. In a sense, it is not a black box evaluation because according to the LM program vendor, the program is theory based.

Specifically, the programs target determinants of the health behaviors based on three empirically supported health behavior theories: transtheoretical model (TTM), social cognitive theory (SCT), and health belief model (HBM). Furthermore, the following evidence-based strategies are used to target the constructs of these health behavior theories: MI and tailoring interventions.

Despite the declaration of being a theory based program, little is known about the details of how the program operationalized this theory in terms of methods and specific strategies used to create change in the determinants (Bartholomew et al., 2006). For example, the vendor states that in the telephone program that the health coaching calls address perceived benefits and barriers for behavior change, social support, and self-efficacy; but, it is unclear which methods and strategies were used to address these constructs beyond the general use of MI and intervention tailoring. There was a lack of process measures and intervening variables that were captured and made available to those other than the vendor, which may be a result of failure to capture the data due to the limited program theory information or merely the proprietary nature of the data. This is a noted limitation of the study.

Due to this proprietary nature of vendor programs, many details about program theory and the translation to specific methods and strategies are not available. Although the need to protect a competitive advantage is understandable, consumers need to know that the programs that they are purchasing are effective. Generally, efficacy and effectiveness information is considered more trustworthy when reported by a third party as compared to the vendor. Therefore, the hope is that someday there will be better transparency in the vendor marketplace.

Participation by program topics. Participants in the LM program were allowed to participate in whichever program or programs they chose. This resulted in participants who participated via multiple modalities and, as discussed previously, these individuals were

excluded from the analysis. Not only did participants select their modality of participation, but they also selected the LM program topic. Participants were given individualized feedback about their health risks with the intention being that the feedback from the HRA would influence them to participate in the topic or topics for which they were high risk; however, the topic that the participant enrolled in was ultimately their decision.

The distribution of participants across program topics is described in Table 3.2. The most popular topic among mail-based participants was the back care program with 40.1% of participants. The weight management (20.3%) and smoking cessation (15.0%) programs were also popular among mail-based participants. Among Internet-based participants, the most popular topic by far was weight management (38.0%) and this was also the case among the telephone modality with 49.5% of participants choosing the weight management program. Recall that there were no Internet programs designed for back care, blood pressure, or cholesterol topics.

Just as participants could choose the topic to participate in, they could also choose to participate multiple times, either multiple topics or multiple times within the same topic. These participants were excluded from the analysis as well as the numbers reported in the previous paragraph. It was necessary to control for multiple participation in order to get a true depiction of the effect of participating in the program since participating in multiple programs would likely have had a greater impact on behavior change than participating in a single program. Since there were only 30 participants meeting the eligibility criterion who participated in multiple program topics, these participants were excluded versus creating a dummy variable to be used as a control variable. Specifically, two of these participants participated via the Internet modality and 28 of them participated via the telephone modality. There were no repeats in the mail modality. There

were a total of 64 participants meeting the eligibility criterion who participated in a single topic multiple times who were also excluded from the analysis.

Global impact. Analyses examining the outcomes by topic areas were not possible for many hypotheses within topic areas due to limited sample sizes; therefore, the main focus of this study was on the general effect of participating in the LM program via the different modalities. Research on the programs studied herein by Gold and colleagues (2000) found that the programs produce a spillover effect and significantly reduce risk factors other than those associated specifically with the topic area for which participants are being counseled. Where the sample sizes were large enough, sub-analyses were conducted within topic.

Many behavior changes skills, regardless of the context in which they were taught, are transferable skills that can be applied to many health behaviors. For example, self-monitoring skills are employed in health behavior interventions targeting nutrition, physical activity, weight loss, depression, and anxiety (Aittasalo, Miilunpalo, Kukkonen-Harjula, & Pasanen, 2006; Finnell & Ditz, 2007; Foster, Makris, & Bailer, 2005; Helsel, Jakicic, & Otto, 2007; Kocovski & Endler, 2000; van den Berg et al., 2007). Success in changing one or more lifestyle behaviors also may increase confidence or self-efficacy to improve risk behaviors across other health behaviors. Unger (1996) observed that adults in the later stages of change for smoking cessation had more healthful levels of alcohol use and exercised more than subjects in the earlier stages of change, suggesting that people changing on their own may have made improvements in several health behaviors concurrently. A recent 7-year prospective observational study with 750 Japanese men found that increased habitual exercise was associated with smoking cessation; conversely, smoking relapse was associated with decreased habitual exercise (Nagaya, Yoshida, Takahashi, & Kawai, 2007). Other studies have found that increases in levels of physical

activity are associated with decreases in levels of depression and anxiety (Annesi & Unruh, 2008; Bonnet et al., 2005; Goodwin, 2003).

Study Measures and Data Collection

Data were collected from the employer's vendors (health management, consultant, incentive administrator, and data warehouse). Specifically, medical claims data, LM program data, HRA data, demographic, and eligibility data were collected from the data warehouse vendor. Program cost data were collected from all of the vendors. A noted limitation of this study is the limited amount of data for the program activities (e.g., dose delivered, dose received, fidelity) and a lack of data for the primarily cognitive changes listed as program outputs (e.g., changes in readiness to change and self-efficacy) in the logic model (Figure 3.3).

Demographic and Eligibility

Demographics and eligibility data were collected from the data warehouse vendor. These measures included: gender, age, tenure, salary, medical carrier, medical plan, risk score, region of United States, plan enrollment date, and plan disenrollment date. These measures were collected for the period 1/2006 though 9/2009 and were used to create the propensity scores and were used to apply the inclusion criteria.

Lifestyle Management

Lifestyle management data were collected from the data warehouse vendor. These data points included participation in the LM programs, lifestyle topic, program status, status date, and program modality. Program modality was defined as mail, telephone, and Internet. Program status was defined previously in the *Completion Criteria* sections of the intervention description. These measures were collected for the entire intervention period (1/2007 through 12/2008), and were used to identify participants in the respective LM program and the dose of the program received, which were the independent variables of interest along with time.

Health Risk Assessment

Health risk assessment data were collected from the data warehouse vendor. These data points included behavioral and biometric risk factors. The following risk factors were coded to indicate if individuals were at high risk (1) or were not at high risk (0): nutrition, back care, alcohol use, physical activity/exercise, tobacco use, stress, and depression. Biometric values were also collected and reported by clinicians at the onsite health centers, including weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose. These measures were collected for each administration of the HRA during the study period and used to measure the proximal and distal study outcomes.

High Risk Definitions

Alcohol. Two questions (frequency and amount) addressed alcohol use in the HRA. Men were defined as being at high risk for excessive alcohol consumption (i.e., high risk for alcohol) if they consumed more than 21 drinks per week; or 5 or more drinks on days alcohol was consumed for at least 2 days per week (National Institute on Alcohol Abuse and Alcoholism, April 1992, April 1998; U.S. Preventive Services Task Force, April 2004a, April 2004b). Women were defined as being at high risk for excessive alcohol consumption if they consumed more than 14 drinks per week; or 4 or more drinks on days alcohol was consumed for at least 2 days per week (National Institute on Alcohol Abuse and Alcoholism, April 1992, April 1998; U.S. Preventive Services Task Force, April 2004a, April 2004b).

Blood pressure. Participants were considered at high risk for high blood pressure (i.e., high risk for blood pressure) if they had no history of cardiovascular disease and no major cardiovascular risk factors, but systolic blood pressure ≥160 or diastolic blood pressure ≥100; or if the participant had either a history of cardiovascular disease or one or more major

cardiovascular risk factors, and systolic blood pressure ≥140 or diastolic blood pressure ≥90 (National Heart Lung & Blood Institute, May 2003; Williams et al., 2004).

Cholesterol. Participants at high risk for high cholesterol (i.e., high risk for cholesterol) were defined separately for three different risk levels for coronary heart disease (CHD) (Grundy et al., 2004; National Cholesterol Education Program, May 2001). First, for those with CHD or a CHD risk equivalent[7] high risk for high cholesterol was defined as having total cholesterol ≥ 200 mg/dL, HDL < 40 mg/dL, and LDL ≥ 100 mg/dL. Second, those with two or more CHD risk factors and a 10 year CHD risk ≤ 20%[8] were defined as high risk for high cholesterol if they had total cholesterol ≥ 200 mg/dL, < 40 mg/dL, and LDL ≥ 130 mg/dL. Third, those with zero to one CHD risk factors were considered to be high risk for high cholesterol if they had total cholesterol ≥ 240 mg/dL and LDL ≥ 190 mg/dL.

Nutrition. Two questions addressed eating behaviors in the HRA, and one of these questions was a multiple part food frequency question. Participants at high risk for poor nutrition were defined as those whose regular eating habits include few (2 or less) of the characteristics of a healthy diet. The definition of healthy eating habits was consuming five or more combined servings of vegetables and fruits in a normal day, three or more servings of whole grains in a normal day, one or more servings of nuts and legumes in a normal day, one or more servings of fish per week for non-vegetarians, and no more than four servings per day of foods high in trans or saturated fats (Willett, 2001).

Physical activity. Two questions in the HRA were used to determine physical activity risk level. Participants were defined as being at high risk for being physical inactive if they did

[7] Risk equivalents are diabetes or CHD risk factors conferring 10-year risk > 20%, which is defined in footnote 8.
[8] CHD risk factors: cigarette smoking; hypertension (blood pressure ≥ 140/90 mm Hg or on antihypertensive medication); HDL < 40 mg/dL (HDL ≥ 60 mg/dL counts as a "negative" risk factor and removes one risk factor from the total count); family history of premature CHD (males < 55 years & females < 65 years); Age (men ≥ 45 years; women ≥ 55 years).

not exercise vigorously, and they participated in less than 3 days per week of moderate-intensity physical activity (Pate et al., 1995).

Stress. Three questions addressed stress in the HRA. A participant defined as high risk for experiencing elevated levels of stress was one that that almost always felt troubled by stress and reported not handling stress well (Cohen, Kamarck, & Mermelstein, 1983).

Tobacco use. Two questions addressed tobacco use in the HRA. A participant who indicated smoking one or more packs of cigarettes per day was considered a high risk tobacco user (i.e., high risk for tobacco) (U.S. Preventive Services Task Force, 1996b).

Overweight or obesity. Participants at high risk for being overweight or obese were defined as those with a BMI of 30 kg/m^2 or higher; or BMI between 25 and 30 kg/m^2 and waist circumference over 40 inches for men and 35 inches for women (National Heart Lung & Blood Institute, September 1998).

Depression. Five questions addressed depression in the HRA. Participants who were defined as being at high risk for experiencing depression (i.e., high risk for depression) were those who indicated current depression (i.e., over past two weeks) or reported chronic depression (i.e., feeling depressed most of the time) (U.S. Preventive Services Task Force, 2002).

Back care. High risk for poor back care was defined as a score of 10 or more on a weighted index of factors (U.S. Preventive Services Task Force, 1996a). These factors were: current back pain (7 points); work requires regular lifting (5 points); at high risk for physical activity (4 points); lack of flexibility exercises (3 points); lack of strength exercises (2 points); at high risk for stress (1 point); at high risk for depression (1 point); overweight (1 point); smoking (1 point) (U.S. Preventive Services Task Force, 1996a). For those factors that were not described previously, there was one question for each of these factors.

Validity

This HRA is a proprietary technology that was developed and field-tested over 30-years and has been subjected to numerous validation tests. Three types of validity have been tested, specifically: content validity, predictive validity, and known-groups validity.

Content validity. The content validity of the HRA was established through a two-step process. First, a panel of subject matter experts was consulted to: 1) identify and prioritize content domains to be included, 2) identify standard and often previously validated measurement protocols, and 3) develop initial questions for testing as necessary. Second, the HRA was piloted among large groups of test participants who were asked to complete and evaluate the questionnaire. Based on their comments and suggestions, improvements were made to assure that participants clearly understood the questions and were able to answer them appropriately. Subsequent use of the HRA by several million participants has provided further verification of content validity.

Predictive validity. The predictive validity of the HRA on key indicators such as coronary heart disease and medical costs has been validated by several studies. A study of 41 HRAs, including this HRA, assessed their predictive validity for death due to coronary heart disease in the Framingham heart study (Health Management Vendor, n.d.; Smith, McKinlay, & Thorington, 1987). It found that the mean correlation values for the HRA used in this study ranged from 0.66 to 0.80 (Smith et al., 1987).

A joint study between the HRA developers and actuarial firm of Milliman & Robertson, Inc. demonstrated predictive validity between the HRA and medical costs (Brink & Anderson, 1987). Further research by the two firms replicated and extended these results (Anderson, Brink , & Courtney, 1995). The most recent and peer reviewed publication demonstrating predictive validity of the HRA with medical costs was sponsored by the *Health Enhancement Research Organization (HERO)* and has become the new "gold standard" in linking HRA health risks to medical costs (Anderson et al., 2000;

Goetzel et al., 1998). Those that were at risk for stress, high glucose, or depression had mean medical expenditures 35% to 70% higher than their low risk counterparts; and those at risk for tobacco, blood pressure, and physical activity had mean medical expenditures ranging from 10% to 21% higher than their low risk counterparts (Goetzel et al., 1998). When looking at the population level impact of health risks (i.e., factoring in the prevalence of these risk factors) a follow-up "HERO" study found that the risk factors measured on this HRA accounted for 25% of total health care expenditures incurred by the study sample (Anderson et al., 2000).

Known-groups validity. This type of validity is a measure of the degree to which groups of participants known to differ on the variable of interest also differ in their responses to the questions in the assessment tool. The HRA aggregate data profiles have been found to differentiate known differences in questionnaire responses across age, gender, and job categories (Health Management Vendor, n.d.). These aggregate data profiles also correspond well to available population norms regarding the prevalence of health risks (Health Management Vendor, n.d.).

Reliability

Unfortunately, reliability statistics for this HRA have not been published, which is a limitation of this study; however, data does exist for similar tools. The questions in this HRA were based heavily on the Health Assessment Questionnaire developed by the Centers for Disease Control and Prevention in 1980 (Anderson et al., 2000). Edington and colleagues (1999) reviewed the reliability of these HRA questions and concluded that the reliability is adequate for most HRA calculations since the results were minimally affected by minor changes to most survey questions.

Health Care Costs

The employer's paid medical claims were collected from the data warehouse vendor. These measures included monthly inpatient facility, outpatient facility, professional services, and

prescription drug claims. These paid claims reflected those incurred during the period January 2005 through September 2009, each period with three months of run out (Serxner et al., 2006).

Program Costs

The following costs were collected for the intervention period (1/2007 through 12/2008). These costs are summarized in the cost inventory listed in Table 3.3 and only reflect those costs pertinent to a cost analysis from an employer perspective.

Lifestyle Management V*endor Fees*

Lifestyle management vendor fees, including the cost per unit and number of units per year, for the program were collected from the vendor. These fees were available from administrative records and will be used to calculate the program cost. Unfortunately, a breakdown of these fees (e.g., personnel, postage, printing, Web-maintenance, etc.) or were not available and this is a noted limitation to the generalizability and replicability of the ROI analysis.

Incentives

Incentives costs for the LM program were collected from the incentive administrator. Since this incentive program was a points-based program, the total number of points and cost per point awarded for the LM program were collected. These costs were available from administrative records and were used to calculate the program cost.

Consulting Fees

Consulting fees, including the cost per unit (hourly rate) and number of hours per year, for time spent on the program were collected from the consultant. These costs included consulting hours for the strategic design, implementation, evaluation, and maintenance of the intervention. Essentially, the consultants filled the role of a wellness coordinator that would

otherwise be a employee on staff. These costs were available from administrative records and were used to calculate program costs.

Administrative Fees

Administrative fees, including the cost per unit and number of units per year, associated with importing LM program data into the data warehouse were collected from the vendor. These costs included the initial implementation of a data feed layout, initial data feed, and quarterly data feeds. These costs were available from administrative records and were used to calculate program costs.

Data Analysis

Missing Data

Not addressing missing data can limit the ability to make valid inferences from research studies due to the distortion of estimates, standard errors, and hypothesis tests (Little & Rubin, 1987). The first step in addressing missing data was to identify the mechanism of the missing data, using frequencies, as: univariate, unit of non-response, multivariate, or monotone (i.e. censored) missing (Briggs, Clark, Wolstenholme, & Clarke, 2003). Univariate missings occur when a single variable contains missing data but all other variables are complete. Unit of non-response missings occur when an individual did not respond to any variables. A third type of missing data is the most common, general or multivariate missings, which occur when multiple but not all variables are missing for multiple individuals. Finally, monotone missings (i.e., censoring) occur when longitudinal data are only available to a certain time point and not beyond that point. Variables with univariate missings and cases with unit of non-response missings were deleted from the data set. Thus, multivariate and monotone are the remaining types of missing data.

There are three possible patterns of missings: missing completely at random (MCAR), missing at random (MAR), or not missing at random (NMAR) (Little & Rubin, 1987). If missing data points have no relationship to any other variables (*observed* or *unobserved*), then they are considered MCAR. Data are considered MAR if they only have a relationship to *observed* variables (i.e., have no relationship to any *unobserved* variables). Data considered NMAR have missing data that are dependent on *observed* and *unobserved* variables. Data were tested for MCAR in SAS v.9.2 using correlational analyses (Pearson and Spearman).

The demographic variables with missing data were salary (0.16%), medical plan type (0.08%), job type (0.16%), and region (2.69%). Though there was missing data across 16 outcomes variables for AIMS 1 and 2, the level of missingness was very low, not higher than 0.98% per variable. The level of missingness for the medical claims data in AIM 3 was higher (35.01%). Missingness for each of these variables was significantly correlated with demographic and/or outcomes variables in the dataset, indicating that data were not MCAR. It is impossible to test for MAR since the variables in question are unobserved; therefore, it is assumed that data are MAR. The identified correlates were used in the MI models. Missingness related to the medical claims data is discussed further later in the methods section.

Since missing data points were not MCAR, simple listwise deletion could not be used. Since missing data points were assumed to be MAR, multiple imputation methods were used to impute the dataset. Though listwise deletion is easy to execute and uses the same sample for all analyses, it is inefficient and will produce biased results when data is MAR (Briggs et al., 2003). Multiple imputation is thought to be a superior imputation method when compared to the many single imputation methods (e.g., mean imputation, regression imputation, hot-deck imputation, predictive mean matching, and propensity for missing) because the imputation of a single value

substantially underestimates the error variance when there are many missing values, which does not account for the uncertainty associated with the imputed value (Kline, 2005). However, multiple imputation methods capture two types of variance for the imputed values: 1) the residual error from the estimation procedure and 2) the prediction error from the estimated coefficients.

Multivariate Missing

Markov chain Monte Carlo (MCMC) methods are a type of multiple imputation methods for continuous variables in datasets with multivariate or arbitrary (multivariate and monotone) missing data that draw values from non-standard distributions using Markov chains (Schafer, 1997, 1999). The first step samples missing values from their conditional predictive distribution, $Y_{\text{mis}}^{(t)} \sim P(\text{Y}_{mis} \,|\text{Y}_{\text{obs}}, \theta^{(t-1)})$ (Schafer, 1999). The second step then samples parameters (θ) from a simulated complete-data posterior distribution, $\theta^{(t)} \sim P(\theta \,|\text{Y}_{\text{obs}}, Y_{\text{mis}}^{(t)})$ (Schafer, 1999). This sampling procedure is conducted by a Markov Chain, defined as $\{Y_{\text{mis}}^{(t)}, \theta^{(t)}, t = 1, 2, \ldots\}$, and will converge at a stationary distribution $P(\text{Y}_{mis} \,|\text{Y}_{\text{obs}},)$ (Schafer, 1999). Draws are then taken from the stationary distribution to impute multiple datasets, typically five (Schafer, 1999). These datasets can either be used to calculate parameter and variance estimates in each set and then combine them, or the cells of the datasets can be averaged together to create a single dataset (Schafer, 1997, 1999).

The MCMC multiple imputation procedure was conducted for the continuous data. Although the medical claims data violate the assumption of normality, Oostenbrink and Al (2005) demonstrated in a simulation study that this approach produced unbiased estimates of the mean and standard error when data are skewed. The MI and MIANALYZE procedures from SAS v9.2 were used to create five imputed data sets, average parameter estimates over the sets of

analyses, and compute standard errors using the average of the standard errors over the set of analyses and the between analysis parameter estimate variation. Unfortunately, the MCMC procedure cannot be used on the categorical health risk data from the HRA, which is discussed further in the following section.

Monotone Missing

Methods to impute multivariate missing categorical data have been debated recently. Since the MCMC method assumes normality, it is not well suited for imputing categorical variables. Categorical variables have distinct values (e.g., 0 and 1 for a binary variable), but the imputed values can be any real value and some may even fall outside the range of values. Many authors (Allison, 2001; Schafer, 1997) have recommended rounding the imputed values to the closest distinct value; however, Horton and colleagues (2003) and later Allison (2005) showed that such rounding can produce biased estimates of proportions. Thus, linear imputation with rounding should never be used (Allison, 2005; Horton et al., 2003). Instead, when estimating proportions, logistic regression multiple imputation is recommended compared to linear imputation with or without rounding (Allison, 2005).

Unfortunately, this method is only applicable to monotone missing data; therefore, no good method exists to impute the multivariate missingness of categorical data. Since participation in the HRA serves as the entry point into the LM program, LM participants had completed the HRA prior to LM participation; therefore, the pattern of missingness was primarily monotonic. Unfortunately, there were some categorical HRA questions at T_1 left unanswered that could not be imputed and precluded the imputation of T_2 data. Since there were only five of these cases, they were deleted from the analysis using listwise deletion. The five cases that were deleted were consisted of four LM non-participants, one Internet participant, ages

ranging from 25 to 42 years, tenure ranging from 0.42 to 13.42 years, annual salary ranging from $22,526 to $54,127, four males, all participants in the Copay 500 plan with either Aetna or BCBSAL, and were from all regions of the country except the northeast. Statistical test for differences could not be run given the small sample, but the relatively wide range on demographic and eligibility variables suggests that they were not significantly different from the broader study sample.

Logistic regression multiple imputation was conducted by fitting a logistic regression model for each of the categorical variables with a set of covariates. For a binary classification variable, based on the fitted regression model, a new logistic regression model is simulated from the posterior predictive distribution of the parameters and is used to impute the missing values for each variable (Rubin, 1987). Specifically, for a binary variable Y_j with responses 1 and 2, a logistic regression model would be fitted using observations with observed values for the imputed variable Y_j and its covariates $X_1, X_2, \ldots, X_k$.

$$logit(p_j) = \beta_0 + \beta_1 X_1 + \beta_1 X_1 + \cdots + \beta_k X_k$$

where $X_1, X_2, \ldots, X_k$ are covariates for Y_j, $p_j = \Pr(R_j = 1 | X_1, X_2, \ldots, X_k)$, and $\text{logit}(p) = \log(p / (1-p))$. The imputed values are calculated by first drawing new parameter estimates from the posterior predictive distribution of the parameters. Second, the probability (p_j) of $Y_j = 1$ is calculated for all of the missing Y_j. Third, and last, a random uniform variate (u) is drawn between 0 and 1. If the value of u is less than p_j, then $Y_j = 1$ is imputed; otherwise, $Y_j = 2$ is imputed. This method can be generalized to ordinal categorical variables.

Logistic regression multiple imputation was carried out on this dataset for the categorical variables with monotone missing patterns. This regression included the covariates that were used to calculate propensity scores, which is discussed in the following section. The procedure

was executed using the MI and MIANALYZE procedures in SAS v9.2, which created five imputed data sets, averaged parameter estimates over the sets of analyses, and computed standard errors using the average of the standard errors over the set of analyses and the between analysis parameter estimate variation.

Sample Representativeness

Due to the quasi-experimental nature of this study, selection bias was a potential threat to the internal validity of this study. The use of propensity scores for adjusting for the selection bias incurred in studies without random assignment is well documented (D'Agostino, 1998; Rosenbaum & Rubin, 1983, 1984); however, there has been little consensus regarding the best propensity score method (Austin & Mamdani, 2006). The use of propensity scores is favored over the inclusion of covariates in the statistical model because it 1) favors parsimony, 2) allows for analyses regarding the overall impact of baseline differences, and 3) differentiates between balancing study groups and the use of covariates as predictors of outcomes (Pasta, 2000). Per two recent literature reviews, the most common method for utilizing propensity scores is covariate adjustment, while matching, stratification, and weighting are also common methods (D'Agostino, 1998; Shah, Laupacis, Hux, & Austin, 2005; Weitzen, Lapane, Toledano, Hume, & Mor, 2004).

A case study by Austin and Mamdani (2006) concentrated on the comparison between stratification and matching and found that matching performed the best with regards to providing group equivalence; however, this was tempered by the fact that many data points are lost because participants receiving treatment could not be matched. This resulted in reduced power to detect changes in the outcome variables. A simulation study comparing these same approaches found that the weighting method tended to perform poorly, but that the matching, stratification, and covariance adjustment methods generally produced comparable results (Luellen, 2007). Given

the drawbacks associated with matching and the cumbersome computations associated with the stratification method, the covariance adjustment propensity score method appears to be the best choice for statistically addressing selection bias in observational research designs.

Therefore, propensity scores were utilized in this study to adjust for baseline differences across study groups (modality and dose) and were implemented as a covariate in hypothesis testing. There were a few cases when the generalized estimating equations would not converge when using the propensity score as a covariate. Specifically, for the test of change in medical claims costs between those who completed and discontinued the program (12 and 22 month analytic horizon) as well as those who participated in the Internet versus telephone modality and the telephone or Internet versus the mail modality (12 month analytic horizon only). In those cases the propensity score was implemented as a weight. The propensity scores were calculated using logistic regression model predicting the probability of being in one's respective group based on relevant covariates. Covariates were included in the propensity score based on those that were significantly related to the grouping and outcome variables. Potential covariates included employee's gender, age, tenure, salary, plan type, medical carrier, job type, region of the United States, months between pre and post HRA, and risk score.

Hypothesis Testing

AIM 1: Impact of Modality on Health Risks

Hypotheses 1A-C were tested using LM and HRA data from 1/2007 through 12/2008 in a pre-test (T_1) / post-test (T_2) design. Continuous risk outcomes were analyzed using repeated measures ANCOVA and categorical risk outcomes were analyzed using logistic regression on difference scores categorized as those who decreased their risk (1) versus those who did not (0). In both analyses, participant group was the grouping variable of interest and propensity score

was the covariate. These methods were chosen over other common methods per the following rationale.

There has been much debate in the literature regarding the best approach for analyzing longitudinal data with data from only two time points (Dimitrov & Rumrill, 2003; Duncan, Duncan, Strycker, Fuzhong, & Alpert, 2006; Gollob & Reichardt, 1987; Meredith & Tisak, 1982; Rogosa, Brandt, & Zimowski, 1982; Rogosa & Willett, 1985; Stoolmiller & Bank, 1995). Two common approaches to the analysis of change with two data points are residual change models (i.e., regressing T_2 on T_1) and difference score, equivalently repeated measures models with two time points. The residual change approach conceives that the autoregressive effect (i.e., the effect T_1 variable on the T_2 variable) is a competing explanation for the observed effect; therefore, must be included in the model in order to draw causal inferences regarding the predictors of interest (Gollob & Reichardt, 1987). The difference score approach contends that there are serious short coming of the residual change approach (Rogosa & Willett, 1985). Specifically that by controlling for the autoregressive effect, the model tends to eliminate all predictors except those that predict changes in the rank order of the observations over time; however, when there are no change in rank order, there could still be significant changes in the dependent variable at the individual or group levels (Meredith & Tisak, 1982; Rogosa & Willett, 1985). Furthermore, the autoregressive effect as a true causal effect is questionable (Rogosa et al., 1982; Rogosa & Willett, 1985).

Hypothesis 1A.1. This hypothesis was examined using separate a logistic regression for each modality with participation (1 = LM participant, 0 = reference group = HRA only participant) as the parameter of interest and a propensity score as the covariate. Support for Hypothesis 1A.1 would be indicated by a statistically significant odds ratio greater than one.

This would indicate that the odds of decreasing risk level for the proximal health risk factor (1= decreased risk, 0 = reference group = no decrease in risk) over time were higher for participants compared to HRA only participants, controlling for propensity score.

Hypothesis 1A.2. The hypotheses for the categorical distal outcomes (blood pressure risk, cholesterol risk, and overweight or obesity risk) were examined using the same methods as Hypothesis 1A.1. The hypotheses for the continuous distal outcomes (weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose) were examined using a separate repeated measure ANCOVA for each modality with the interaction of participation (1 = LM participant, 0 = reference group = HRA only participant) and time as the test of interest and propensity score as the covariate in the model. Support for Hypothesis 1A.2 would be the same as Hypothesis 1A.1 for the categorical outcomes and for continuous outcomes would be indicated by a statistically significant interaction with means indicating that LM participants have a greater decrease or less of an increase in health risk factors over time than HRA only participants, controlling for propensity score.

Hypothesis 1B.1. This hypothesis was examined using a logistic regression with modality (1 = telephone or Internet LM, 0 = reference group = mail LM) as the parameter of interest and a propensity score as the covariate. Support for Hypothesis 1B.1 would be indicated by a statistically significant odds ratio greater than one. This would indicate that the odds of decreasing risk level for the proximal health risk factor (1= decreased risk, 0 = reference group = no decrease in risk) were higher for participants in the telephone or Internet LM intervention compared to the participants in the mail-based LM intervention, controlling for propensity score.

Hypothesis 1B.2. The hypotheses for the categorical distal outcomes (blood pressure risk, cholesterol risk, and overweight or obesity risk) were examined using the same methods as

Hypothesis 1B.1. The hypotheses for the continuous distal outcomes (weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose) were examined using repeated measure ANCOVA with the interaction of modality (1 = telephone or Internet LM, 0 = reference group = mail LM) and time as the test of interest and propensity score as the covariate in the model. Support for Hypothesis 1B.2 would be the same as Hypothesis 1B.1 for the categorical outcomes, and for continuous outcomes would be indicated by a statistically significant interaction with means indicating that participants in the telephone or Internet LM interventions have a greater decrease or less of an increase in health risk factors over time than participants in the mail-based LM intervention, controlling for propensity score.

Hypothesis 1C.1. This hypothesis was examined using a logistic regression with modality (1 = telephone LM, 0 = reference group = Internet LM) as the parameter of interest and a propensity score as the covariate. Support for Hypothesis 1A.1 would be indicated by a lack of a statistically significant odds ratio.

Hypothesis 1C.2. The hypotheses for the categorical distal outcomes (blood pressure risk, cholesterol risk, and overweight or obesity risk) were examined using the same methods as Hypothesis 1C.1. The hypotheses for the continuous distal outcomes (weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose) were examined using repeated measure ANCOVA with the interaction of modality (1 = telephone LM, 0 = reference group = Internet LM) and time as the test of interest and propensity score as the covariate in the model. Support for Hypothesis 1C.2 would be the same as Hypothesis 1C.1 for the categorical outcomes and for continuous outcomes would be indicated by a lack of a statistically significant interaction, controlling for propensity score.

AIM 2: Impact of Dose Received on Health Risks

Similarly to AIM1, Hypotheses 2A and B were tested using LM and HRA data from 1/2007 through 12/2008 in a pre-test (T_1) / post-test (T_2) design. Continuous risk outcomes were analyzed using repeated measures ANCOVA and categorical risk outcomes were analyzed using logistic regression on difference scores categorized as those who decreased their risk (1) versus those who did not (0). In both analyses, dose received (completed or discontinued program) was the grouping variable of interest and propensity score was the covariate.

Hypothesis 2A. This hypothesis was examined using a logistic regression for the telephone modality with completion (1 = completed, 0 = reference group = discontinued) as the parameter of interest and a propensity score as the covariate. When broken down by completion status, the cell sizes were not large enough to conduct the statistical analyses for the mail or Internet modalities; therefore, descriptive data was used to examine these hypotheses. Support for Hypothesis 2A would be indicated by a statistically significant odds ratio greater than one for the telephone modality. This would indicate that the odds of decreasing risk level for the proximal health risk factor (1= high risk, 0 = reference group = not high risk) were higher for participants who completed the telephone LM intervention compared to the participants who discontinued participation in the LM intervention, controlling for propensity score. Sufficient sample size was not available for the mail or Internet modalities to statistically test Hypothesis 2A; therefore, only frequencies were reported.

Hypothesis 2B. The hypotheses for the categorical distal outcomes (blood pressure risk, cholesterol risk, and overweight or obesity risk) were examined using the same methods as Hypothesis 2A. The hypotheses for the continuous distal outcomes (weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose) were examined for the telephone modality

using repeated measure ANCOVA with the interaction of completion (1 = completed, 0 = reference group = discontinued) and time as the test of interest and propensity score as the covariate in the model. When broken down by completion status, the cell sizes were not large enough to conduct the statistical analyses for the mail or Internet modalities; therefore, descriptive data was used to examine these hypotheses. Support for Hypothesis 2B would be the same as Hypothesis 2A for the categorical outcomes, and for continuous outcomes would be indicated by a statistically significant interaction with means indicating that participants who completed the telephone LM intervention have a greater decrease in health risk factors over time than participants who discontinued participation in the LM intervention, controlling for propensity score. Sufficient sample size was not available for the mail or Internet modalities to statistically test Hypothesis 2A; therefore, only frequencies were reported.

AIM 3: Return on Investment

Hypotheses 3A through D were tested using a subsample from the sample utilized in AIMS 1 and 2, specifically, those with 75% or more of medical eligibility months during the 22 month analytic horizon. The sample was selected according to a simulation study by Scheffer (Scheffer, 2002) that showed imputation procedures to be fairly suspect at missingness rates of 50% or higher, particularly when data are NMAR, and the fact that there were few significant differences between those with 75% or more of medical claims data and those with fewer. It was not possible to use the entire sample because 35% of the dataset had more than 25% missing medical claims data. It was not possible to use only those with complete data because such listwise deletion assumes that those with complete data are representative of the entire sample; however, those with complete data were significantly different than those without complete data on many outcome variables. Specifically, the only significant differences in outcome variables

after controlling for significant demographic variables were for depression risk, elevated stress risk, and poor back care risk. Therefore, the significant demographic variables (age, tenure, salary, and medical plan name) and these three outcome variables were included in the imputation model. Program modality or status (i.e., completed or discontinued) did not significantly differ between those included versus excluded from the sample. Potential samples with lower levels of missingness (e.g., 10% missing) demonstrated more significant differences on outcome variables, even after controlling for demographic covariates than the selected sample.

The sample with 75% or more of their medical eligibility claims only included those that participated in the program in 2007; therefore, hypotheses 3A through D were tested using LM program data (1/2007 through 12/2007), medical claims data (1/2006 through 9/2009), and program cost data (1/2007 through 12/2007). Changes in medical claims across time were calculated using a difference-in-difference (DID) design, which is a common method for calculating differences in claims cost (Kleinbaum, Kupper, Nizam, & Muller, 2008; Ozminkowski, Shaohung, & Long, 2007; Parente, Feldman, & Christianson, 2004). This difference was estimated via one-part regressions conducted with generalized estimating equations (GEE). The models included group membership (modality or dose), time (month), and their interaction as the independent variables with propensity score and baseline claims as covariates. This method was chosen due to the right skewed distribution of medical claims data and the correlation of individuals' medical claims across time.

Multiple time points. All program costs were incurred in 2007; therefore, adjustments for inflation were not necessary, and program costs represent 2007 dollars (Corso & Haddix, 2003; Serxner et al., 2006). The program benefits were analyzed using constant dollars and, as

described further in the following section, the employers discount rate that does not allow for inflation was applied (Drummond, O'Brien, Stoddart, & Torrance, 2007).

Program costs and benefits were discounted to adjust for time value of money; that is to say that the value of a dollar of savings 5 years from now is less than if I had that dollar today, because I could invest that dollar. These program costs and benefits were discounted to the program start date (1/2007), with the present value (PV), or discounted value, defined as

$$PV = \sum_{t=.5}^{T-.5} FV_t(1+r)^{-t}$$

where *FV* is the future value of the benefit or cost, *r* is the discount rate, *t* is the time period, and *T* is the time stream (i.e., analytic horizon). The discount rate of 6% reflects the employer's assumptions about the rate of return for alternate investments, in other words the opportunity cost (Corso & Haddix, 2003). The above formula accounts for costs and benefits that occur at the middle of the period, which is appropriate since the program costs and benefits could have occurred at any point during the period, not just at the beginning or end (Corso & Haddix, 2003). It should be noted that *future medical costs* should not be discounted as it understates the amount spent, thereby inflating the apparent benefit, which is the opposite of the intended effect. Therefore, discounting was done after the benefit from medical claims costs was calculated.

Outliers. Per the recommendations of Serxner and colleagues (2006), all outliers for which the employer was financially liable were included. Since the employer does not have stop loss insurance on individual or aggregate medical claims, all paid claims were included in the analysis.

Further in line with the recommendations, sensitivity analyses were conducted excluding outliers (Serxner et al., 2006). Outliers within each service category were identified using the

non-parametric trimming method, which uses quartiles (Disease Management Association of America, 2006; Pirson, Dramaix, Leclercq, & Jackson, 2006; Schreyogg, Stargardt, Tiemann, & Busse, 2006). Observations that are greater than 3rd quartile or 75th percentile + 3*interquartile range were considered outliers and were capped (Pirson et al., 2006; Schreyogg et al., 2006). The same approach can be applied to remove lower bound outliers; however, only upper bound outliers were removed from the medical claims data given the expected distribution of the claims data with a lower bound of zero (Schreyogg et al., 2006).

Baseline claims cost. The mean baseline claims cost was included as a covariate in the models to adjust for differences between groups in this quasi-experimental study (Dimitrov & Rumrill, 2003). The baseline period was defined as the 12 months prior to the completion of the pre-period HRA (Serxner et al., 2006).

Estimation with skewed data. A one-part model estimated via generalized estimating equations (GEE) was chosen over a standard two-part regression model (2PM) or a modified two-part regression model (M2PM) to account for the skewed nature of the medical claims data. Duan and colleagues (1983) first introduced a two-part parametric model (2PM), which uses ordinary least squares (OLS) estimation methods in the general linear model (GLM). The model includes two stages in which the first stage uses a logistic equation for the dichotomous event of having zero or positive medical claims costs,

$$\Pr(c > 0|x) = \frac{e^{\alpha_0 + \sum_k \alpha_k x_{ik}}}{1 + e^{\alpha_0 + \sum_k \alpha_k x_{ik}}}$$

where α is a vector of coefficients. The second stage uses a linear regression model for non-zero values on the log-scale

$$\ln(c_t) = \beta_0 + \sum_j \beta_j x_{ij} + \varepsilon_i \ , for\ c > 0$$

where β is a vector of coefficients and ε is the residual error. Finally, the individual's predicted cost is the product of the expected cost and the probability of having costs, so the cost per person can be estimated by

$$\widehat{Y_i} = \Pr(c > 0|x) \times \ln(c_t) = \frac{e^{\widehat{\alpha}_0 + \sum_k \widehat{\alpha}_k x_{ik}} \times e^{\widehat{\beta}_0 + \sum_j \widehat{\beta}_j x_{ij}}}{1 + e^{\widehat{\alpha}_0 + \sum_k \widehat{\alpha_k} x_{ik}}}$$

Though this approach is appealing, there are concerns with using costs on a log-scale. Specifically, data is difficult to interpret on log-scales and simply exponentiating the estimated mean log cost yields a biased estimate of the mean distribution of the medical claims cost (Cooper, Sutton, Mugford, & Abrams, 2003). Thus, Duan (1983) proposed applying a smearing factor to accurately estimate mean costs from the estimated mean log-costs. Per the distribution of the errors, either a parametric or non-parametric smearing factor can be used (Cooper et al., 2003). Although Duan's smearing estimator is still used frequently, Mullahy (1998) illustrated that this estimator can biased under heteroskedasticity because it assumes that the error term is independent of the predictors.

More recently, generalized linear models (GZLMs), of which GEEs are a subset, have been proposed to facilitate inferences about predictors of expected costs (Mullahy, 1998). GZLM models allow for dependent variables with non-normal distributions; therefore, the mean and variance functions can be modeled directly on the original scale of the dependent variable (Liang & Zeger, 1986; McCullagh & Nelder, 1989; Nelder & Wedderburn, 1972; Zeger & Liang, 1986). This allows for the results in the GZLM model to be interpreted directly, unlike OLS methods that require transformation of the results from the log scale to the original scale. This method can model skewed distributions in a single step as well as in multiple steps. Mullahy (1998) as well as Buntin and Zaslavsky (2004) found that the one- and two-part models both performed well, particularly when compared to the traditional 2PM with a smearing factor.

The advantage of the one-part model compared to the two-part model is three-fold. First, it is more intuitive to the practitioner audience. Second, it is more computationally efficient. Third, it preserves the AR(1) working correlation matrix assumption, which is discussed further in the following paragraphs.

Another advantage to using GEE method versus the GLM, which typically uses OLS estimation methods (Kleinbaum et al., 2008), is that GEE takes into account the correlation of an individuals' claims costs over time; whereas, the GLM method does not (Kleinbaum et al., 2008; Liang & Zeger, 1986; Zeger & Liang, 1986). Failure to account for this correlation can lead to incorrect inferences about the regression coefficients, due to incorrect estimation of the variances, and inefficient or biased estimates of the regression coefficients that could lead to incorrect conclusions regarding their research questions (Ballinger, 2004; Diggle, Heagerty, Liang, & Zeger, 2002). The GEE approach has demonstrated consistent estimators of the regression coefficients and of their variances under weak assumptions about the actual correlation among a subject's observations (Liang & Zeger, 1986; Zeger & Liang, 1986). Due to this and the ability to model non-normal distributions, the use of GEEs has become popular in the medical care literature and is generally preferred to the more common method of using log transformation (Mark, Gibson, & McGuigan, 2009; Stuart et al., 2005; Veazie, Manning, & Kane 2003).

There are two key steps in specifying the GEE model that are unique to this method compared to the GLM method. First, the distribution of the data must be specified. The gamma distribution generally accurately reflects the distribution of medical claims costs (Blough, Madden, & Hornbrook, 1999; Mark et al., 2009; Stuart et al., 2005; Veazie et al., 2003). A histogram of the data was created and confirmed the gamma distribution.

Second, the working correlation matrix for the data must be specified. The working correlation matrix is the component of the analysis that adjusts for the correlation of the longitudinal claims data (Zeger & Liang, 1986). Since the working correlation matrix does not have to correctly reflect the actual correlation among data points to obtain consistent estimates, accuracy in this step of the model specification is not as imperative as it may seem. However, specifying the correct correlation matrix is beneficial as it increases efficiency (Zeger & Liang, 1986). The correlation matrices include identity (i.e., no correlation), AR(1) (i.e., first-order autoregressive), exchangeable (i.e., correlations are identical), M-dependent (i.e., pairs of data elements separated by *m* consecutive repeated measurements have a common correlation coefficient), and unstructured (i.e., estimation without constraints) (Liang & Zeger, 1986). Though the unstructured working correlation matrix provides the most flexibility, it is not efficient (Liang & Zeger, 1986). The AR(1) working matrix is often specified with medical claims data, indicating that the correlation is a function of the prior values, decreasing exponentially across time (Liang & Zeger, 1986; Schneeweiss, Maclure, Soumerai, Walker, & Glynn, 2002; Zhang, Donohue, Lave, O'Donnell, & Newhouse, 2009). Therefore, it is likely that a AR(1) working correlation matrix, which requires equal spacing of measurement intervals, will provide the best fit to the data in this study. This assumption was then tested by using each of the available correlation matrices to confirm which is the best fit per the quasi-likelihood under independence criterion (QIC) and the AR(1) did, in fact, provide the best fit to the data. Furthermore, the Huber-White Sandwich Estimator (i.e., robust estimator) was used to estimate standard errors. This estimator produces consistent standard errors even if the correlation structure is misspecified (Huber, 1967; White, 1980).

Program costs. Fixed costs are those that, in the short run (1 year), do not vary with the level of output, or participants in this case (Drummond et al., 2007). The fixed costs included in this analysis were consulting fees and administrative fees. The total cost for the consulting fees were calculated as the unit cost (hourly rate) by the number of units (number of hours). The per participant consulting cost were then calculated by dividing the total consulting costs by the number of intervention participants during 2007.

The administrative fees were calculated by totaling the related program costs from invoices. There were two types of costs, reoccurring quarterly update data feeds and a capital outlay to implement the LM program data layout, which enables the receipt of the data feeds. The equivalent annual cost (*E*) for the capital outlay was calculated using the annuitization procedure defined as

$$E = \frac{K - (S/(1+r)^n)}{A(n,r)}$$

where *K* is the initial outlay, *S* is the resale value, *r* is the discount rate, *n* is the useful life of the technology, and *A(n,r)* is the annuity factor (Drummond et al., 2007). Consistent with the rest of the calculations, the discount rate of 6% was used because it reflects the employer's assumptions about the rate of return for alternate investments, in other words the opportunity cost (Corso & Haddix, 2003). Since this cost is due prior to the receipt of the future quarterly data feeds, the annuity factor was calculated as being payable in advance as opposed to in arrears (Drummond et al., 2007). The cost for the quarterly data feeds was totaled from the invoices and was added to the equivalent annual cost of the LM data implementation to get the total administrative costs. The per participant administrative cost were then calculated by dividing by the total administrative costs by the total number of intervention participants during 2007.

Variable costs are those costs that vary with the level of output, or participants in this case (Drummond et al., 2007). Variable costs were totaled first for each cost item by multiplying the cost per unit times the number of units. These costs include vendor fees and incentive costs. Since the incentive costs differed by participant completion or discontinuation, program costs were calculated separately for those who completed and those who discontinued the program within each modality. Participants were also allowed to participate in more than one program; so, participants who did so cost more than those who only participated in one program. Therefore, the per participant incentive and program costs was calculated as a weighted average of the cost and the number of programs in which an individual participated, separately for those who completed and discontinued the program within each modality. Then average per participant cost for each modality was calculated by taking the weighted average of those that completed or discontinued the program.

Total per participant program costs were obtained by totaling the fixed and variable per participant expenses. Then the cost were discounted to the program start date (1/2007). Incremental costs were then calculated using simple subtraction.

Summary measures. This study presents ROI and NPV as summary measures. Although payback period and IRR could also be calculated, the deficiencies of these methods limit their applicability to making decisions on the investment of resources (Brighham & Houston, 2004; Weston & Brigham, 2000).

Return on investment is a ratio of the present value program benefits to program costs that is expressed as the dollars of benefits for each dollar of cost (*$X:$1*). The ROI can be calculated as an average or an incremental summary measure. An incremental ROI would be calculated as $(PV\ Benefits_A - PV\ Benefits_B) / (PV\ Cost_A - PV\ Cost_B)$, where *A* is the program of

interest, the LM program, and *B* is the comparison program, the non-participant group with only HRA costs. When evaluating a single program an ROI greater than one is favorable unless an alternate ROI benchmark has been established (Cohn, 2003). When comparing programs, the program with the higher ROI is favored (Cohn, 2003).

The major benefit to using the ROI is that it appears to be simple, logical, and easy to understand. The drawback to this summary measure is that it is sensitive to the classification of benefits and costs and masks the absolute size of the dollar figures (Haddix, Teutsch, & Corso, 2002). For example, the avoidance of a cost may be incorrectly classified as a negative cost instead of a benefit. Additionally, a program that will save fewer total dollars may have a higher ROI than a program with higher total savings but a lower ROI. These drawbacks are poignant when comparing interventions. However, if only one intervention is being considered and if the analysis is primarily concerned with determining the direction versus the magnitude of the ROI, then ROI can be a very good summary measure.

Net present value is thought to be the superior summary measure in ROI analysis (Haddix et al., 2002). This measure represents the present value benefits of the program less the present value costs of the program. Similar to ROI, NPV can be calculated as an average or an incremental summary measure, which would be calculated as $NPV = (PV\ Benefits_A - PV\ Benefits_B) - (PV\ Cost_A - PV\ Cost_B)$. When evaluating a single program, a positive NPV is favorable unless an alternate NPV benchmark has been established (Cohn, 2003). When comparing programs, the program with the higher NPV is favored (Cohn, 2003).

The benefits to using NPV as the summary measure are that it provides the absolute cost benefit and does not depend on the classification of costs and benefits. For example, if a cost avoidance figure was classified as a negative cost, then the cost figure would decrease by the

amount of the cost avoidance, and if the cost avoidance was classified as a positive benefit, then the benefit figure would increase by the amount of the cost avoidance. Either method essentially adds the cost avoidance figure back into the NPV calculation. The drawbacks to using the NPV figure are that it provides no information regarding the resource requirements for the program and it is more complicated to explain than the ROI. Accompanying the NPV with its cost and benefit components mostly alleviates these drawbacks.

Hypothesis 3A.1. Within each modality, this hypothesis was examined using a GEE model using a gamma distribution, identity link function, AR(1) working correlation matrix, and the interaction of modality (1 = LM participant, 0 = reference group = LM non-participant/HRA only participant) and time as the parameter of interest. The model also included time and modality as the other independent variables as well as propensity score and baseline claims cost as covariates. Support for Hypothesis 3A.1 would be indicated by a statistically significant interaction with a negative coefficient. This would indicate that the average monthly medical claims cost decreased more or increased less over time for participants in the respective LM intervention modality compared to non-participants in the mail-based LM intervention, controlling for the baseline claims cost and propensity score.

Hypothesis 3A.2. This hypothesis was examined using the results from Hypothesis 3A.1, which represent the incremental change in monthly medical claims costs compared to non-participants, as the program benefits in the NPV and ROI calculations. The incremental program costs for the respective modality compared to non-participants were then used as the cost side in the NPV and ROI calculations. Since those that participated in the LM program also completed the HRA, the incremental cost was simply calculated by excluding the costs of the HRA from the

LM program costs. Support for Hypothesis 3A.2 would be indicated by a positive NPV and an ROI greater than one.

Hypothesis 3B.1. This hypothesis was examined using a GEE model using a gamma distribution, identity link function, AR(1) working correlation matrix, and the interaction of modality (1 = telephone or Internet LM, 0 = reference group = mail LM) and time as the parameter of interest. The model also included time and modality as the other independent variables as well as propensity score and baseline claims cost as covariates. Support for Hypothesis 3B.1 would be indicated by a statistically significant interaction with a negative coefficient. This would indicate that the average monthly medical claims cost decreased more or increased less over time for participants in the telephone or Internet LM intervention compared to participants in the mail-based LM intervention, controlling for the baseline claims cost and propensity score.

Hypothesis 3B.2. This hypothesis was examined using the results from Hypothesis 3B.1, which represent the incremental change in monthly medical claims costs for those in the telephone or Internet LM intervention compared to participants in the mail-based LM intervention, as the program benefits in the NPV and ROI calculations. The incremental program costs for the telephone or Internet LM intervention compared to mail-based participants were then used as the cost side in the NPV and ROI calculations. This incremental cost was simply calculated by subtracting the costs of the mail-based program from the telephone or Internet LM program costs. Support for Hypothesis 3B.2 would be indicated by a positive NPV and an ROI greater than one for the telephone or Internet LM intervention compared to the mail-based intervention.

Hypothesis 3C.1. This hypothesis was examined using a GEE model using a gamma distribution, identity link function, AR(1) working correlation matrix, and the interaction of modality (1 = telephone LM, 0 = reference group = Internet LM) and time as the parameter of interest. The model also included time and modality as the other independent variables as well as propensity score and baseline claims cost as covariates. Support for Hypothesis 3C.1 would be indicated by a lack of a statistically significant interaction. This would indicate that there was no difference in the average monthly medical claims cost for participants in the telephone or Internet LM intervention, controlling for the baseline claims cost and propensity score.

Hypothesis 3C.2. This hypothesis was examined using the results from Hypothesis 3C.1, which represent the incremental change in monthly medical claims costs for those in the telephone LM intervention compared to participants in the Internet LM intervention, as the program benefits in the NPV and ROI calculations. The incremental program costs for the telephone LM intervention compared to Internet participants were then used as the cost side in the NPV and ROI calculations. This incremental cost was simply calculated by subtracting the costs of the Internet-based program from the telephone LM program costs. Support for Hypothesis 3C.2 would be indicated by a NPV of zero and an ROI of one for the telephone LM intervention.

Hypothesis 3D.1. This hypothesis was examined using a GEE model using a gamma distribution, identity link function, AR(1) working correlation matrix, and the interaction of modality (1 = completed, 0 = reference group = discontinued) and time as the parameter of interest. The model also included time and completion status as the other independent variables as well as propensity score and baseline claims cost as covariates. Support for Hypothesis 3D.1 would be indicated by a statistically significant interaction with a negative coefficient. This

would indicate that the average monthly medical claims cost decreased more or increased less over time for those who complete the LM program compared to those who discontinue the LM intervention, controlling for the baseline claims cost and propensity score.

Hypothesis 3D.2. This hypothesis was examined using the results from Hypothesis 3D.1, which represent the incremental change in monthly medical claims costs for those who completed the LM intervention compared to participants who discontinued the LM intervention, as the program benefits in the NPV and ROI calculations. The incremental program costs for those who completed the LM intervention compared to participants who discontinued the program were then used as the cost side in the NPV and ROI calculations. This incremental cost was simply calculated by subtracting the costs of the participants who discontinued the program from the cost of those who completed the LM program. Support for Hypothesis 3D.2 would be indicated by a positive NPV and an ROI greater than one for those who completed the LM intervention compared to those who discontinued the LM intervention.

Sensitivity Analyses

Excluding those with no high risk at baseline. The above hypotheses from all three AIMs were also tested excluding those with no high risks identified in the baseline HRA but otherwise using the same methods. Although the original analyses included risk status (i.e., the number of high risks on the baseline HRA) as a covariate in the propensity score calculation, this approach was taken to exclude those who were not targeted by the program (i.e., those with no high risk at baseline).

By program topic. The above hypotheses were also tested within program topic areas where the sample size was sufficient according to power analyses. Table 3.2 in conjunction with the power analyses indicate that all of the above analyses could not be conducted for all of the

topic areas. In fact, the sample sizes for the blood pressure and cholesterol topic areas were too small to conduct any of the above analyses; additionally, none of the topic areas were large enough to test any of the hypotheses included in AIM 3. With regards to AIMs 1 and 2, the categorical risk factors, which were primarily the proximal risk factors, could only be tested within the topic of weight management and only for those comparisons that included the telephone modality within that topic. The ANCOVA models that could be conducted by topic area are indicated in Table 3.4.

Table 3.1

Health Risk Assessment and Lifestyle Management Intervention Components

Program	Eligibility	Program Description
Health Risk Assessment	Medical Plan: Self-insured plan participants	6th grade reading level Online and paper Mail, onsite, internet Spanish and English For each of the top health risks identified by employees during the survey, feedback and helpful resources were provided, including references to the organization's health management activities, programs and incentives. The information is tailored to the employee's risk level, health and disease status, stage of change, levels of motivation and confidence, and any barriers to change.
Next Steps	Must have one high risk factor from HRA Full-time employees (no dependents) Medical Plan: Self-insured plan participants	Topic Areas: Back, Exercise, Eating, Stress, Smoking, Weight, Cholesterol, Blood Pressure All Programs aim to: set goals (short- and long-term), identify barriers, build skills for overcoming barriers, make progress on new behaviors, strategize self-rewards, and stay motivated. Modality & Program Description Phone 5 one-on-one calls with a Health Coach over a 6-8 month period Topic Areas: all of the above Create personal action guide Mail 6 mailings over span of 6 months for all topic areas Topic Areas: all of the above Personalized Welcome and Program Review Ongoing personalized letters, educational brochures and booklets Online 6 week online program Topic Areas: nutrition, exercise, stress, tobacco, and weight control Personalized Healthy Living Programs via the Internet 6 comprehensive modules

Table 3.2

Lifestyle Management Participation by Topic

	Mail		Internet		Telephone		Total
	N	%	N	%	N	%	
Physical Activity	13	6.3%	43	16.7%	31	5.1%	87
Back care	83	40.1%	--	--	58	9.5%	141
Blood pressure	8	3.9%	--	--	19	3.1%	27
Cholesterol	3	1.4%	--	--	20	3.3%	23
Nutrition	9	4.3%	28	10.9%	63	10.3%	100
Smoking cessation	31	15.0%	45	17.4%	66	10.8%	142
Stress management	18	8.7%	44	17.1%	52	8.5%	114
Weight management	42	20.3%	98	38.0%	303	49.5%	443
Total	207		258		612		1077

Table 3.3
Cost Inventory

Cost Category	Cost Item	Source	Year 2007					
			Cost / unit	Unit	# of Units	Total	# of Parts	Total PP
Lifestyle Management Program Fees	Telephone Internet Mail	Vendor						
Incentive Costs	Points for registration Points for completion	Vendor						
Consulting Fees	Hours on strategic design and program implementation	Consultant						
Administrative Fees	Implementation of data feed layout Data feeds from HM vendors	Vendor invoices						

Note. "Parts" indicates participants

Table 3.4

ANCOVA Models Conducted by Lifestyle Management Topic

	Mail v Non	Internet v Non	Telephone v Non	Internet or Telephone v Mail	Telephone v Mail	All Modalities	Telephone Status
Physical Activity		X	X	X	X	X	
Back care	X		X	X	X	X	X
Blood pressure		N/A					
Cholesterol							
Nutrition		X	X	X	X	X	X
Smoking cessation	X	X	X	X	X	X	X
Stress management		X	X	X	X	X	
Weight management	X	X	X	X	X	X	X

Note. "v" indicates versus, "non" indicates non-participant; "N/A" indicates that these topics were not available via that modality

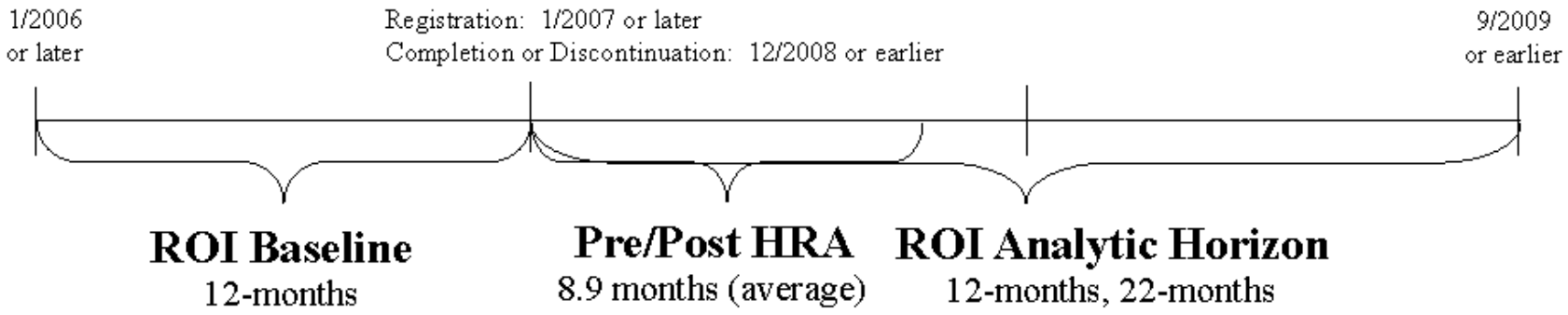

Figure 3.1. Study timeline

Inputs/ Resources	Activities	Outputs‡	Outcomes† Proximal	Distal	Impact
Program coordinator	Promote program‡	Readiness to change identified	↓Behavioral Risk	↓ Biometrics	Financial Δs:
HRAs	Implement program‡	Goals set	- Diet	- Weight	- ↓claims costs
LM interventions*	Engage employees in program**	Barriers identified	- Back care	- BMI	- Positive ROI
Incentives		Increased skills for overcoming barriers, administering self-reward, and staying motivated	- Alcohol use	- Blood pressure	
Communications			- Physical activity	- Cholesterol	
Consulting fees			- Tobacco use	- Triglycerides	
Administrative fees		Positive decisional balance (perceived benefits outweigh barriers)	- Stress	- Blood glucose	
				↓Depression risk	
		Increased levels of self-efficacy to make and maintain health behavior changes			
		Increased levels of perceived susceptibility and severity			

Figure 3.3. Logic model

Note. "Δ" indicates changes; "↓" indicates decreased; * Interventions were delivered by telephone, mail, or Internet and topics include: back care, exercise, eating, stress, smoking, weight, cholesterol, blood pressure ; ** Only available measure is employee participation and program status. No other measures of dose received were available.; ‡ No available measures for dose delivered, fidelity, or program promotion; † Available measures for behavioral and depression changes were risk level for each of these behaviors, biometric changes were values and some risk levels, and financial changes were medical claims and program cost.

	Stages of Change				
	Precontemplation	Contemplation	Preparation	Action	Maintenance
Processes of Change	Consciousness raising Dramatic relief Environmental reevaluation	Self-reevaluation	Self-liberation	Contingency management Helping relationship Counterconditioning Stimulus control	

Figure 3.2. Transtheoretical model

CHAPTER 4 – RESULTS

Sample Selection

The sample was selected (Figure 4.1) according to the eligibility criteria described in the methods section. Furthermore, the sample was composed of those with pre and post HRA data. It was not possible to include all participants, including those without pre and post HRA because it required the imputation of over 50% of the data, including binary risk data for which imputation at this level of missing has been shown to be unreliable (Scheffer, 2002).

Demographics and medical plan eligibility variables were examined for difference across groups at each step of the sample selection process. There were significant differences between those in the self-insured medical plans and those not in the self-insured medical plans across all demographic variables (Table 4.1). The next step of the sample selection process selected those that were at least 18 years of age, and since only 35 people were dropped from the sample, inferential statistics could not be calculated. There were 2,685 women who were dropped from the sample because they were pregnant during the study period and they differed from those who remained in the sample in terms of medical plan type; furthermore, they were younger, made less salary, and were less tenured (Table 4.2).

Those who participated in the HRA (n = 25,839) were significantly different than those who did not participate in the HRA (n = 77,788) during the 2007 to 2008 period on many of the demographic variables (Table 4.3). Specifically, HRA participants were more female, younger, more tenured, paid higher, more likely to have BCBS AL than BCBS NC as their medical carrier, less likely to be in the copay or self-funded HMO compared to the Ohio copay 500

medical plan, more likely to be in the Kentucky copay 500 compared to the Ohio copay 500 medical plan, less likely to be in transportation or operations compared to other positions, and more likely to be form the Midwestern or Northeastern compared to the Western part of the United States, There were also differences between HRA participants who had pre and post HRAs (n = 3,962), which were used to test the hypotheses in AIMS 1 and 2, and who did not have pre and post HRAs (n = 21,877) (Table 4.4). Specifically, pre and post HRA participants were more female, younger, more tenured, paid higher, less likely to be in the copay 500 or copay 750 compared to the Ohio copay 500 medical plan, more likely to be in the copay or self-funded HMO compared to the Ohio copay 500 medical plan, less likely to be in transportation or operations compared to management or sales positions, and less likely to be form the Southern compared to the Western part of the United States. Those who participated in multiple modalities were similar to participants in a single modality, with the exception that those who participated in multiple modalities were 1.7 years less tenured ($p < .0001$) and more likely to have Aetna as their medical carrier compared to BCBS NC ($p = .0056$) (Table 4.5). Additionally, those who participated in the program multiple times within the same modality were similar to those who only participated in the program a single time, except that those who only participated in the program a single time were compensated more than those who participated in the program multiple times ($\beta = \$4{,}221.90$, $p = .0039$) (Table 4.6).

After selecting the sample there were 2,505 non-participants and 1,077 participants (mail = 207, Internet = 258, telephone = 612) for the sample testing hypothesis in AIMS 1 and 2. The sample with 75% of their medical claims data used to fulfill AIM 3 had 1,486 non-participants and 666 participants (mail = 132, Internet = 160, telephone = 374).

Demographics and Medical Plan Eligibility for Selected Sample

The demographic analysis compared participants to non-participants and participants across the modalities. When comparing participants to non-participants (Table 4.7), participants were significantly more likely to be female (OR = 1.77, $p < .0001$) and were 1.1 years older ($p = .0268$) and with a lower income by $2,346 ($p = .0143$). The distribution across regions of the country, plan type, medical carrier, and tenure did not significantly differ.

When examining demographics across the participation modalities (Table 4.8), we see that Internet participants were significantly less likely to be from the South compared to the West (OR = 0.68, $p = .0280$), have their medical benefits through Aetna (OR = 0.78, $p = .0481$) and make $3,630 more in salary ($p = .0003$) when compared to mail participants. Telephone participants, when compared to mail participants, were more likely to be female (OR = 1.60, $p = .0058$) and significantly less likely to have their medical benefit through Aetna (OR = 0.79, $p = .0326$). Furthermore, they were 2.2 years older ($p = .0033$) and made $3,742 more in salary ($p = .0002$) than mail participants. There are no significant differences when comparing Internet to telephone participants (Table 4.9).

Power

Per the previously described sample flow chart, this sample was large enough to sufficiently power the statistical test. This study consists of GLM logistic regression and repeated measures (AIMS 1 and 2) as well as GEEs (AIM 3). The sample size sufficiently powered the GLM logistic regressions, because this regression calls for a sample size of 300 when assuming a power of .80, $\alpha = .05$, and a baseline probability of .5 (Hsieh, Block, & Larsen, 1998). Additionally, the sample size sufficiently powered the GLM repeated measures analysis, because this calls for a sample size of 60 when assuming a power of .80, $\alpha = .05$, two groups

with two repeated measures, and a low correlation (.05) among repeated measures (Cohen, 1988). Tables indicate that for GEEs with continuous measures as dependent variables, a sample size of 417 was necessary to achieve a power of .80 given $\alpha = .05$, dependent missing data, 30% of the sample was in the treatment group, and the working correlation matrix was AR(1) (Jung & Ahn, 2003).

AIM 1: Impact of Modality on Health Risks

Hypothesis 1A.1

In general, there was partial support for the hypotheses that the participant groups within each modality would demonstrate a higher likelihood of decreased risk of proximal risk factors compared to similar LM non-participants. Specifically the following proximal risk factors: poor nutrition, poor back care, excessive alcohol use, physical inactivity, tobacco use, elevated stress, and depression.

Mail

The mail participants had significantly higher likelihood of decreasing their risk for the following risk factors when compared to non-participants: poor back care (OR = 1.60, $p < .0001$), physical inactivity (OR = 1.36, $p = .0125$), and high stress (OR = 1.37, $p = .0064$) (Table 4.10).

Internet

As illustrated in Table 4.11, the Internet participants had significantly higher likelihood of decreasing their risk compared to non-participants for the following risk factors: physical inactivity (OR = 1.52, $p < .0001$) and high stress (OR = 1.39, $p = .0010$). Although there were no significant changes in poor back care risk, it should be highlighted that the Internet modality did not cover the topic of back care.

Telephone

The telephone participants had significantly more positive changes compared to non-participants in all proximal risk factors except eating risk, which demonstrated a positive, though not significant, trend (OR = 1.18, p = .0575). The magnitude of these changes is outlined in Table 4.12.

Hypothesis 1A.2

There was very little support for the general hypothesis that the participant groups within each modality would demonstrate a higher likelihood of decreased risk or more positive changes, defined as less increase or more decrease, in distal risk factors compared to similar LM non-participants. These distal risk factors include: weight, BMI, blood pressure, cholesterol, triglycerides, and blood glucose.

Mail

There were few significant changes in distal measures (Table 4.10). The only positive significant changes for those mail participants versus non-participants were for blood pressure risk (OR = 1.32, p = .0059) and diastolic blood pressure (β = -1.79 mmHg, p = .0499). The only significant negative change when comparing any modality to non-participants was the increase of glucose levels (β = 10.41 mg/dL, p = .0259) among mail participants compared to non-participants.

Internet

The Internet participants were significantly more likely to reduce only one distal risk factor, overweight or obesity risk (OR = 1.34, p = .00211), when compared to non-participants (Table 4.11).

Telephone

The only significant change in distal outcomes indicated that telephone participants were 1.20 times as likely to reduce their blood pressure risk ($p = .0100$) compared to non-participants (Table 4.12). There was a trend, though not significant, for telephone participants to reduce their triglyceride levels ($\beta = -11.6$ mg/dL, $p = .0660$) when compared to non-participants.

Hypothesis 1B.1

Generally, the combined telephone or Internet participants performed similar to the mail participants; thus, providing no support for the hypothesis that those who participate in the telephone- or Internet-based LM program would demonstrate a higher likelihood of decreased risk of proximal risk factors compared to similar participants in the mail-based LM program (Table 4.13). The only significant difference was for changes in poor back care risk, in which the telephone or Internet participants were 0.78 times as likely to reduce their risk compared to the mail participants ($p = .0054$). Though there was a significant decrease in poor back care risk among the telephone participants compared to non-participants, this effect was less than among mail participants and the effect was diluted by the Internet participants since the Internet modality did not have a back care module. There were no other significant changes for any of the proximal risk factors.

Hypothesis 1B.2

Similar to the proximal outcomes, the telephone or Internet participants performed about the same as the mail participants (Table 4.13). There were no significant differences between the groups in terms of changes in distal outcomes.

Hypothesis 1C.1

When comparing the telephone participants to the Internet participants, there was general support for the hypothesis that there would be no differences between similar participants in the telephone- or Internet-based LM program on changes in proximal risk factors (Table 4.14). The only notable exception to this was a significant reductions in depression risks (OR = 1.30, p = .0394) in favor of the telephone participants. Telephone participants also had a significant reduction in poor back care risk (OR = 1.33, p = .0051) when compared to Internet participants. Though this is counter to the hypothesis, it is somewhat unfair to make the comparison since the Internet program did not have a back care module.

Hypothesis 1C.2

When comparing the telephone participants to the Internet participants, there was general support for the hypothesis that there would be no differences between similar participants in the telephone- or Internet-based LM program on changes in distal risk factors (Table 4.14). The only exception is the significant reduction in blood pressure risk (OR = 1.32, p = .0337) for telephone participants compared to Internet participants.

All Modalities

When combining all modalities and comparing participants to non-participants, participants had significantly more positive changes compared to non-participants across all proximal risk factors except for excessive alcohol consumption risk (OR = 1.21, p = .1027). The magnitude of these changes is outlined in Table 4.15.

When comparing the LM participants to the non-participants, the only significant change in distal outcomes indicated that participants were 1.15 times as likely to reduce their blood pressure risk (p = .0150) compared to non-participants (Table 4.15). There was a trend, though

not significant, for participants to reduce their odds for being overweight or obese (OR = 1.15, p = .0953) and for their glucose levels to increase (β = 4.46 mg/dL, p = .0546) when compared to non-participants.

Sensitivity Analyses

Exclusion of Participants without a High Risk

All of these analyses were conducted excluding those without a single high risk factor from the participant and non-participant groups since the LM program was designed to target those with high risks, though anyone could participate. The propensity score included risk level, defined as the number of baseline risks, as a predictor of group membership; therefore, the results from this sensitivity analysis did not produce significantly different results.

Nutrition Program

The sample size was too small to test the proximal and distal high risk outcomes for any of the comparisons involving only the participants in the nutrition topic area; as well as the mail modality versus non-participants, Internet or telephone versus mail participants, and telephone status comparisons of the distal outcomes. There were no significant differences for the remaining comparisons of participants to non-participants or comparisons of modalities (Tables 4.16-4.19).

Physical Activity Program

The sample size was too small to test the proximal and distal high risk outcomes for any of the comparisons involving only the participants in the physical activity topic area as well as the mail modality versus non-participants and telephone program status comparisons of the distal outcomes. There were no significant differences for the remaining comparisons of participants to non-participants or comparisons of modalities (Tables 4.20-4.24).

W*eight Management Program*

The sample size was large enough to test the proximal and distal risk factors for all comparisons including the telephone modality, but was only able to test the continuous distal outcomes for the remaining comparisons. When comparing LM participants (i.e., combining all modalities) to non-participants, there were significant decreases in three proximal high risk factors: poor back care (OR = 1.24, p = .0011), physical inactivity (OR = 1.41, p = <.0001), and depression (OR = 1.26, p = .0040) (Table 4.25). There were also significant decreases in weight risk (OR = 1.71, p = <.0001) and body mass index (β = -0.32, p = .0142), which was accompanied by a trend, though not significant, for a decrease in weight (β = -1.54 lbs, p = .0527). When compared to non-participants, the mail participants demonstrated a significant reduction in LDL levels (β = -19.67 mg/dL, p = .0265) and a trend, though not significant, for reduction in weight and diastolic blood pressure (Table 4.26). Analyses could not be run on categorical risk factors. The Internet participants significantly reduced their triglyceride level (β = -33.22, p = .0204) but had no other significant changes in distal risk factors; however, analyses could not be run on categorical risk factors (Table 4.27). Telephone participants significantly reduced their four proximal risk factors: poor back care, physical inactivity, elevated stress, and depression (Table 4.28). They were also successful at significantly reducing their risk of overweight or obesity, and blood pressure risk; however, there was a significant increase in diastolic blood pressure and blood glucose levels. The Internet or telephone participants did not significantly reduce any outcomes and they were significantly less likely to reduce their poor nutrition risk when compared to mail participants (Table 4.29). When compared to the Internet modality, the telephone participants significantly reduced four proximal outcomes measures: poor back care (OR = 1.51, p = .0190), physical inactivity (OR = 1.83, p = .0251), elevated stress

(OR = 1.93, p = .0338), and depression (OR = 1.64, p = .0302). However, the telephone participants were significantly less likely to reduce their overweight or obesity risk (OR = 0.69, p = .0212) compared to Internet participants (Table 4.30). The telephone participants who completed the intervention did not significantly reduce any of their continuous distal outcomes measures when compared to those that discontinued the telephone program (Table 4.31).

Smoking Cessation Program

The sample size was too small to test the proximal and distal high risk outcomes for any of the comparisons involving only the participants in the smoking cessation topic area as well as the telephone participant status comparison. The LM participants (i.e., combining all modalities) did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants, in fact, there was a significant increase in blood glucose levels (β = 14.34mg/dL, p = .0096) (Table 4.32). The mail participants did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants (Table 4.33). The Internet participants did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants, but there was a significant increase in triglyceride levels (β = 43.75 mg/dL, p = .0374) (Table 4.34). The telephone participants did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants (Table 4.35). The Internet or telephone participants did not significantly reduce any of their continuous distal outcomes measures when compared to mail participants (Table 4.36). The telephone participants did not significantly reduce any of their continuous distal outcomes measures when compared to Internet participants (Table 4.37).

Stress Management Program

The sample size was too small to test the proximal and distal high risk outcomes for any of the comparisons involving only the participants in the stress management topic area as well as the mail modality versus non-participants and telephone program status comparisons of the distal outcomes. The LM participants (i.e., combining all modalities) did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants (Table 4.38). The Internet participants did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants (Table 4.39). The telephone participants did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants (Table 4.40). The Internet or telephone participants significantly reduced their systolic blood pressure levels (β = -17.13 mg/dL, p = .0021) when compared to mail participants, but that was the only significant change (Table 4.41). The telephone participants did not significantly reduce any of their continuous distal outcomes measures when compared to Internet participants (Table 4.42).

Back Care Program

The sample size was too small to test the proximal and distal high risk outcomes for any of the comparisons involving only the participants in the back care topic area as well as the comparison on telephone status and for any comparisons involving the Internet modality since there was no back care program available for that topic area. The LM participants (i.e., combining the telephone and mail modalities) did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants, in fact, there was a significant increase in blood glucose levels (β = 14.34mg/dL, p = .0096) (Table 4.43). The mail participants did not significantly reduce any of their continuous distal outcomes measures when

compared to non-participants; however, there was a significant increase in HDL levels (β = 10.07 mg/dL, p = .0402) (Table 4.44). The telephone participants did not significantly reduce any of their continuous distal outcomes measures when compared to non-participants (Table 4.45). The telephone participants did significantly reduce their HDL levels (β = -17.32 mg/dL, p = .0253) but increased their BMI (β = 0.55, p = .0467) when compared to mail participants (Table 4.46).

AIM 2: Impact of Dose Received on Health Risks

Hypothesis 2A

Unfortunately, the sample size for those who discontinued the program (N = 1) in the mail modality and the sample size for those who completed the program (N = 6) in the Internet modality were too small to statistically test the hypotheses. Within the telephone modality, there was no support that those who completed the LM program would demonstrate a higher likelihood of decreased risk of proximal risk factors compared to similar participants who discontinued the LM program (Table 4.47). There was a 2.4% decrease in excessive alcohol consumption risk among those who discontinued the program and no change among those who completed the program, though this difference could not be tested statistically due to quasi-separation of data points on the difference score variable.

Hypothesis 2B

As mentioned previously, the sample size for those who discontinued the program (N = 1) in the mail modality and the sample size for those who completed the program (N = 6) in the Internet modality were too small to statistically test the hypothesis. There was limited support that those who completed the telephonic LM program would demonstrate a higher likelihood of decreased risk of distal risk factors compared to similar participants who discontinued the

telephonic LM program (Table 4.47). Specifically, those who completed the program were also more likely to reduce their blood pressure risk (OR = 1.38, p = .0415) than those who discontinued the program, and there was a trend, though not significant, for the reduction of systolic (β = -4.86 mmHg, p = .0517) and diastolic (β = -2.80 mmHg, p = .0545) blood pressure levels. There was an additional trend for those who completed the program to reduce their triglyceride level more (β = -31.29 mg/dL, p = .0821) than those who discontinued the program.

AIM 3: Return on Investment

Program Costs

The completed program cost inventory is provided in Table 4.48 and the program cost calculations by modality are provided in Table 4.49. All costs are expressed in 2007 dollars. The administration costs consisted of $455.00 quarterly data feeds and an $11,000.00 LM data implementation fee, which includes the initial data feed. The annual equivalent cost for the implementation fee was $2,463.55 given that there is no resale value; the useful life of the programming is about 5 years, a 6% discount rate, and payment in advance. New implementations must occur as technology or customer needs require. These changes could include the selection of a new LM vendor, new data from the LM vendor to be imported into the data warehouse, or a change in the platform used by the data warehouse vendor. For a progressive employer such as this one when it comes to health management, a 5 year useful life of the currently implemented data feed layout is average per the data warehouse vendor's experience. The implementation fee was billed on June 30, 2007; therefore, only half of the annual equivalent cost was included in the 2007 administration cost.

The employer's consultants spent 14.3 hours working on the LM program. At an average of $195.92 per hour, that was a total of $2,802.34. The incentive costs, as mentioned previously,

were equivalent to $5.00 for registering for the program and $5.00 for completing the program. Finally, the vendor costs for the LM program were $65.00 for mail participant per program, $45.00 for Internet participant per program, and $195.00 per telephone participant per program.

The total discounted incremental cost for the LM program compared to non-participants was $74.92 per participant (PP) for the mail program, $50.71 PP for the Internet program, $197.00 PP for the telephone program, and $137.66 PP for all modalities combined. The incremental cost of the telephone or Internet modality over the mail modality, which weights the telephone or internet modality group by participation, was $79.61 PP. The telephone modality was $146.29 PP more costly than the Internet modality. The last incremental cost that was calculated with which to test the hypotheses was the comparison of the completed telephone program to the discontinued telephone program. The cost of the telephone program for those who completed the program was actually $4.86 more costly for those who discontinued the program.

Outliers

The application of the trimming method resulted in the following trimming threshold levels: $43,624.00 for inpatient, $5,268.74 for outpatient, $698.38 for professional services, and $483.14 for pharmacy. This translated into capping seven monthly inpatient costs as high as $238,800.00, 197 monthly outpatient costs as high as $55,252.90, 1358 monthly professional services costs as high as $41,473.08, and 1100 monthly pharmacy costs as high as $92,182.97.

Hypothesis 3A.1

Mail

There was no significant change in medical claims cost over time for the mail participants compared to non-participants at 12 months ($p = .2440$) or 22 months ($p = .4193$) (Table 4.50).

Excluding outliers, defined by the trimming method, from the analysis did not result in any significant changes to the results (Table 4.51).

Internet

There was no significant change in medical claims cost over time for the Internet participants compared to non-participants at 12 months (p = .8717) or 22 months (p = .3800). Excluding outliers from the analysis did result in any significant changes to the results.

Telephone

Participants in the telephone-based LM intervention significantly reduced their medical claims cost by $9.01 PP (p = .0307) at 12-months compared to non-participants, controlling for propensity score and baseline claims cost. At 22 months from the program start date this effect disappeared (p = .5547). When removing outliers via the trimming method, savings by the telephone participants reduced to $7.70 PP (p = .0118) and there was still no effect at 22 months (p = .3655).

Hypothesis 3A.2

Mail

There was no support for the hypothesis that the benefits from the mail program would be greater than the program costs (Table 4.52). Statistically speaking, the results from *Hypothesis 3A.1* indicated that there was no change in the medical claims cost comparing mail participants to non-participants. Thus, the program costs were greater than the program benefits.

Internet

There was no support for the hypothesis that the benefits from the Internet program be greater than the program costs. Statistically speaking, the results from *Hypothesis 3A.1* indicated

that there was no change in the medical claims cost comparing Internet participants to non-participants. Thus, the program costs were greater than the program benefits.

Telephone

There was no support for the hypothesis that the benefits from the telephone program would be greater than the program costs. Comparing the discounted benefits of the program in terms of medical claims costs ($8.76 PPPM, $105.07 PP) over a 12 month horizon to the discounted cost of the program ($197.00 PP) for telephone participants, the ROI was less than one ($0.53:$1.00) and the NPV was negative, a cost of $91.93 PP. When excluding outliers, the ROI decreased to $0.46:$1.00 and the NPV decreased to -$107.29.

Hypothesis 3B.1

Those in the telephone or Internet LM program experienced a significant reduction in medical claims costs compared to mail participants (β = -$9.23, p = .0301) at 12 months from the start of the program; however, that effect had dissipated by 22 months (p = .1681). When removing outliers, via the trimming method, there was no longer a significant effect at 12 months (p = .0713) and still no effect at 22 months.

Hypothesis 3B.2

There was support for the hypothesis that benefits from the telephone or Internet program would be greater than the program costs over a 12 month horizon when compared to the mail-based LM program. Comparing the incremental discounted benefits of the program in terms of medical claims costs ($8.96 PPPM, $107.55 PP) over a 12 month horizon to the incremental discounted cost of the program ($79.61 PP) for telephone- or Internet participants, the ROI was greater than one ($1.35:$1.00). The NPV was positive, a savings of $27.94 PP over a 12 month horizon. When excluding outliers, there was no longer a statistically significant program benefit;

therefore, there was no ROI and the NPV was negative in the amount equivalent to the present value of the cost of the program.

Hypothesis 3C.1

There was support for the hypothesis that there would be no difference in medical claims costs over time between participants in the telephone-based LM program and the Internet-based program. There were no significant changes in medical claims costs for those that participated in the telephone program compared to the Internet participants over either the 12 or 22 month horizon. Removing the outliers from the analysis provided a trend (β = -$7.88, p = .0713), though not significant, at 12 months; however, this trend was not present at 22 months (p = .1191).

Hypothesis 3C.2

There was support for the hypothesis that benefits from the telephone program would be greater than the program costs when compared to the Internet-based LM program. Statistically speaking, the results from *Hypothesis 3A.1* indicated that there was no change in the medical claims cost comparing telephone participants to Internet participants. Thus, the program costs were greater than the program benefits.

Hypothesis 3D.1

As mentioned previously, the sample sizes for those who discontinued the program (N = 1) in the mail modality and the sample size for those who completed the program (N = 6) in the Internet modality were too small to statistically test the hypothesis. There was no support for the hypothesis that within the telephone modality, those who completed the LM program would demonstrate greater reductions in medical claims costs compared to those who discontinued the program. Those that completed the telephone program experienced no significant change in their

medical costs compared to those that discontinued the program at 12 or 22 months. However, over a 22 month horizon there was a non-significant trend for those who completed the program to increase their costs (β = $6.34, p = .0983). Removing outliers did not notably change these results, though it did strengthen the trend for the increase of medical claims cost at 22 months (β = $7.52, p = .0701), though this trend still did not reach statistical significance.

Hypothesis 3D.2

There was no support for the hypothesis that within the telephone modality, those who completed the LM program would demonstrate benefits from the program that would outweigh the cost of the program when compared to those who discontinued the program. Statistically speaking, the results from *Hypothesis 3A.1* indicated that there was no change in the medical claims cost comparing telephone participants who completed the program to those that discontinued it. Thus, the program costs were greater than the program benefits.

All Modalities

When combining all modalities, there was no significant change in medical claims cost over time for the participants compared to non-participants at 12 months (p = .2675) or 22 months (p = .3638). Excluding outliers, defined by the trimming method, from the analysis did not result in any significant changes to the results.

There was no support for the hypothesis that the benefits from the overall LM program would be greater than the program costs. Statistically speaking, the results from Tables 4.50 and 4.51 indicated that there was no change in the medical claims cost comparing participants to non-participants. Thus, the program costs were greater than the program benefits.

Table 4.1

Demographic Characteristics by Insurance Funding Type

			N	Prevalence/ Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	Not SI Plan (ref)	479,168	16.2%	-1.512	0.22	0.02	4943.94	<0.0001
		SI Plan	106,347	13.6%					
	Northeast	Not SI Plan (ref)	479,168	18.7%	0.275	1.32	0.02	319.12	<0.0001
		SI Plan	106,347	3.8%					
	South	Not SI Plan (ref)	479,168	46.7%	1.019	2.77	0.01	6879.96	<0.0001
		SI Plan	106,347	69.7%					
	West (ref)	Not SI Plan (ref)	479,168	18.3%	--	--	--	--	--
		SI Plan	106,347	13.0%					
Job Type	Other	Not SI Plan (ref)	479,168	42.6%	-0.331	0.72	0.01	977.81	<0.0001
		SI Plan	106,347	21.5%					
	Executives, Regional, Directors, Management	Not SI Plan (ref)	479,168	7.2%	-0.209	0.81	0.02	190.12	<0.0001
		SI Plan	106,347	20.4%					
	Sales, Merchandising	Not SI Plan (ref)	479,168	8.3%	0.365	1.44	0.01	788.37	<0.0001
		SI Plan	106,347	19.6%					
	Store, Transportation, Operations (ref)	Not SI Plan (ref)	479,168	41.9%	--	--	--	--	--
		SI Plan	106,347	38.4%					
Gender	Female	Not SI Plan (ref)	479,168	38.6%	0.189	1.21	0.01	456.31	<0.0001
		SI Plan	106,347	38.5%					
	Male (ref)	Not SI Plan (ref)	479,168	61.4%	--	--	--	--	--
		SI Plan	106,347	61.5%					
Age	Mean	Not SI Plan (ref)	479,168	34.4	0.004	1.00	0.00	162.31	<0.0001
		SI Plan	106,347	39.0					
	Std Deviation	Not SI Plan (ref)	479,168	14.5					
		SI Plan	106,347	13.0					
Salary	Mean	Not SI Plan (ref)	479,168	$19,775.85	0.000	1.00	0.00	19173.76	<0.0001

		SI Plan	106,347	$31,148.62					
		Not SI Plan (ref)	479,168	$11,347.21					
	Std Deviation	SI Plan	106,347	$16,898.68					
Tenure	Mean	Not SI Plan (ref)	479,168	1.79	0.092	1.10	0.00	3712.20	<0.0001
		SI Plan	106,347	3.91					
		Not SI Plan (ref)	479,168	2.52					
	Std Deviation	SI Plan	106,347	3.88					

Note. "OR" indicates odds ratio*;* "Std Err" indicates standard error; "SI" indicates self-insured; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.2

Demographic Characteristics by Pregnancy Status

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	Pregnant (ref)	2,685	14.6%	0.167	1.18	0.12	1.82	0.1771
		Not Pregnant	103,627	13.6%					
	Northeast	Pregnant (ref)	2,685	3.6%	-0.057	0.95	0.09	0.37	0.5410
		Not Pregnant	103,627	3.8%					
	South	Pregnant (ref)	2,685	69.7%	-0.047	0.95	0.06	0.54	0.4632
		Not Pregnant	103,627	69.7%					
	West (ref)	Pregnant (ref)	2,685	12.2%	--	--	--	--	--
		Not Pregnant	103,627	13.0%					
Job Type	Other	Pregnant (ref)	2,685	22.3%	-0.008	0.99	0.05	0.02	0.8847
		Not Pregnant	103,627	21.5%					
	Executives, Regional, Directors, Management	Pregnant (ref)	2,685	20.0%	-0.051	0.95	0.06	0.66	0.4162
		Not Pregnant	103,627	20.5%					
	Sales, Merchandising	Pregnant (ref)	2,685	17.3%	-0.095	0.91	0.06	2.61	0.1060
		Not Pregnant	103,627	19.7%					
	Store, Transportation, Operations (ref)	Pregnant (ref)	2,685	40.4%	--	--	--	--	--
		Not Pregnant	103,627	38.4%					
Plan Type	Copay	Pregnant (ref)	2,685	18.8%	0.228	1.26	0.12	3.43	0.0639
		Not Pregnant	103,627	16.8%					
	Copay 500	Pregnant (ref)	2,685	58.1%	0.072	1.07	0.11	0.40	0.5283
		Not Pregnant	103,627	57.2%					
	Copay 750	Pregnant (ref)	2,685	12.2%	0.460	1.58	0.12	13.85	0.0002
		Not Pregnant	103,627	15.8%					
	HMO-Self Funded Kentucky Copay 500	Pregnant (ref)	2,685	2.5%	0.540	1.72	0.15	12.16	0.0005
		Not Pregnant	103,627	2.8%					
		Pregnant (ref)	2,685	2.6%	0.112	1.12	0.17	0.44	0.5087

		Not Pregnant	103,627	2.4%					
		Pregnant (ref)	2,685	5.3%	--	--	--	--	--
	Ohio Copay 500 (ref)	Not Pregnant	103,627	4.5%					
Age		Pregnant (ref)	2,685	27.7					
	Mean	Not Pregnant	103,627	39.3	0.123	1.13	0.00	1487.56	<0.0001
		Pregnant (ref)	2,685	5.1					
	SE	Not Pregnant	103,627	13.0					
Salary		Pregnant (ref)	2,685	$28,920.39					
	Mean	Not Pregnant	103,627	$31,207.00	0.000	1.00	0.00	13.43	0.0002
		Pregnant (ref)	2,685	$12,232.33					
	SE	Not Pregnant	103,627	$16,999.85					
Tenure		Pregnant (ref)	2,685	3.75					
	Mean	Not Pregnant	103,627	3.92	-0.122	0.88	0.01	336.06	<0.0001
		Pregnant (ref)	2,685	2.91					
	SE	Not Pregnant	103,627	3.91					

Note. "OR" indicates odds ratio*;* "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.3

Demographic Characteristics by HRA 2007 or 2008 Participation

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	HRA Non-part. (ref)	77,788	12.1%	-0.194	0.82	0.05	15.79	0.0001
		HRA Part. ('07/'08)	25,839	17.9%					
	Northeast	HRA Non-part. (ref)	77,788	3.6%	0.503	1.65	0.03	215.24	<0.0001
		HRA Part. ('07/'08)	25,839	4.3%					
	South	HRA Non-part. (ref)	77,788	71.0%	0.035	1.04	0.02	2.03	0.1538
		HRA Part. ('07/'08)	25,839	65.9%					
	West (ref)	HRA Non-part. (ref)	77,788	13.4%	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	11.9%					
Job Type	Other	HRA Non-part. (ref)	77,788	23.0%	-0.054	0.95	0.02	5.85	0.0156
		HRA Part. ('07/'08)	25,839	17.1%					
	Executives, Regional, Directors, Management	HRA Non-part. (ref)	77,788	18.1%	0.323	1.38	0.02	196.85	<0.0001
		HRA Part. ('07/'08)	25,839	27.7%					
	Sales, Merchandising	HRA Non-part. (ref)	77,788	18.5%	0.421	1.52	0.02	385.63	<0.0001
		HRA Part. ('07/'08)	25,839	23.0%					
	Store, Transportation, Operations (ref)	HRA Non-part. (ref)	77,788	40.4%	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	32.3%					
Plan Type	Copay	HRA Non-part. (ref)	77,788	17.5%	-0.263	0.77	0.05	31.49	<0.0001
		HRA Part. ('07/'08)	25,839	14.5%					
	Copay 500	HRA Non-part. (ref)	77,788	56.3%	0.060	1.06	0.04	2.08	0.1488
		HRA Part. ('07/'08)	25,839	59.8%					
	Copay 750	HRA Non-part. (ref)	77,788	16.2%	-0.003	1.00	0.04	0.00	0.9519
		HRA Part. ('07/'08)	25,839	14.7%					
	HMO-Self Funded	HRA Non-part. (ref)	77,788	2.9%	-0.375	0.69	0.06	41.74	<0.0001
		HRA Part. ('07/'08)	25,839	2.3%					

	Kentucky Copay 500	HRA Non-part. (ref)	77,788	2.3%	0.144	1.15	0.06	5.31	0.0211
		HRA Part. ('07/'08)	25,839	2.7%					
	Ohio Copay 500 (ref)	HRA Non-part. (ref)	77,788	4.0%	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	6.0%					
Medical Carrier	AETNA	HRA Non-part. (ref)	77,788	0.0%	23.929	24.677E-9	1137.84	0.00	0.9832
		HRA Part. ('07/'08)	25,839	4.9%					
	BCBSAL	HRA Non-part. (ref)	77,788	99.8%	1.500	4.48	0.59	6.36	0.0117
		HRA Part. ('07/'08)	25,839	95.1%					
	BCBSNC (ref)	HRA Non-part. (ref)	77,788	0.2%	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	0.0%					
Gender	Female	HRA Non-part. (ref)	77,788	34.3%	0.595	1.81	0.02	1343.07	<0.0001
		HRA Part. ('07/'08)	25,839	44.8%					
	Male (ref)	HRA Non-part. (ref)	77,788	65.7%	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	55.2%					
Age	Mean	HRA Non-part. (ref)	77,788	39.3	-0.008	0.99	0.00	148.79	<0.0001
		HRA Part. ('07/'08)	25,839	39.2					
	SE	HRA Non-part. (ref)	77,788	13.4	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	11.9					
Salary	Mean	HRA Non-part. (ref)	77,788	$29,802.28	0.000	1.00	0.00	826.55	<0.0001
		HRA Part. ('07/'08)	25,839	$35,332.02					
	SE	HRA Non-part. (ref)	77,788	$14,946.78	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	$21,419.67					
Tenure	Mean	HRA Non-part. (ref)	77,788	3.63	0.048	1.05	0.00	492.35	<0.0001
		HRA Part. ('07/'08)	25,839	4.78					
	SE	HRA Non-part. (ref)	77,788	3.76	--	--	--	--	--
		HRA Part. ('07/'08)	25,839	4.20					

Note. "OR" indicates odds ratio*;* "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.4

Demographic Characteristics by Pre and Post HRA Participation

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	No Pre/Post HRA (ref)	21,877	13.2%	-0.130	0.88	0.16	0.67	0.4139
		Pre/Post HRA	3,962	21.8%					
	Northeast	No Pre/Post HRA (ref)	21,877	3.5%	0.112	1.12	0.09	1.51	0.2198
		Pre/Post HRA	3,962	11.6%					
	South	No Pre/Post HRA (ref)	21,877	70.2%	-0.248	0.78	0.06	15.97	0.0001
		Pre/Post HRA	3,962	55.9%					
	West (ref)	No Pre/Post HRA (ref)	21,877	13.1%	--	--	--	--	--
		Pre/Post HRA	3,962	10.7%					
Job Type	Other	No Pre/Post HRA (ref)	21,877	21.8%	0.066	1.07	0.06	1.19	0.2756
		Pre/Post HRA	3,962	15.8%					
	Executives, Regional, Directors, Management	No Pre/Post HRA (ref)	21,877	20.0%	0.511	1.67	0.06	74.92	<0.0001
		Pre/Post HRA	3,962	30.1%					
	Sales, Merchandising	No Pre/Post HRA (ref)	21,877	19.5%	0.551	1.74	0.06	96.20	<0.0001
		Pre/Post HRA	3,962	22.8%					
	Store, Transportation, Operations (ref)	No Pre/Post HRA (ref)	21,877	38.7%	--	--	--	--	--
		Pre/Post HRA	3,962	31.3%					
Plan Type	Copay	No Pre/Post HRA (ref)	21,877	15.1%	2.973	19.56	0.18	276.01	<0.0001
		Pre/Post HRA	3,962	58.5%					
	Copay 500	No Pre/Post HRA (ref)	21,877	58.4%	0.693	2.00	0.18	15.08	0.0001
		Pre/Post HRA	3,962	26.8%					
	Copay 750	No Pre/Post HRA (ref)	21,877	16.2%	0.749	2.11	0.19	15.71	0.0001
		Pre/Post HRA	3,962	6.0%					
	HMO-Self Funded	No Pre/Post HRA (ref)	21,877	2.6%	2.883	17.87	0.18	271.01	<0.0001

	Kentucky Copay 500	Pre/Post HRA	3,962	7.1%	0.261	1.30	0.29	0.83	0.3610
		No Pre/Post HRA (ref)	21,877	2.5%					
		Pre/Post HRA	3,962	0.5%					
	Ohio Copay 500 (ref)	No Pre/Post HRA (ref)	21,877	4.7%	--	--	--	--	--
		Pre/Post HRA	3,962	1.0%					
Gender	Female	No Pre/Post HRA (ref)	21,877	36.4%	0.693	2.00	0.04	279.14	<0.0001
		Pre/Post HRA	3,962	50.1%					
	Male (ref)	No Pre/Post HRA (ref)	21,877	63.6%	--	--	--	--	--
		Pre/Post HRA	3,962	49.9%					
Medical Carrier	AETNA	No Pre/Post HRA (ref)	21,877	0.0%	24.897	64.97E-9	1069.32	0.00	0.9814
		Pre/Post HRA	3,962	31.9%					
	BCBSAL	No Pre/Post HRA (ref)	21,877	99.8%	0.410	1.51	0.60	0.47	0.4948
		Pre/Post HRA	3,962	68.1%					
	BCBSNC (ref)	No Pre/Post HRA (ref)	21,877	0.1%	--	--	--	--	--
		Pre/Post HRA	3,962	0.1%					
Age	Mean	No Pre/Post HRA (ref)	21,877	39.3	-0.008	0.99	0.00	20.57	<0.0001
		Pre/Post HRA	3,962	37.3					
	SE	No Pre/Post HRA (ref)	21,877	13.1	--	--	--	--	--
		Pre/Post HRA	3,962	11.3					
Salary	Mean	No Pre/Post HRA (ref)	21,877	$31,082.17	0.000	1.00	0.00	269.56	<0.0001
		Pre/Post HRA	3,962	$34,272.96					
	SE	No Pre/Post HRA (ref)	21,877	$16,971.30	--	--	--	--	--
		Pre/Post HRA	3,962	$17,409.99					
Tenure	Mean	No Pre/Post HRA (ref)	21,877	3.91	0.050	1.05	0.01	83.13	<0.0001
		Pre/Post HRA	3,962	4.17					
	SE	No Pre/Post HRA (ref)	21,877	3.90	--	--	--	--	--
		Pre/Post HRA	3,962	3.97					

Note. "OR" indicates odds ratio; "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.5

Demographic Characteristics by Multiple or Single LM Modality Participation

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	Multiple Modality (ref)	285	24.5%	-0.617	0.54	0.44	1.94	0.1639
		Single Modality	1,166	18.9%					
	Northeast	Multiple Modality (ref)	285	11.3%	0.078	1.08	0.31	0.06	0.8005
		Single Modality	1,166	3.2%					
	South	Multiple Modality (ref)	285	53.9%	0.234	1.26	0.24	0.94	0.3333
		Single Modality	1,166	69.0%					
	West (ref)	Multiple Modality (ref)	285	10.4%	--	--	--	--	--
		Single Modality	1,166	8.9%					
Job Type	Other	Multiple Modality (ref)	285	15.0%	-0.033	0.97	0.23	0.02	0.8834
		Single Modality	1,166	13.9%					
	Executives, Regional, Directors, Management	Multiple Modality (ref)	285	28.8%	0.367	1.44	0.20	3.41	0.0649
		Single Modality	1,166	32.1%					
	Sales, Merchandising	Multiple Modality (ref)	285	24.5%	0.209	1.23	0.19	1.21	0.2713
		Single Modality	1,166	24.6%					
	Store, Transportation, Operations (ref)	Multiple Modality (ref)	285	31.7%	--	--	--	--	--
		Single Modality	1,166	29.3%					
Plan Type	Copay	Multiple Modality (ref)	285	59.4%	0.595	1.81	1.11	0.29	0.5914
		Single Modality	1,166	67.7%					
	Copay 500	Multiple Modality (ref)	285	25.6%	0.271	1.31	1.11	0.06	0.8079
		Single Modality	1,166	18.9%					
	Copay 750	Multiple Modality (ref)	285	5.9%	0.282	1.33	1.14	0.06	0.8050
		Single Modality	1,166	4.6%					
	HMO-Self Funded	Multiple Modality (ref)	285	8.1%	0.252	1.29	1.11	0.05	0.8203
		Single Modality	1,166	7.7%					
	Kentucky Copay 500	Multiple Modality (ref)	285	0.3%	1.487	4.43	1.44	1.06	0.3032

		Single Modality	1,166	0.7%					
		Multiple Modality (ref)	285	6.0%	--	--	--	--	--
	Ohio Copay 500 (ref)	Single Modality	1,166	0.4%					
Gender		Multiple Modality (ref)	285	59.5%	0.078	1.08	0.15	0.28	0.5984
	Female	Single Modality	1,166	60.7%					
		Multiple Modality (ref)	285	40.5%	--	--	--	--	--
	Male (ref)	Single Modality	1,166	39.3%					
Medical Carrier		Multiple Modality (ref)	285	34.2%	0.298	1.35	0.11	7.68	0.0056
	AETNA	Single Modality	1,166	18.9%					
		Multiple Modality (ref)	285	65.8%	--	--	--	--	--
	BCBSAL (ref)	Single Modality	1,166	80.7%					
Age		Multiple Modality (ref)	285	37.9	0.005	1.00	0.01	0.51	0.4735
	Mean	Single Modality	1,166	39.2					
		Multiple Modality (ref)	285	10.7	--	--	--	--	--
	SE	Single Modality	1,166	10.1					
Salary		Multiple Modality (ref)	285	$32,723.56	0.000	1.00	0.00	1.84	0.1747
	Mean	Single Modality	1,166	$33,261.00					
		Multiple Modality (ref)	285	$14,812.15	--	--	--	--	--
	SE	Single Modality	1,166	$13,389.48					
Tenure		Multiple Modality (ref)	285	4.11	0.081	1.08	0.02	21.70	<0.0001
	Mean	Single Modality	1,166	5.82					
		Multiple Modality (ref)	285	3.89	--	--	--	--	--
	SE	Single Modality	1,166	4.07					

Note. "OR" indicates odds ratio*;* "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.6

Demographic Characteristics by Multiple or Single LM Program Participation

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	Multiple Programs (ref)	89	11.6%	0.135	1.14	0.53	0.07	0.7970
		Single Programs	1,077	11.2%					
	Northeast	Multiple Programs (ref)	89	19.8%	0.330	1.39	0.47	0.49	0.4844
		Single Programs	1,077	24.8%					
	South	Multiple Programs (ref)	89	57.0%	0.212	1.24	0.37	0.32	0.5688
		Single Programs	1,077	53.7%					
	West (ref)	Multiple Programs (ref)	89	11.6%	--	--	--	--	--
		Single Programs	1,077	10.3%					
Job Type	Other	Multiple Programs (ref)	89	17.6%	-0.091	0.91	0.34	0.07	0.7863
		Single Programs	1,077	14.8%					
	Executives, Regional, Directors, Management	Multiple Programs (ref)	89	24.2%	-0.315	0.73	0.35	0.82	0.3649
		Single Programs	1,077	29.3%					
	Sales, Merchandising	Multiple Programs (ref)	89	25.3%	0.054	1.06	0.30	0.03	0.8597
		Single Programs	1,077	24.3%					
	Store, Transportation, Operations (ref)	Multiple Programs (ref)	89	33.0%	--	--	--	--	--
		Single Programs	1,077	31.6%					
Plan Type	Copay	Multiple Programs (ref)	89	62.6%	-18.405	0.00	16345.32	0.00	0.9991
		Single Programs	1,077	59.1%					
	Copay 500	Multiple Programs (ref)	89	25.3%	-18.281	0.00	16345.32	0.00	0.9991
		Single Programs	1,077	25.6%					
	Copay 750	Multiple Programs (ref)	89	8.8%	-18.864	0.00	16345.32	0.00	0.9991
		Single Programs	1,077	5.7%					
	HMO-Self Funded	Multiple Programs (ref)	89	3.3%	-17.547	0.00	16345.32	0.00	0.9991
		Single Programs	1,077	8.6%					
	Kentucky Copay 500	Multiple Programs (ref)	89	0.0%	0.735	2.09	28366.63	0.00	1.0000

		Single Programs	1,077	0.3%					
		Multiple Programs (ref)	89	0.0%	--	--	--	--	--
	Ohio Copay 500 (ref)	Single Programs	1,077	0.6%					
Gender		Multiple Programs (ref)	89	40.7%	0.238	1.27	0.24	0.99	0.3199
	Female	Single Programs	1,077	40.6%					
		Multiple Programs (ref)	89	59.3%	--	--	--	--	--
	Male (ref)	Single Programs	1,077	59.4%					
Medical Carrier		Multiple Programs (ref)	89	37.4%	-0.033	0.97	0.32	0.01	0.9170
	AETNA	Single Programs	1,077	33.8%					
		Multiple Programs (ref)	89	62.6%	--	--	--	--	--
	BCBSAL (ref)	Single Programs	1,077	66.2%					
Age		Multiple Programs (ref)	89	38.5	-0.010	0.99	0.01	0.91	0.3394
	Mean	Single Programs	1,077	37.8					
		Multiple Programs (ref)	89	10.3	--	--	--	--	--
	SE	Single Programs	1,077	10.7					
Salary		Multiple Programs (ref)	89	$28,825.87	0.000	1.00	0.00	8.31	0.0039
	Mean	Single Programs	1,077	$33,047.16					
		Multiple Programs (ref)	89	$7,257.51	--	--	--	--	--
	SE	Single Programs	1,077	$15,243.40					
Tenure		Multiple Programs (ref)	89	4.20	-0.038	0.96	0.03	1.51	0.2189
	Mean	Single Programs	1,077	4.10					
		Multiple Programs (ref)	89	3.94	--	--	--	--	--
	SE	Single Programs	1,077	3.88					

Note. "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.7

Demographic Characteristic by Participant and Non-participant Groups

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	**p-value**
Region	Midwest	Non-Participant (ref)	2,505	21.3%	0.09	1.09	0.08	1.20	0.2307
		Participant	1,077	24.7%					
	Northeast	Non-Participant (ref)	2,505	12.9%	-0.10	0.91	0.10	-0.99	0.3201
		Participant	1,077	11.5%					
	South	Non-Participant (ref)	2,505	55.0%	0.01	1.01	0.06	0.14	0.8919
		Participant	1,077	53.6%					
	West (ref)	Non-Participant (ref)	2,505	10.9%	--	--	--	--	--
		Participant	1,077	10.2%					
Job Type	Other	Non-Participant (ref)	2,505	16.4%	-0.12	0.88	0.08	-1.64	0.1006
		Participant	1,077	15.0%					
	Executives, Regional, Directors, Management	Non-Participant (ref)	2,505	30.4%	0.08	1.09	0.07	1.23	0.2192
		Participant	1,077	28.9%					
	Sales, Merchandising	Non-Participant (ref)	2,505	21.7%	0.12	1.12	0.07	1.79	0.0734
		Participant	1,077	24.4%					
	Store, Transportation, Operations (ref)	Non-Participant (ref)	2,505	31.5%	--	--	--	--	--
		Participant	1,077	31.7%					
Plan Type	Copay 500 or 750	Non-Participant (ref)	2,505	93.4%	-0.09	0.92	0.08	-1.12	0.2637
		Participant	1,077	91.9%					
	HMO (ref)	Non-Participant (ref)	2,505	6.6%	--	--	--	--	--
		Participant	1,077	8.2%					
Gender	Female	Non-Participant (ref)	2,505	44.6%	0.57	1.77	0.07	7.66	<.0001
		Participant	1,077	59.4%					
	Male (ref)	Non-Participant (ref)	2,505	55.5%	--	--	--	--	--
		Participant	1,077	40.6%					

Medical Carrier	AETNA	Non-Participant (ref)	2,505	32.3%	0.05	1.05	0.05	1.09	0.2756
		Participant	1,077	34.1%					
	BCBSAL (ref)	Non-Participant (ref)	2,505	67.7%	--	--	--	--	--
		Participant	1,077	65.9%					
Age	Mean	Non-Participant (ref)	2,505	36.8	0.007	1.007	0.00	2.21	0.0268
		Participant	1,077	37.9					
	SE	Non-Participant (ref)	2,505	0.2					
		Participant	1,077	0.3					
Salary	Mean	Non-Participant (ref)	2,505	$35,095.00	0.000	1.000	0.00	-2.45	0.0143
		Participant	1,077	$32,749.00					
	SE	Non-Participant (ref)	2,505	$352.87					
		Participant	1,077	$517.19					
Tenure	Mean	Non-Participant (ref)	2,505	4.01	0.007	1.007	0.01	0.74	0.4587
		Participant	1,077	4.11					
	SE	Non-Participant (ref)	2,505	0.08					
		Participant	1,077	0.12					

Note. "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.8

Demographic Characteristic by Participation Modality Compared to Mail Participants

			N	Prevalence / Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	Mail (ref)	207	29%	--	--	--	--	--
		Internet	258	27.2%	-0.049	0.95	0.20	-0.24	0.8104
		Telephone	612	22.4%	-0.315	0.73	0.18	-1.74	0.0829
	Northeast	Mail (ref)	207	9%	--	--	--	--	--
		Internet	258	13.7%	0.434	1.54	0.26	1.66	0.0966
		Telephone	612	11.2%	0.255	1.29	0.24	1.07	0.2833
	South	Mail (ref)	207	55%	--	--	--	--	--
		Internet	258	49.8%	-0.387	0.68	0.18	-2.20	0.0280
		Telephone	612	54.7%	-0.213	0.81	0.16	-1.35	0.1767
	West (ref)	Mail (ref)	207	6%					
		Internet	258	9.4%	--	--	--	--	--
		Telephone	612	11.7%					
Job Type	Other	Mail (ref)	207	15.9%	--	--	--	--	--
		Internet	258	15.2%	0.063	1.07	0.20	0.32	0.7481
		Telephone	612	14.7%	0.026	1.03	0.17	0.15	0.8802
	Executives, Regional, Directors, Management	Mail (ref)	207	27.1%	--	--	--	--	--
		Internet	258	26.4%	-0.349	0.71	0.19	-1.84	0.0662
		Telephone	612	30.5%	-0.142	0.87	0.16	-0.87	0.3866
	Sales, Merchandising	Mail (ref)	207	23.2%	--	--	--	--	--
		Internet	258	23.8%	0.115	1.12	0.17	0.68	0.4981
		Telephone	612	25.0%	0.129	1.14	0.15	0.88	0.3808
	Store, Transportation, Operations (ref)	Mail (ref)	207	33.8%					
		Internet	258	34.7%	--	--	--	--	--
		Telephone	612	29.9%					
Plan Type	Copay 500 or 750	Mail (ref)	207	91%	--	--	--	--	--

		Internet	258	93.5%	0.340	1.41	0.21	1.65	0.0985
		Telephone	612	91.4%	0.066	1.07	0.17	0.38	0.7021
		Mail (ref)	207	9%					
	HMO (ref)	Internet	258	6.5%	--	--	--	--	--
		Telephone	612	8.7%					
		Mail (ref)	207	56%	--	--	--	--	--
	Female	Internet	258	56.7%	0.210	1.23	0.20	1.07	0.2842
Gender		Telephone	612	61.6%	0.472	1.60	0.17	2.76	0.0058
		Mail (ref)	207	44%					
	Male (ref)	Internet	258	43.3%	--	--	--	--	--
		Telephone	612	0.0%					
		Mail (ref)	207	40%	--	--	--	--	--
	AETNA	Internet	258	36.5%	-0.248	0.78	0.13	-1.98	0.0481
Medical Carrier		Telephone	612	31.5%	-0.233	0.79	0.11	-2.13	0.0329
		Mail (ref)	207	60.4%					
	BCBSAL (ref)	Internet	258	63.5%	--	--	--	--	--
		Telephone	612	68.5%					
		Mail (ref)	207	36.3	--	--	--	--	--
	Mean	Internet	258	37.6	0.014	1.28	0.01	1.51	0.1319
Age		Telephone	612	38.5	0.024	2.24	0.01	2.94	0.0033
		Mail (ref)	207	0.7					
	SE	Internet	258	0.6	--	--	--	--	--
		Telephone	612	0.4					
		Mail (ref)	207	$29,698.00	--	--	--	--	--
	Mean	Internet	258	$33,328.00	0.000	$3,630.00	0.00	3.59	0.0003
Salary		Telephone	612	$33,440.00	0.000	$3,742.00	0.00	3.71	0.0002
		Mail (ref)	207	$1,027.65					
	SE	Internet	258	$888.36	--	--	--	--	--
		Telephone	612	$566.59					

Tenure	Mean	Mail (ref)	207	4.41	--	--	--	--	--
		Internet	258	4.17	-0.041	-0.25	0.03	-1.63	0.1027
		Telephone	612	3.99	-0.062	-0.42	0.02	-2.81	0.0050
	SE	Mail (ref)	207	0.27					
		Internet	258	0.23	--	--	--	--	--
		Telephone	612	0.15					

Note. "OR" indicates odds ratio*;* "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.9

Demographic Characteristic of Telephone Participants Compared to Internet Participants

			N	Prevalence/ Mean	Estimate	OR	Std Err	Wald χ^2	p-value
Region	Midwest	Internet (ref)	258	14%	-0.255	0.78	0.15	-1.68	0.0939
		Telephone	612	11%					
	Northeast	Internet (ref)	258	27%	-0.180	0.84	0.20	-0.92	0.3585
		Telephone	612	22%					
	South	Internet (ref)	258	50%	0.169	1.18	0.13	1.26	0.2096
		Telephone	612	55%					
	West (ref)	Internet (ref)	258	9%	--	--	--	--	--
		Telephone	612	12%					
Job Type	Other	Internet (ref)	258	15.2%	-0.059	0.94	0.15	-0.38	0.7014
		Telephone	612	14.7%					
	Executives, Regional, Directors, Management	Internet (ref)	258	26.4%	0.217	1.24	0.15	1.49	0.1367
		Telephone	612	30.5%					
	Sales, Merchandising	Internet (ref)	258	23.8%	0.022	1.02	0.13	0.16	0.8697
		Telephone	612	25.0%					
	Store, Transportation, Operations (ref)	Internet (ref)	258	34.7%	--	--	--	--	--
		Telephone	612	29.9%					
Plan Type	Copay 500 or 750	Internet (ref)	258	94%	-0.267	0.77	0.16	-1.63	0.1023
		Telephone	612	91%					
	HMO (ref)	Internet (ref)	258	7%	--	--	--	--	--
		Telephone	612	9%					
Gender	Female	Internet (ref)	258	57%	0.261	1.30	0.15	1.71	0.0877
		Telephone	612	62%					
	Male (ref)	Internet (ref)	258		--	--	--	--	--
		Telephone	612						
Medical Carrier	AETNA	Internet (ref)	258	0.3646	0.007	1.01	0.10	0.07	0.9469
		Telephone	612	0.3152					

	BCBSAL (ref)	Internet (ref)	258	0.6354	--	--	--	--	--
		Telephone	612	0.6848					
Age	Mean	Internet (ref)	258	37.6	0.010	0.952	0.01	1.44	0.1505
		Telephone	612	38.5					
	SE	Internet (ref)	258	0.6					
		Telephone	612	0.4					
Salary	Mean	Internet (ref)	258	$33,328.00	0.000	112.00	0.00	-0.25	0.8051
		Telephone	612	$33,440.00					
	SE	Internet (ref)	258	$928.52					
		Telephone	612	$592.16					
Tenure	Mean	Internet (ref)	258	4.17	-0.021	-0.17	0.02	-1.06	0.2877
		Telephone	612	3.99					
	SE	Internet (ref)	258	0.23					
		Telephone	612	0.15					

Note. "OR" indicates odds ratio*;* "Std Err" indicates standard error; "ref" indicates reference group; "Other" job types refer to Administrative, HR, Training, Customer Service, Accounting, Finance, Engineering, or Technical job types.

Table 4.10

Mail Modality versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ β	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk	Mail Part.	207	4%	0.05%	3%	0.03%	-1.4%	1.053	0.22	0.8288
	Non-Part.	2,505	4%	0.01%	3%	0.01%	-0.6%			
Poor Back Care Risk*	Mail Part.	207	75%	0.13%	56%	0.01%	-19.3%	1.599	32.27	<0.0001
	Non-Part.	2,505	38%	0.05%	38%	0.00%	0.0%			
Poor Nutrition Risk	Mail Part.	207	14%	0.13%	11%	0.15%	-3.4%	1.199	1.34	0.1796
	Non-Part.	2,505	10%	0.03%	9%	0.03%	-1.6%			
Physical Inactivity Risk	Mail Part.	207	16%	0.10%	14%	0.04%	-1.9%	1.364	2.50	0.0125
	Non-Part.	2,505	11%	0.02%	11%	0.01%	0.1%			
Tobacco Use Risk	Mail Part.	207	7%	0.12%	5%	0.17%	-1.4%	1.370	1.28	0.2005
	Non-Part.	2,505	2%	0.01%	2%	0.02%	-0.5%			
Elevated Stress Risk	Mail Part.	207	18%	0.19%	12%	0.02%	-6.3%	1.368	2.73	0.0064
	Non-Part.	2,505	13%	0.04%	12%	0.01%	-0.8%			
Depression Risk	Mail Part.	207	18%	0.18%	14%	0.17%	-4.8%	1.053	0.41	0.6839
	Non-Part.	2,505	15%	0.04%	13%	0.05%	-1.4%			
Distal Risk Factors										
Overweight or obesity Risk	Mail Part.	207	30%	0.01%	29%	0.08%	-1.0%	0.962	-0.20	0.8387
	Non-Part.	2,505	25%	0.00%	23%	0.02%	-1.3%			
Weight (lbs)	Mail Part.	207	186.7	2.95	185.9	2.96	-0.84	-0.826	-0.81	0.4163
	Non-Part.	2,505	181.4	0.85	181.4	0.85	-0.01			
Body Mass Index	Mail Part.	207	28.3	0.38	28.2	0.39	-0.10	-0.105	-0.62	0.5336
	Non-Part.	2,505	27.2	0.11	27.3	0.11	0.01			
High Blood Pressure (BP) Risk	Mail Part.	207	21%	0.01%	16%	0.05%	-5.3%	1.319	2.75	0.0059
	Non-Part.	2,505	13%	0.00%	13%	0.02%	0.0%			
Systolic BP (mmHg)	Mail Part.	207	124.3	1.03	125.8	1.00	1.46	1.225	0.90	0.3706
	Non-Part.	2,505	122.8	0.29	123.1	0.29	0.23			
Diastolic BP (mmHg)	Mail Part.	207	78.9	0.68	77.1	0.67	-1.81	-1.789	-1.96	0.0499
	Non-Part.	2,505	76.6	0.20	76.6	0.19	-0.02			

Glucose (mg/dL)	Mail Part.	207	100.7	3.43	108.9	2.92	8.17	10.408	2.23	0.0259
	Non-Part.	2,505	105.0	0.98	102.8	0.84	-2.24			
High Cholesterol Risk	Mail Part.	207	25%	0.12%	23%	0.24%	-2.3%	0.971	-0.31	0.7552
	Non-Part.	2,505	26%	0.03%	23%	0.02%	-3.0%			
Cholesterol (mg/dL)	Mail Part.	207	184.5	3.52	178.9	3.41	-5.58	-2.748	-0.56	0.5781
	Non-Part.	2,505	183.4	1.01	180.6	0.98	-2.83			
HDL (mg/dL)	Mail Part.	207	63.5	2.17	67.2	2.21	3.79	2.400	0.75	0.4523
	Non-Part.	2,505	64.6	0.62	66.0	0.63	1.39			
LDL (mg/dL)	Mail Part.	207	105.1	2.78	103.6	2.88	-1.57	-1.413	-0.34	0.7343
	Non-Part.	2,505	104.2	0.80	104.0	0.82	-0.16			
Triglycerides (mg/dL)	Mail Part.	207	129.2	6.35	139.9	7.19	10.68	2.386	0.24	0.8117
	Non-Part.	2,505	132.2	1.81	140.5	2.06	8.29			

Note. "Part." Indicates participant; "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets. "N/A" indicates not applicable due to a quasi-separation of data points with no participants in the completed group decreasing their excessive alcohol consumption risk.

Table 4.11

Internet Modality versus Non-participants

			PRE		POST					
	Participant Group	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk	Internet part.	258	3%	0.05%	4%	0.05%	0.8%	0.963	-0.16	0.8723
	Non-part.	2,505	4%	0.02%	3%	0.01%	-0.6%			
Poor Back Care Risk	Internet part.	258	48%	0.15%	45%	0.06%	-3.9%	1.030	0.31	0.7537
	Non-part.	2,505	38%	0.04%	38%	0.02%	0.0%			
Poor Nutrition Risk	Internet part.	258	16%	0.21%	16%	0.15%	-0.8%	1.113	0.84	0.4033
	Non-part.	2,505	10%	0.04%	9%	0.03%	-1.6%			
Physical Inactivity Risk	Internet part.	258	25%	0.29%	19%	0.15%	-6.3%	1.515	4.00	<.0001
	Non-part.	2,505	11%	0.05%	11%	0.03%	0.1%			
Tobacco Use Risk	Internet part.	258	4%	0.05%	2%	0.00%	-2.0%	1.253	0.92	0.3554
	Non-part.	2,505	2%	0.01%	2%	0.00%	-0.5%			
Elevated Stress Risk	Internet part.	258	28%	0.01%	20%	0.05%	-8.2%	1.386	3.30	0.0010
	Non-part.	2,505	13%	0.00%	12%	0.01%	-0.8%			
Depression Risk	Internet part.	258	17%	0.02%	16%	0.03%	-0.8%	1.024	0.20	0.8424
	Non-part.	2,505	15%	0.01%	13%	0.01%	-1.4%			
Distal Risk Factors										
Overweight or Obesity Risk	Internet part.	258	46%	0.07%	40%	0.00%	-5.9%	1.340	2.31	0.0211
	Non-part.	2,505	25%	0.01%	23%	0.00%	-1.3%			
Weight (lbs)	Internet part.	258	188.4	2.64	188.9	2.66	0.42	0.440	0.48	0.6300
	Non-part.	2,505	181.5	0.84	181.4	0.85	-0.02			
Body Mass Index	Internet part.	258	28.9	0.34	29.0	0.34	0.03	0.027	0.18	0.8567
	Non-part.	2,505	27.3	0.11	27.3	0.11	0.00			
Blood Pressure (BP) Risk	Internet part.	258	11%	0.05%	14%	0.01%	3.5%	0.898	-0.90	0.3656
	Non-part.	2,505	13%	0.02%	13%	0.00%	0.0%			
Systolic BP (mmHg)	Internet part.	258	123.4	0.92	122.0	0.89	-1.36	-1.591	-1.30	0.1942
	Non-part.	2,505	122.8	0.29	123.1	0.28	0.23			
Diastolic BP (mmHg)	Internet part.	258	76.4	0.60	76.1	0.61	-0.29	-0.264	-0.32	0.7495

	Non-part.	2,505	76.6	0.19	76.6	0.19	-0.02			
Glucose (mg/dL)	Internet part.	258	98.8	3.06	102.0	2.55	3.21	5.475	1.31	0.1895
	Non-part.	2,505	105.0	0.98	102.8	0.81	-2.26			
Cholesterol Risk	Internet part.	258	21%	0.04%	24%	0.20%	2.0%	0.866	-1.57	0.1165
	Non-part.	2,505	26%	0.01%	23%	0.04%	-3.0%			
Cholesterol (mg/dL)	Internet part.	258	179.7	3.15	178.4	3.06	-1.23	1.556	0.35	0.7272
	Non-part.	2,505	183.4	1.01	180.6	0.98	-2.79			
HDL (mg/dL)	Internet part.	258	65.0	1.95	68.9	1.98	3.91	2.521	0.87	0.3831
	Non-part.	2,505	64.6	0.62	66.0	0.63	1.39			
LDL (mg/dL)	Internet part.	258	101.9	2.51	103.9	2.57	2.09	2.310	0.62	0.5363
	Non-part.	2,505	104.3	0.80	104.0	0.82	-0.22			
Triglycerides (mg/dL)	Internet part.	258	142.7	5.81	144.9	6.40	2.19	-5.864	-0.64	0.5219
	Non-part.	2,505	132.3	1.86	140.4	2.05	8.05			

Note. "Part." Indicates participant; "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets. "N/A" indicates not applicable due to a quasi-separation of data points with no participants in the completed group decreasing their excessive alcohol consumption risk.

Table 4.12

Telephone Modality versus Non-participants

			PRE		POST					
	Participant Group	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk*	Telephone part.	612	5%	0.12%	3%	0.07%	-2.1%	1.365	5.50	0.0191
	Non-part.	2,505	4%	0.04%	3%	0.03%	-0.6%			
Poor Back Care Risk*	Telephone part.	612	67%	0.00%	55%	0.00%	-11.8%	1.348	27.95	<.0001
	Non-part.	2,505	38%	0.00%	38%	0.00%	0.0%			
Poor Nutrition Risk	Telephone part.	612	17%	0.49%	14%	0.46%	-2.3%	1.181	1.90	0.0575
	Non-part.	2,505	10%	0.20%	9%	0.18%	-1.6%			
Physical Inactivity Risk	Telephone part.	612	23%	0.11%	21%	0.21%	-1.8%	1.492	5.36	<.0001
	Non-part.	2,505	11%	0.03%	11%	0.07%	0.1%			
Tobacco Use Risk	Telephone part.	612	5%	0.05%	3%	0.03%	-2.3%	1.557	2.93	0.0034
	Non-part.	2,505	2%	0.01%	2%	0.01%	-0.5%			
Elevated Stress Risk	Telephone part.	612	27%	0.04%	25%	0.00%	-2.3%	1.396	4.69	<.0001
	Non-part.	2,505	13%	0.01%	12%	0.00%	-0.8%			
Depression Risk	Telephone part.	612	31%	0.02%	28%	0.04%	-2.8%	1.300	3.68	0.0002
	Non-part.	2,505	15%	0.01%	13%	0.01%	-1.4%			
Distal Risk Factors										
Overweight or Obesity Risk	Telephone part.	612	59%	0.05%	58%	0.03%	-1.8%	1.153	1.44	0.149
	Non-part.	2,505	25%	0.02%	23%	0.01%	-1.3%			
Weight (lbs)*	Telephone part.	612	205.4	1.76	205.5	1.77	0.05	0.092	0.13	0.8938
	Non-part.	2,505	181.5	0.87	181.4	0.87	-0.04			
Body Mass Index	Telephone part.	612	32.2	0.23	32.1	0.24	-0.07	-0.071	-0.63	0.5305
	Non-part.	2,505	27.3	0.12	27.3	0.12	0.00			
Blood Pressure (BP) Risk	Telephone part.	612	82%	0.09%	83%	0.01%	1.0%	1.195	2.58	0.0100
	Non-part.	2,505	87%	0.03%	87%	0.00%	0.0%			
Systolic BP (mmHg)	Telephone part.	612	124.6	0.61	123.7	0.58	-0.93	-1.184	-1.36	0.1727
	Non-part.	2,505	122.8	0.30	123.0	0.29	0.26			
Diastolic BP (mmHg)	Telephone part.	612	77.4	0.40	76.9	0.40	-0.52	-0.498	-0.86	0.3908

	Non-part.	2,505	76.6	0.20	76.6	0.20	-0.02			
Glucose (mg/dL)	Telephone part.	612	104.6	2.01	104.8	1.70	0.19	2.524	0.86	0.3911
	Non-part.	2,505	105.0	0.99	102.7	0.83	-2.34			
Cholesterol Risk	Telephone part.	612	76%	0.00%	77%	0.16%	0.2%	0.953	-0.82	0.4104
	Non-part.	2,505	74%	0.00%	77%	0.04%	3.0%			
Cholesterol (mg/dL)	Telephone part.	612	180.8	2.03	177.7	1.95	-3.15	-0.281	-0.09	0.9263
	Non-part.	2,505	183.4	1.00	180.5	0.96	-2.87			
HDL (mg/dL)	Telephone part.	612	63.3	1.27	64.4	1.28	1.11	-0.367	-0.18	0.854
	Non-part.	2,505	64.6	0.62	66.0	0.63	1.48			
LDL (mg/dL)	Telephone part.	612	106.8	1.65	103.6	1.69	-3.18	-2.954	-1.13	0.2596
	Non-part.	2,505	104.3	0.81	104.0	0.83	-0.23			
Triglycerides (mg/dL)	Telephone part.	612	141.0	3.79	137.4	4.15	-3.50	-11.602	-1.84	0.0660
	Non-part.	2,505	132.3	1.88	140.4	2.05	8.10			

Note. "Part." Indicates participant; "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets. "N/A" indicates not applicable due to a quasi-separation of data points with no participants in the completed group decreasing their excessive alcohol consumption risk.

Table 4.13

Internet or telephone modality versus mail modality

			PRE		POST					
	Participation Modality	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk	Tele. or Internet	870	5%	0.05%	3%	0.01%	-1.3%	1.178	0.66	0.5121
	Mail	207	4%	0.09%	3%	0.01%	-1.4%			
Poor Back Care Risk	Tele. or Internet	870	61%	0.06%	52%	0.09%	-9.4%	0.781	-2.78	0.0054
	Mail	207	75%	0.10%	56%	0.21%	-19.3%			
Poor Nutrition Risk	Tele. or Internet	870	16%	0.37%	15%	0.36%	-1.8%	0.911	-0.65	0.5175
	Mail	207	14%	0.79%	11%	0.68%	-3.4%			
Physical Inactivity Risk	Tele. or Internet	870	24%	0.00%	21%	0.00%	-3.1%	1.130	0.97	0.3336
	Mail	207	16%	0.01%	14%	0.00%	-1.9%			
Tobacco Use Risk	Tele. or Internet	870	5%	0.03%	2%	0.03%	-2.2%	1.053	0.21	0.8368
	Mail	207	7%	0.09%	5%	0.12%	-1.4%			
Elevated Stress Risk	Tele. or Internet	870	27%	0.07%	23%	0.04%	-4.0%	1.087	0.71	0.4805
	Mail	207	18%	0.12%	12%	0.05%	-6.3%			
Depression Risk	Tele. or Internet	870	27%	0.22%	25%	0.20%	-2.2%	1.204	1.39	0.1651
	Mail	207	18%	0.39%	14%	0.29%	-4.8%			
Distal Risk Factors										
Overweight or Obesity Risk	Tele. or Internet	870	55%	0.12%	52%	0.06%	-3.0%	1.322	1.43	0.1531
	Mail	207	30%	0.20%	29%	0.10%	-1.0%			
Weight (lbs)	Tele. or Internet	870	200.5	1.59	200.6	1.59	0.11	0.711	0.54	0.5871
	Mail	207	184.4	3.28	183.8	3.28	-0.60			
Body Mass Index	Tele. or Internet	870	31.2	0.23	31.2	0.23	-0.04	0.018	0.08	0.9325
	Mail	207	28.3	0.47	28.2	0.47	-0.06			
Blood Pressure (BP) Risk*	Tele. or Internet	870	16%	0.10%	16%	0.09%	0.3%	0.826	3.14	0.0765
	Mail	207	21%	0.25%	16%	0.19%	-5.3%			
Systolic BP (mmHg)	Tele. or Internet	870	123.9	0.54	123.0	0.52	-0.85	-2.436	-1.49	0.1353
	Mail	207	124.1	1.12	125.7	1.08	1.59			
Diastolic BP (mmHg)	Tele. or Internet	870	77.0	0.35	76.6	0.36	-0.40	1.575	1.49	0.1375

	Mail	207	79.1	0.72	77.2	0.75	-1.98			
Glucose (mg/dL)	Tele. or Internet	870	102.9	1.38	103.4	1.53	0.51	-8.005	-1.67	0.0945
	Mail	207	100.9	2.87	109.4	3.15	8.51			
Cholesterol Risk	Tele. or Internet	870	23%	0.10%	23%	0.11%	0.4%	0.939	-0.61	0.5416
	Mail	207	25%	0.21%	23%	0.05%	-2.4%			
Cholesterol (mg/dL)	Tele. or Internet	870	180.3	1.62	177.9	1.60	-2.33	4.543	0.90	0.3703
	Mail	207	185.3	3.33	178.4	3.28	-6.87			
HDL (mg/dL)	Tele. or Internet	870	63.9	1.06	66.0	1.11	2.05	-1.958	-0.57	0.5657
	Mail	207	63.3	2.17	67.3	2.29	4.01			
LDL (mg/dL)	Tele. or Internet	870	105.5	1.41	103.6	1.45	-1.84	-0.671	-0.14	0.8866
	Mail	207	104.6	2.88	103.4	3.01	-1.17			
Triglycerides (mg/dL)	Tele. or Internet	870	140.7	3.40	139.3	3.67	-1.33	-11.682	-1.00	0.3182
	Mail	207	131.0	7.05	141.3	7.60	10.35			

Note. “Tele.” Indicates telephone; "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets. “N/A” indicates not applicable due to a quasi-separation of data points with no participants in the completed group decreasing their excessive alcohol consumption risk.

Table 4.14

Telephone Modality versus Internet Modality

			PRE		POST					
	Participation Modality	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk	Telephone	258	5%	0.10%	3%	0.01%	-2.1%	1.433	1.41	0.1584
	Internet	612	3%	0.10%	4%	0.03%	0.8%			
Poor Back Care Risk	Telephone	258	67%	0.14%	55%	0.14%	-11.8%	1.333	2.80	0.0051
	Internet	612	48%	0.26%	45%	0.23%	-3.9%			
Poor Nutrition Risk	Telephone	258	17%	0.26%	14%	0.22%	-2.3%	1.009	0.06	0.9509
	Internet	612	16%	0.41%	16%	0.38%	-0.8%			
Physical Inactivity Risk	Telephone	258	23%	0.03%	21%	0.02%	-1.8%	1.003	0.02	0.9810
	Internet	612	25%	0.04%	19%	0.03%	-6.3%			
Tobacco Use Risk	Telephone	258	5%	0.07%	3%	0.04%	-2.3%	1.296	1.01	0.3147
	Internet	612	4%	0.08%	2%	0.04%	-2.0%			
Elevated Stress Risk*	Telephone	258	27%	0.05%	25%	0.01%	-2.3%	1.014	0.02	0.8961
	Internet	612	28%	0.08%	20%	0.02%	-8.2%			
Depression Risk	Telephone	258	31%	0.12%	28%	0.08%	-2.8%	1.300	2.06	0.0394
	Internet	612	17%	0.13%	16%	0.09%	-0.8%			
Distal Risk Factors										
Overweight or Obesity Risk*	Telephone	258	59%	0.15%	58%	0.06%	-1.8%	0.844	1.36	0.2444
	Internet	612	46%	0.24%	40%	0.09%	-5.9%			
Weight (lbs)	Telephone	258	205.2	1.88	205.3	1.90	0.07	-0.186	-0.14	0.8868
	Internet	612	188.4	2.91	188.7	2.94	0.26			
Body Mass Index	Telephone	258	32.2	0.27	32.1	0.27	-0.06	-0.075	-0.36	0.7221
	Internet	612	29.0	0.42	29.0	0.42	0.01			
Blood Pressure (BP) Risk*	Telephone	258	18%	0.14%	17%	0.12%	-1.0%	1.315	4.51	0.0337
	Internet	612	11%	0.15%	14%	0.16%	3.5%			
Systolic BP (mmHg)*	Telephone	258	124.3	0.64	123.5	0.60	-0.79	0.300	0.20	0.8439
	Internet	612	122.9	0.99	121.8	0.93	-1.09			
Diastolic BP (mmHg)*	Telephone	258	77.4	0.41	76.9	0.44	-0.50	-0.226	-0.22	0.8244

	Internet	612	76.3	0.63	76.0	0.68	-0.28			
Glucose (mg/dL)	Telephone	258	104.7	1.70	104.3	1.74	-0.43	-3.494	-0.77	0.4437
	Internet	612	98.6	2.63	101.7	2.70	3.06			
Cholesterol Risk	Telephone	258	24%	0.10%	23%	0.17%	-0.2%	1.095	0.88	0.3780
	Internet	612	21%	0.15%	24%	0.21%	2.0%			
Cholesterol (mg/dL)	Telephone	258	180.8	1.91	177.7	1.85	-3.13	-1.915	-0.40	0.6886
	Internet	612	179.6	2.96	178.3	2.87	-1.22			
HDL (mg/dL)	Telephone	258	63.3	1.26	64.7	1.30	1.41	-2.538	-0.78	0.4337
	Internet	612	65.1	1.95	69.1	2.02	3.94			
LDL (mg/dL)	Telephone	258	106.9	1.70	103.6	1.75	-3.36	-5.459	-1.22	0.2211
	Internet	612	101.6	2.61	103.7	2.70	2.10			
Triglycerides (mg/dL)	Telephone	258	140.9	4.20	137.2	4.28	-3.67	-6.299	-0.56	0.5763
	Internet	612	142.6	6.50	145.3	6.64	2.63			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets. "N/A" indicates not applicable due to a quasi-separation of data points with no participants in the completed group decreasing their excessive alcohol consumption risk.

Table 4.15

All Participants versus Non-participants

			PRE		POST					
	Participant Group	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk	All parts.	1,077	5%	0.06%	3%	0.04%	-1.3%	1.206	1.63	0.1027
	Non-parts.	2,505	4%	0.03%	3%	0.02%	-0.6%			
Poor Back Care Risk	All parts.	1,077	64%	0.04%	52%	0.00%	-11.3%	1.322	5.91	<.0001
	Non-parts.	2,505	38%	0.03%	38%	0.00%	0.0%			
Poor Nutrition Risk	All parts.	1,077	16%	0.42%	14%	0.38%	-2.1%	1.202	2.51	0.0121
	Non-parts.	2,505	10%	0.22%	9%	0.19%	-1.6%			
Physical Inactivity Risk	All parts.	1,077	22%	0.08%	19%	0.14%	-2.9%	1.452	5.89	<.0001
	Non-parts.	2,505	11%	0.03%	11%	0.07%	0.1%			
Tobacco Use Risk	All parts.	1,077	5%	0.01%	3%	0.00%	-2.0%	1.487	2.96	0.0031
	Non-parts.	2,505	2%	0.00%	2%	0.00%	-0.5%			
Elevated Stress Risk	All parts.	1,077	26%	0.07%	21%	0.02%	-4.5%	1.362	5.20	<.0001
	Non-parts.	2,505	13%	0.03%	12%	0.01%	-0.8%			
Depression Risk	All parts.	1,077	25%	0.06%	22%	0.03%	-2.7%	1.187	2.80	0.0051
	Non-parts.	2,505	15%	0.03%	13%	0.01%	-1.4%			
Distal Risk Factors										
Overweight or Obesity Risk	All parts.	1,077	51%	0.08%	48%	0.04%	-2.6%	1.146	1.67	0.0953
	Non-parts.	2,505	25%	0.04%	23%	0.02%	-1.3%			
Weight (lbs)	All parts.	1,077	200.9	1.25	200.9	1.26	-0.02	0.007	0.01	0.9894
	Non-parts.	2,505	180.0	0.82	179.9	0.82	-0.03			
Body Mass Index	All parts.	1,077	30.7	0.18	30.6	0.18	-0.04	-0.047	-0.52	0.6058
	Non-parts.	2,505	27.2	0.12	27.2	0.12	0.00			
Blood Pressure (BP) Risk*	All parts.	1,077	17%	0.06%	16%	0.02%	-0.7%	1.149	5.91	0.0150
	Non-parts.	2,505	13%	0.03%	13%	0.01%	0.0%			
Systolic BP (mmHg)	All parts.	1,077	124.2	0.46	123.7	0.44	-0.55	-0.834	-1.18	0.2391
	Non-parts.	2,505	122.7	0.30	123.0	0.29	0.29			
Diastolic BP	All parts.	1,077	77.4	0.30	76.7	0.30	-0.73	-0.721	-1.53	0.1248

(mmHg)	Non-parts.	2,505	76.6	0.20	76.6	0.20	-0.01			
Glucose (mg/dL)	All parts.	1,077	102.5	1.45	104.7	1.29	2.18	4.457	1.92	0.0546
	Non-parts.	2,505	105.0	0.95	102.7	0.84	-2.27			
Cholesterol Risk	All parts.	1,077	23%	0.02%	23%	0.09%	-0.1%	0.930	-1.51	0.1315
	Non-parts.	2,505	26%	0.01%	23%	0.04%	-3.0%			
Cholesterol (mg/dL)	All parts.	1,077	181.2	1.52	178.1	1.47	-3.09	-0.205	-0.08	0.9334
	Non-parts.	2,505	183.4	1.00	180.5	0.96	-2.88			
HDL (mg/dL)	All parts.	1,077	63.8	0.95	66.2	0.97	2.42	1.019	0.64	0.5248
	Non-parts.	2,505	64.5	0.62	65.9	0.64	1.40			
LDL (mg/dL)	All parts.	1,077	105.2	1.24	103.6	1.28	-1.61	-1.359	-0.64	0.5230
	Non-parts.	2,505	104.3	0.81	104.0	0.83	-0.25			
Triglycerides (mg/dL)	All parts.	1,077	139.6	2.89	140.6	3.18	1.02	-7.012	-1.35	0.1766
	Non-parts.	2,505	132.0	1.89	140.0	2.08	8.03			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.16

Nutrition: All Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Part.	100	186.0	3.9	186.8	3.9	0.78	0.808	0.57	0.5720
	Non-part.	2,505	181.2	0.8	181.2	0.8	-0.02			
Body Mass Index	Part.	100	28.5	0.5	28.5	0.5	0.00	-0.004	-0.02	0.9875
	Non-part.	2,505	27.2	0.1	27.2	0.1	0.00			
Systolic BP (mmHg)	Part.	100	124.6	1.5	122.4	1.4	-2.22	-2.454	-1.28	0.1995
	Non-part.	2,505	122.8	0.3	123.1	0.3	0.23			
Diastolic BP (mmHg)	Part.	100	77.3	1.0	76.4	1.0	-0.90	-0.882	-0.69	0.489
	Non-part.	2,505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Part.	100	103.8	5.0	105.8	4.1	2.09	4.401	0.67	0.5059
	Non-part.	2,505	105.0	1.0	102.7	0.8	-2.31			
Cholesterol (mg/dL)	Part.	100	184.0	5.1	170.6	4.9	-13.33	-10.529	-1.51	0.1321
	Non-part.	2,505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Part.	100	64.4	3.1	73.7	3.2	9.29	7.874	1.74	0.0813
	Non-part.	2,505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Part.	100	103.8	4.1	99.2	4.1	-4.59	-4.412	-0.75	0.4538
	Non-part.	2,505	104.2	0.8	104.0	0.8	-0.18			
Triglycerides (mg/dL)	Part.	100	149.6	9.3	134.5	10.3	-15.07	-23.074	-1.62	0.1047
	Non-part.	2,505	132.2	1.8	140.2	2.0	8.00			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.17

Nutrition: Internet Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet part.	28	182.0	8.0	182.8	8.1	0.80	0.827	0.31	0.7576
	Non-part.	2,505	181.5	0.8	181.4	0.8	-0.03			
Body Mass Index	Internet part.	28	28.1	1.0	28.0	1.0	-0.08	-0.086	-0.19	0.8466
	Non-part.	2,505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Internet part.	28	125.8	2.8	122.2	2.7	-3.60	-3.811	-1.08	0.2823
	Non-part.	2,505	122.9	0.3	123.1	0.3	0.22			
Diastolic BP (mmHg)	Internet part.	28	77.6	1.8	77.1	1.8	-0.44	-0.419	-0.18	0.8608
	Non-part.	2,505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Internet part.	28	100.3	9.5	117.4	7.7	17.11	19.397	1.58	0.1131
	Non-part.	2,505	105.0	1.0	102.7	0.8	-2.28			
Cholesterol (mg/dL)	Internet part.	28	172.3	9.6	172.3	9.2	0.04	2.835	0.22	0.8266
	Non-part.	2,505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Internet part.	28	62.4	5.9	73.0	5.9	10.64	9.209	1.10	0.2696
	Non-part.	2,505	64.6	0.6	66.0	0.6	1.43			
LDL (mg/dL)	Internet part.	28	88.6	7.6	96.8	7.8	8.19	8.348	0.77	0.4442
	Non-part.	2,505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Internet part.	28	165.7	17.4	162.2	19.3	-3.52	-11.590	-0.44	0.6597
	Non-part.	2,505	132.2	1.8	140.3	2.0	8.07			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.18

Nutrition: Telephone Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)*	Telephone part.	63	182.2	5.3	183.5	5.4	1.31	1.344	0.75	0.4550
	Non-part.	2505	181.5	0.8	181.4	0.8	-0.04			
Body Mass Index	Telephone part.	63	28.8	0.7	28.9	0.7	0.06	0.059	0.20	0.8436
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Telephone part.	63	123.8	1.9	121.6	1.8	-2.17	-2.393	-1.01	0.3146
	Non-part.	2505	122.9	0.3	123.1	0.3	0.22			
Diastolic BP (mmHg)	Telephone part.	63	77.6	1.2	76.1	1.2	-1.56	-1.541	-0.96	0.3366
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Telephone part.	63	106.7	6.4	103.0	5.2	-3.71	-1.402	-0.17	0.8657
	Non-part.	2505	105.0	1.0	102.7	0.8	-2.30			
Cholesterol (mg/dL)	Telephone part.	63	187.2	6.4	167.7	6.2	-19.47	-16.671	-1.91	0.0560
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Telephone part.	63	64.8	3.9	72.5	4.0	7.64	6.203	1.11	0.2684
	Non-part.	2505	64.6	0.6	66.0	0.6	1.43			
LDL (mg/dL)	Telephone part.	63	109.4	5.1	96.3	5.2	-13.11	-12.941	-1.77	0.0768
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.17			
Triglycerides (mg/dL)	Telephone part.	63	144.3	11.5	122.4	12.9	-21.93	-29.964	-1.70	0.0888
	Non-part.	2505	132.2	1.8	140.3	2.0	8.03			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.19

Nutrition: Telephone versus Internet Participants

			PRE		POST					
	Participation Modality	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Telephone	63	182.3	4.3	183.1	4.3	0.81	0.076	0.03	0.9736
	Internet	28	178.8	6.5	179.5	6.5	0.74			
Body Mass Index	Telephone	63	29.0	0.6	29.0	0.6	0.02	0.137	0.32	0.7482
	Internet	28	27.9	0.9	27.8	1.0	-0.12			
Systolic BP (mmHg)*	Telephone	63	123.5	1.7	122.0	1.6	-1.52	2.140	0.52	0.6017
	Internet	28	125.5	2.6	121.9	2.4	-3.66			
Diastolic BP (mmHg)*	Telephone	63	77.5	1.2	76.1	1.2	-1.44	-1.266	-0.47	0.6372
	Internet	28	77.3	1.8	77.1	1.8	-0.18			
Glucose (mg/dL)*	Telephone	63	104.8	5.8	101.9	5.2	-2.87	-14.204	-1.00	0.3222
	Internet	28	102.3	8.8	113.7	7.9	11.34			
Cholesterol (mg/dL)*	Telephone	63	186.8	5.8	167.5	5.1	-19.33	-19.832	-1.37	0.1732
	Internet	28	172.0	8.7	172.5	7.6	0.50			
HDL (mg/dL)*	Telephone	63	65.0	4.0	72.7	4.5	7.76	-3.917	-0.40	0.6932
	Internet	28	62.0	6.1	73.7	6.8	11.68			
LDL (mg/dL)	Telephone	63	109.6	5.5	95.7	4.8	-13.85	-22.370	-1.58	0.1142
	Internet	28	88.6	8.3	97.2	7.2	8.52			
Triglycerides (mg/dL)	Telephone	63	140.8	13.1	117.9	12.8	-22.88	-14.620	-0.43	0.6657
	Internet	28	174.5	19.9	166.2	19.3	-8.26			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.20

Physical Activity: All Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Participant	87	179.8	4.3	180.8	4.3	1.03	1.058	0.69	0.4930
	Non-part.	2505	181.3	0.8	181.3	0.8	-0.03			
Body Mass Index	Participant	87	27.6	0.6	27.7	0.6	0.15	0.151	0.59	0.5533
	Non-part.	2505	27.2	0.1	27.2	0.1	0.00			
Systolic BP (mmHg)	Participant	87	124.2	1.6	123.0	1.5	-1.21	-1.412	-0.70	0.4868
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Participant	87	77.3	1.0	76.4	1.0	-0.91	-0.886	-0.65	0.5164
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Participant	87	101.8	5.3	102.0	4.4	0.27	2.545	0.36	0.7164
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Participant	87	179.9	5.4	181.9	5.2	2.02	4.826	0.65	0.5137
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Participant	87	66.8	3.4	64.0	3.4	-2.86	-4.280	-0.89	0.3719
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Participant	87	101.7	4.3	106.0	4.5	4.27	4.435	0.71	0.4805
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Participant	87	126.5	9.8	145.4	11.2	18.88	10.831	0.71	0.4765
	Non-part.	2505	132.2	1.8	140.3	2.0	8.05			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.21

Physical Activity: Internet Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet part.	43	171.3	6.4	171.6	6.5	0.34	0.369	0.17	0.8642
	Non-part.	2505	181.5	0.8	181.5	0.8	-0.03			
Body Mass Index	Internet part.	43	26.9	0.8	26.9	0.8	0.07	0.064	0.18	0.8572
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Internet part.	43	125.5	2.2	124.5	2.1	-1.01	-1.221	-0.43	0.6693
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Internet part.	43	77.4	1.5	77.1	1.5	-0.31	-0.286	-0.15	0.8821
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Internet part.	43	101.6	7.6	102.4	6.4	0.76	3.044	0.30	0.7605
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Internet part.	43	184.6	7.7	191.1	7.5	6.46	9.252	0.88	0.3776
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.79			
HDL (mg/dL)	Internet part.	43	69.1	4.8	72.8	4.8	3.62	2.189	0.32	0.7465
	Non-part.	2505	64.6	0.6	66.0	0.6	1.43			
LDL (mg/dL)	Internet part.	43	99.8	6.1	101.8	6.3	2.06	2.232	0.25	0.8007
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.17			
Triglycerides (mg/dL)	Internet part.	43	116.1	13.9	140.3	15.8	24.26	16.162	0.76	0.4480
	Non-part.	2505	132.2	1.8	140.3	2.0	8.09			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.22

Physical Activity: Telephone Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)*	Telephone part.	31	178.1	7.6	181.3	7.7	3.18	3.207	0.66	0.5127
	Non-part.	2505	181.5	0.8	181.5	0.9	-0.03			
Body Mass Index	Telephone part.	31	27.9	1.0	28.3	1.0	0.47	0.469	1.11	0.2669
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Telephone part.	31	121.0	2.6	118.9	2.5	-2.12	-2.327	-0.69	0.4878
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Telephone part.	31	76.3	1.7	75.1	1.7	-1.13	-1.109	-0.49	0.6240
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Telephone part.	31	103.4	9.0	96.2	7.3	-7.19	-4.914	-0.42	0.6716
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Telephone part.	31	178.2	9.1	174.3	8.8	-3.95	-1.141	-0.09	0.9260
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Telephone part.	31	62.1	5.6	57.8	5.6	-4.38	-5.800	-0.73	0.4643
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Telephone part.	31	107.4	7.2	110.5	7.8	3.12	3.282	0.31	0.7562
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Telephone part.	31	151.0	16.5	153.0	18.4	2.01	-6.043	-0.24	0.8090
	Non-part.	2505	132.3	1.8	140.3	2.0	8.06			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.23

Physical Activity: Telephone or Internet versus Mail Participants

	Grouping Variable	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet or Tele.	74	173.9	4.8	175.4	4.5	1.48	2.906	0.65	0.5147
	Mail	13	181.7	11.5	180.3	10.9	-1.43			
Body Mass Index	Internet or Tele.	74	27.3	0.7	27.5	0.6	0.22	0.449	0.73	0.4641
	Mail	13	28.3	1.6	28.1	1.5	-0.23			
Systolic BP (mmHg)	Internet or Tele.	74	123.4	1.6	121.8	1.8	-1.61	-2.226	-0.37	0.7086
	Mail	13	127.2	4.1	127.8	4.5	0.62			
Diastolic BP (mmHg)*	Internet or Tele.	74	76.8	0.9	76.2	1.2	-0.65	1.985	0.54	0.5907
	Mail	13	80.6	2.3	78.0	2.9	-2.63			
Glucose (mg/dL)	Internet or Tele.	74	102.4	2.8	99.4	3.9	-3.04	-21.598	-1.72	0.0853
	Mail	13	98.2	6.7	116.7	9.3	18.55			
Cholesterol (mg/dL)	Internet or Tele.	74	180.9	4.4	184.0	5.1	3.03	7.530	0.46	0.6455
	Mail	13	174.3	10.7	169.8	12.3	-4.50			
HDL (mg/dL)	Internet or Tele.	74	66.1	4.0	66.5	3.5	0.44	22.028	1.63	0.1024
	Mail	13	71.1	9.6	49.5	8.2	-21.59			
LDL (mg/dL)	Internet or Tele.	74	102.8	4.7	104.8	4.8	2.03	-14.598	-0.80	0.4215
	Mail	13	95.3	11.3	112.0	11.2	16.63			
Triglycerides (mg/dL)	Internet or Tele.	74	130.1	11.3	144.6	13.7	14.50	-22.350	-0.48	0.6338
	Mail	13	105.9	27.9	142.8	33.3	36.85			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.24

Physical Activity: Telephone versus Internet Participants

			PRE		POST					
	Participant Modality	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Telephone	31	177.5	7.2	180.7	6.8	3.14	2.690	0.75	0.4562
	Internet	43	171.9	6.1	172.4	5.7	0.45			
Body Mass Index	Telephone	31	27.8	1.0	28.3	0.9	0.46	0.381	0.78	0.4363
	Internet	43	26.8	0.9	26.9	0.8	0.08			
Systolic BP (mmHg)*	Telephone	31	120.8	2.5	118.5	2.5	-2.28	-1.196	-0.30	0.7614
	Internet	43	125.2	2.1	124.1	2.1	-1.08			
Diastolic BP (mmHg)*	Telephone	31	76.2	1.5	75.1	1.8	-1.10	-0.725	-0.27	0.7882
	Internet	43	77.3	1.2	77.0	1.6	-0.37			
Glucose (mg/dL)	Telephone	31	103.2	4.3	95.8	5.0	-7.39	-7.508	-0.89	0.3715
	Internet	43	102.1	3.7	102.2	4.5	0.12			
Cholesterol (mg/dL)	Telephone	31	177.1	6.5	174.9	8.2	-2.21	-8.283	-0.65	0.5188
	Internet	43	184.7	5.5	190.8	7.0	6.07			
HDL (mg/dL)	Telephone	31	61.2	6.1	57.1	5.2	-4.18	-8.013	-0.75	0.4508
	Internet	43	69.6	5.1	73.4	4.5	3.83			
LDL (mg/dL)	Telephone	31	107.5	7.5	110.7	7.5	3.27	1.852	0.12	0.9019
	Internet	43	99.6	6.3	101.0	6.1	1.42			
Triglycerides (mg/dL)	Telephone	31	151.4	18.7	151.2	19.5	-0.18	-24.330	-0.68	0.4942
	Internet	43	116.9	15.8	141.0	16.7	24.15			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.25

Weight Management: All Participants versus Non-participants

			PRE		POST					
	Participant Group	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Alcohol Risk	Participant	443	3%	0.08%	2%	0.05%	-1.1%	1.031	0.17	0.8680
	Non-part.	2,505	4%	0.04%	3%	0.03%	-0.6%			
Back Risk	Participant	443	60%	0.07%	54%	0.09%	-6.3%	1.243	3.27	0.0011
	Non-part.	2,505	38%	0.03%	38%	0.04%	0.0%			
Eating Risk	Participant	443	9%	0.32%	12%	0.34%	3.2%	0.912	-0.77	0.4384
	Non-part.	2,505	10%	0.15%	9%	0.12%	-1.6%			
Exercise Risk	Participant	443	23%	0.18%	22%	0.27%	-0.9%	1.414	4.04	<.0001
	Non-part.	2,505	11%	0.04%	11%	0.07%	0.1%			
Smoking Risk	Participant	443	2%	0.00%	1%	0.00%	-0.9%	1.061	0.26	0.7942
	Non-part.	2,505	2%	0.00%	2%	0.00%	-0.5%			
Stress Risk	Participant	443	19%	0.04%	20%	0.00%	1.1%	1.125	1.30	0.1943
	Non-part.	2,505	13%	0.01%	12%	0.00%	-0.8%			
Depression Risk	Participant	443	26%	0.15%	22%	0.08%	-3.4%	1.262	2.87	0.004
	Non-part.	2,505	15%	0.04%	13%	0.02%	-1.4%			
Distal Risk Factors										
Overweight or Obesity Risk	Participant	443	97%	0.01%	86%	0.02%	-11.5%	1.714	6.07	<.0001
	Non-part.	2,505	25%	0.03%	23%	0.01%	-1.3%			
Weight (lbs)	Participant	443	235.1	1.9	233.5	1.9	-1.57	-1.540	-1.94	0.0527
	Non-part.	2,505	180.5	0.8	180.5	0.8	-0.03			
Body Mass Index	Participant	443	36.0	0.3	35.7	0.3	-0.32	-0.321	-2.45	0.0142
	Non-part.	2,505	27.2	0.1	27.2	0.1	0.00			
Blood Pressure (BP) Risk*	Participant	443	16%	0.08%	15%	0.00%	-1.1%	1.146	2.88	0.0897
	Non-part.	2,505	13%	0.03%	13%	0.02%	0.0%			

Systolic BP (mmHg)	Participant	443	124.2	0.7	123.3	0.7	-0.87	-1.126	-1.14	0.2536
	Non-part.	2,505	122.8	0.3	123.0	0.3	0.26			
Diastolic BP (mmHg)	Participant	443	76.9	0.5	76.7	0.5	-0.15	-0.136	-0.21	0.8356
	Non-part.	2,505	76.6	0.2	76.6	0.2	-0.01			
Glucose (mg/dL)	Participant	443	101.5	2.3	103.1	2.0	1.60	3.877	1.16	0.2447
	Non-part.	2,505	105.0	1.0	102.8	0.8	-2.27			
Cholesterol Risk	Participant	443	23%	0.02%	23%	0.22%	0.1%	0.925	-1.14	0.2538
	Non-part.	2,505	26%	0.01%	23%	0.07%	-3.0%			
Cholesterol (mg/dL)	Participant	443	181.4	2.4	176.2	2.3	-5.27	-2.443	-0.70	0.4847
	Non-part.	2,505	183.4	1.0	180.6	1.0	-2.83			
HDL (mg/dL)	Participant	443	62.3	1.5	64.1	1.5	1.75	0.332	0.15	0.8833
	Non-part.	2,505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Participant	443	106.8	1.9	103.3	2.0	-3.49	-3.332	-1.13	0.2598
	Non-part.	2,505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Participant	443	143.0	4.5	138.8	4.9	-4.17	-12.318	-1.69	0.0907
	Non-part.	2,505	132.0	1.9	140.2	2.0	8.15			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.26

Weight Management: Mail Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Mail part.	42	240.2	6.5	236.3	6.5	-3.89	-3.867	-1.76	0.0780
	Non-part.	2505	181.5	0.8	181.4	0.8	-0.03			
Body Mass Index	Mail part.	42	35.9	0.8	35.5	0.8	-0.39	-0.397	-1.09	0.2742
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Mail part.	42	125.1	2.3	122.0	2.2	-3.08	-3.289	-1.14	0.2550
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Mail part.	42	79.1	1.5	75.4	1.5	-3.70	-3.683	-1.89	0.0591
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Mail part.	42	97.8	7.7	105.3	6.3	7.56	9.826	0.98	0.3271
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.27			
Cholesterol (mg/dL)	Mail part.	42	179.4	7.8	170.6	7.5	-8.75	-5.945	-0.56	0.5754
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Mail part.	42	67.9	4.8	67.9	4.9	0.02	-1.400	-0.21	0.8374
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Mail part.	42	117.6	6.2	97.8	6.3	-19.83	-19.673	-2.22	0.0265
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Mail part.	42	130.8	14.0	143.9	15.8	13.11	4.989	0.23	0.8159
	Non-part.	2505	132.2	1.8	140.4	2.0	8.12			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.27

Weight Management: Internet Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet part.	98	218.8	4.3	218.2	4.3	-0.54	-0.506	-0.35	0.7299
	Non-part.	2505	181.5	0.8	181.4	0.8	-0.03			
Body Mass Index	Internet part.	98	33.2	0.5	33.2	0.6	-0.05	-0.051	-0.21	0.8340
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Internet part.	98	123.6	1.5	122.3	1.4	-1.31	-1.530	-0.80	0.4263
	Non-part.	2505	122.9	0.3	123.1	0.3	0.22			
Diastolic BP (mmHg)	Internet part.	98	76.1	1.0	76.7	1.0	0.56	0.576	0.44	0.6579
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Internet part.	98	96.8	5.0	97.3	4.1	0.51	2.788	0.42	0.6737
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Internet part.	98	181.4	5.1	169.5	4.9	-11.89	-9.089	-1.30	0.1941
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Internet part.	98	66.1	3.2	67.2	3.2	1.09	-0.329	-0.07	0.9426
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Internet part.	98	102.9	4.1	100.8	4.1	-2.18	-2.015	-0.34	0.7320
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Internet part.	98	148.5	9.5	123.4	10.2	-25.12	-33.217	-2.32	0.0204
	Non-part.	2505	132.2	1.8	140.3	2.0	8.09			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.28

Weight Management: Telephone Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Alcohol Risk*	Telephone part.	303	2%	0.07%	1%	0.04%	-1.0%	0.938	0.07	0.7861
	Non-part.	2,505	4%	0.04%	3%	0.03%	-0.6%			
Back Risk*	Telephone part.	303	65%	0.00%	55%	0.00%	-9.9%	1.363	17.35	<.0001
	Non-part.	2,505	38%	0.00%	38%	0.00%	0.0%			
Eating Risk	Telephone part.	303	8%	0.13%	11%	0.28%	2.6%	0.886	-0.84	0.3989
	Non-part.	2,505	10%	0.07%	9%	0.09%	-1.6%			
Exercise Risk	Telephone part.	303	25%	0.14%	24%	0.32%	-1.0%	1.560	4.66	<.0001
	Non-part.	2,505	11%	0.03%	11%	0.07%	0.1%			
Smoking Risk	Telephone part.	303	2%	0.04%	1%	0.03%	-1.0%	1.159	0.61	0.5445
	Non-part.	2,505	2%	0.01%	2%	0.02%	-0.5%			
Stress Risk	Telephone part.	303	21%	0.02%	23%	0.02%	1.3%	1.234	2.08	0.0374
	Non-part.	2,505	13%	0.00%	12%	0.01%	-0.8%			
Depression Risk	Telephone part.	303	31%	0.24%	26%	0.10%	-5.0%	1.373	3.56	0.0004
	Non-part.	2,505	15%	0.05%	13%	0.02%	-1.4%			
Distal Risk Factors										
Overweight or Obesity Risk	Telephone part.	303	97%	0.01%	88%	0.06%	-9.2%	1.578	4.27	<.0001
	Non-part.	2,505	25%	0.03%	23%	0.03%	-1.3%			
Weight (lbs)	Telephone part.	303	186.7	3.0	185.9	3.0	-0.84	1.016	-0.81	0.4160
	Non-part.	2,505	181.4	0.8	181.4	0.8	-0.01			
Body Mass Index	Telephone part.	303	28.3	0.4	28.2	0.4	-0.10	0.168	-0.62	0.5332
	Non-part.	2,505	27.2	0.1	27.3	0.1	0.01			
Blood Pressure (BP) Risk*	Telephone part.	303	83%	0.11%	85%	0.03%	1.7%	1.202	1.99	0.0468
	Non-part.	2,505	87%	0.03%	87%	0.02%	0.0%			

Systolic BP (mmHg)	Telephone part.	303	124.3	1.0	125.8	1.0	1.46	1.368	0.89	0.371
	Non-part.	2,505	122.8	0.3	123.1	0.3	0.23			
Diastolic BP (mmHg)	Telephone part.	303	78.9	0.7	77.1	0.7	-1.81	0.912	-1.96	0.0497
	Non-part.	2,505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Telephone part.	303	101.0	3.4	108.9	2.9	7.92	4.682	2.16	0.0307
	Non-part.	2,505	105.0	1.0	102.8	0.8	-2.20			
Cholesterol Risk	Telephone part.	303	75%	0.00%	76%	0.32%	0.8%	0.974	-0.33	0.7386
	Non-part.	2,505	74%	0.00%	77%	0.07%	3.0%			
Cholesterol (mg/dL)	Telephone part.	303	184.5	3.5	178.8	3.4	-5.72	4.941	-0.58	0.5608
	Non-part.	2,505	183.4	1.0	180.6	1.0	-2.84			
HDL (mg/dL)	Telephone part.	303	63.5	2.2	67.1	2.2	3.58	3.191	0.68	0.4939
	Non-part.	2,505	64.5	0.6	65.9	0.6	1.40			
LDL (mg/dL)	Telephone part.	303	105.1	2.8	103.6	2.9	-1.56	4.172	-0.32	0.7454
	Non-part.	2,505	104.3	0.8	104.1	0.8	-0.20			
Triglycerides (mg/dL)	Telephone part.	303	128.9	6.4	139.8	7.2	10.90	10.015	0.27	0.7869
	Non-part.	2,505	132.2	1.8	140.4	2.1	8.20			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.29

Weight Management: Telephone or Internet versus Mail Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Alcohol Risk	Internet or tele.	401	3%	0.03%	2%	0.04%	-1.0%	0.990	-0.02	0.9852
	Mail	42	5%	0.20%	2%	0.18%	-2.4%			
Back Risk	Internet or tele.	401	61%	0.21%	54%	0.02%	-7.3%	1.073	0.32	0.7474
	Mail	42	57%	0.89%	60%	0.08%	2.4%			
Eating Risk	Internet or tele.	401	8%	0.06%	12%	0.22%	4.0%	0.563	-2.13	0.0331
	Mail	42	19%	0.44%	14%	0.91%	-4.8%			
Exercise Risk	Internet or tele.	401	23%	0.06%	23%	0.17%	0.0%	0.792	-1.04	0.2968
	Mail	42	31%	0.25%	21%	0.56%	-9.5%			
Smoking Risk	Internet or tele.	401	2%	0.01%	1%	0.00%	-0.8%	0.731	-0.56	0.5748
	Mail	42	5%	0.06%	2%	0.03%	-2.4%			
Stress Risk	Internet or tele.	401	19%	0.04%	21%	0.02%	2.3%	0.774	-1.07	0.2828
	Mail	42	19%	0.11%	10%	0.04%	-9.5%			
Depression Risk	Internet or tele.	401	27%	0.07%	23%	0.03%	-3.3%	1.229	0.75	0.4545
	Mail	42	19%	0.20%	14%	0.09%	-4.8%			
Distal Risk Factors										
Overweight or Obesity Risk	Internet or tele.	401	97%	0.08%	86%	0.10%	-11.5%	0.993	-0.03	0.9766
	Mail	42	98%	0.22%	86%	0.35%	-11.9%			
Weight (lbs)	Internet or tele.	401	228.9	2.0	227.5	2.1	-1.39	2.327	0.690	0.4911
	Mail	42	236.2	6.1	232.5	6.5	-3.71			
Body Mass Index	Internet or tele.	401	35.9	0.3	35.6	0.3	-0.32	0.068	0.120	0.9018
	Mail	42	35.9	0.8	35.5	0.9	-0.39			
Blood Pressure (BP) Risk*	Internet or tele.	401	15%	0.18%	15%	0.18%	0.0%	0.837	0.64	0.4232
	Mail	42	21%	0.74%	10%	0.37%	-11.9%			

Systolic BP (mmHg)	Internet or tele.	401	123.7	0.8	123.3	0.7	-0.41	1.975	0.580	0.5623
	Mail	42	124.5	2.4	122.1	2.2	-2.39			
Diastolic BP (mmHg)	Internet or tele.	401	76.6	0.5	76.9	0.5	0.29	4.072	1.850	0.0639
	Mail	42	79.2	1.5	75.4	1.6	-3.78			
Glucose (mg/dL)	Internet or tele.	401	101.8	2.2	102.9	2.4	1.07	-5.444	-0.510	0.6093
	Mail	42	98.1	6.9	104.6	7.3	6.51			
Cholesterol Risk	Internet or tele.	401	23%	0.09%	23%	0.25%	-0.6%	1.100	0.41	0.6801
	Mail	42	19%	0.30%	26%	0.03%	7.1%			
Cholesterol (mg/dL)	Internet or tele.	401	181.8	2.4	176.7	2.3	-5.05	3.850	0.360	0.7176
	Mail	42	178.5	7.5	169.6	7.1	-8.90			
HDL (mg/dL)	Internet or tele.	401	61.8	1.5	63.6	1.6	1.86	1.557	0.220	0.8261
	Mail	42	68.1	4.7	68.4	4.9	0.30			
LDL (mg/dL)	Internet or tele.	401	105.8	2.1	104.0	2.0	-1.81	17.820	1.900	0.0577
	Mail	42	116.5	6.4	96.9	6.2	-19.63			
Triglycerides (mg/dL)	Internet or tele.	401	143.0	4.9	137.5	5.1	-5.55	-18.320	-0.780	0.4365
	Mail	42	130.0	15.2	142.7	15.7	12.77			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.30

Weight Management: Telephone versus Internet Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Alcohol Risk	Telephone	303	2%	0.04%	1%	0.03%	-1.0%	0.757	-0.74	0.4581
	Internet	98	4%	0.11%	3%	0.13%	-1.0%			
Back Risk	Telephone	303	65%	0.11%	55%	0.09%	-9.9%	1.509	2.34	0.0190
	Internet	98	46%	0.25%	47%	0.20%	1.0%			
Eating Risk	Telephone	303	8%	0.18%	11%	0.26%	2.6%	1.315	0.84	0.4027
	Internet	98	7%	0.31%	15%	0.67%	8.2%			
Exercise Risk	Telephone	303	25%	0.28%	24%	0.01%	-1.0%	1.831	2.24	0.0251
	Internet	98	14%	0.36%	18%	0.02%	3.1%			
Smoking Risk	Telephone	303	2%	0.02%	1%	0.00%	-1.0%	287.999	0.05	0.9595
	Internet	98	0%	0.00%	0%	0.00%	0.0%			
Stress Risk*	Telephone	303	21%	0.17%	23%	0.11%	1.3%	1.928	4.51	0.0338
	Internet	98	11%	0.19%	16%	0.15%	5.2%			
Depression Risk	Telephone	303	31%	0.29%	26%	0.15%	-5.0%	1.636	2.17	0.0302
	Internet	98	11%	0.25%	13%	0.16%	2.1%			
Distal Risk Factors										
Overweight or Obesity Risk*	Telephone	303	97%	0.10%	88%	0.06%	-9.2%	0.686	5.31	0.0212
	Internet	98	98%	0.12%	79%	0.17%	-18.6%			
Weight (lbs)	Telephone	303	231.8	2.3	230.3	2.4	-1.48	-0.389	-0.16	0.8755
	Internet	98	218.6	4.0	217.5	4.3	-1.09			
Body Mass Index	Telephone	303	36.8	0.3	36.4	0.3	-0.39	-0.274	-0.68	0.4990
	Internet	98	33.2	0.5	33.1	0.6	-0.12			
Blood Pressure (BP) Risk*	Telephone	303	17%	0.25%	15%	0.15%	-1.6%	1.338	2.02	0.1551
	Internet	98	10%	0.30%	15%	0.28%	5.2%			

Systolic BP (mmHg)	Telephone	303	123.7	0.9	123.5	0.8	-0.20	0.667	0.27	0.7880
	Internet	98	123.4	1.6	122.5	1.4	-0.87			
Diastolic BP (mmHg)	Telephone	303	76.8	0.5	76.9	0.6	0.15	-0.535	-0.33	0.7390
	Internet	98	76.0	1.0	76.7	1.1	0.68			
Glucose (mg/dL)	Telephone	303	103.7	2.6	104.7	2.7	0.95	0.097	0.01	0.9900
	Internet	98	96.1	4.6	96.9	4.7	0.85			
Cholesterol Risk	Telephone	303	25%	0.08%	24%	0.43%	-0.8%	1.205	1.11	0.2655
	Internet	98	18%	0.11%	18%	0.41%	0.0%			
Cholesterol (mg/dL)	Telephone	303	182.1	2.7	179.2	2.6	-2.96	8.729	1.15	0.2491
	Internet	98	180.3	4.8	168.7	4.6	-11.69			
HDL (mg/dL)	Telephone	303	60.3	1.8	62.6	1.8	2.31	1.714	0.33	0.7377
	Internet	98	66.5	3.1	67.1	3.2	0.59			
LDL (mg/dL)	Telephone	303	106.7	2.4	104.9	2.3	-1.86	-0.312	-0.05	0.9629
	Internet	98	102.4	4.2	100.8	4.1	-1.55			
Triglycerides (mg/dL)	Telephone	303	141.3	5.8	141.3	5.6	0.04	24.073	1.44	0.1509
	Internet	98	148.4	10.3	124.4	9.8	-24.04			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.31

Weight Management: Telephone Participants Status

	Participant Status	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Alcohol Risk	Completed	42	0%	0.00%	0%	0.00%	0.0%	0.006	-0.04	0.9686
	Discontinued	261	3%	0.08%	2%	0.04%	-1.1%			
Back Risk	Completed	42	52%	0.38%	48%	0.25%	-4.8%	0.829	-0.81	0.4179
	Discontinued	261	67%	0.08%	57%	0.06%	-10.7%			
Eating Risk*	Completed	42	17%	1.38%	12%	1.16%	-4.8%	1.439	1.32	0.2507
	Discontinued	261	7%	0.38%	10%	0.54%	3.8%			
Exercise Risk*	Completed	42	21%	0.36%	21%	0.04%	0.0%	1.027	0.01	0.9127
	Discontinued	261	26%	0.17%	25%	0.02%	-1.1%			
Smoking Risk*	Completed	42	2%	0.00%	2%	0.00%	0.0%	0.004	0.00	0.9698
	Discontinued	261	2%	0.00%	1%	0.00%	-1.1%			
Stress Risk*	Completed	42	19%	0.64%	17%	0.83%	-2.4%	1.233	0.69	0.4072
	Discontinued	261	22%	0.25%	24%	0.36%	1.9%			
Depression Risk	Completed	42	12%	1.03%	14%	1.10%	2.4%	0.703	-1.10	0.2708
	Discontinued	261	34%	0.63%	28%	0.50%	-6.1%			
Distal Risk Factors										
Overweight or Obesity Risk	Completed	42	86%	0.87%	79%	0.81%	-7.1%	1.059	0.21	0.8334
	Discontinued	261	99%	0.02%	89%	0.10%	-9.6%			
Weight (lbs)	Completed	42	218.2	6.6	221.0	7.0	2.83	5.182	1.29	0.1967
	Discontinued	261	234.1	2.5	231.8	2.7	-2.35			
Body Mass Index	Completed	42	34.8	0.9	35.1	1.0	0.29	0.810	1.23	0.2185
	Discontinued	261	37.1	0.3	36.6	0.4	-0.52			
Blood Pressure (BP) Risk*	Completed	42	24%	0.61%	7%	0.21%	-16.7%	1.428	1.63	0.1039
	Discontinued	261	16%	0.12%	16%	0.12%	0.8%			

Systolic BP (mmHg)*	Completed	42	129.2	2.5	122.3	2.2	-6.93	-7.909	-0.22	0.823
	Discontinued	261	122.8	1.0	123.7	0.9	0.98			
Diastolic BP (mmHg)	Completed	42	79.3	1.6	75.7	1.8	-3.65	-4.403	-1.83	0.0671
	Discontinued	261	76.4	0.6	77.2	0.7	0.76			
Glucose (mg/dL)	Completed	42	102.3	7.9	106.6	7.8	4.27	3.674	0.30	0.7659
	Discontinued	261	103.7	3.0	104.3	3.0	0.59			
Cholesterol Risk	Completed	42	24%	0.38%	21%	0.45%	-2.4%	0.874	-0.58	0.5629
	Discontinued	261	25%	0.10%	25%	0.40%	-0.5%			
Cholesterol (mg/dL)	Completed	42	174.3	7.8	175.7	7.6	1.47	5.122	0.43	0.6688
	Discontinued	261	183.1	3.0	179.5	3.0	-3.65			
HDL (mg/dL)	Completed	42	55.2	4.8	64.0	5.1	8.87	7.717	1.01	0.3117
	Discontinued	261	61.1	1.9	62.3	2.0	1.15			
LDL (mg/dL)	Completed	42	113.4	6.8	107.9	6.9	-5.49	-4.454	-0.43	0.6702
	Discontinued	261	105.4	2.6	104.4	2.7	-1.03			
Triglycerides (mg/dL)	Completed	42	166.5	15.6	129.0	16.9	-37.57	-44.029	-1.75	0.0807
	Discontinued	261	137.3	6.0	143.8	6.5	6.46			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.32

Smoking Cessation: All Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Participant	142	175.0	3.5	176.5	3.5	1.46	1.487	1.23	0.2198
	Non-part.	2505	181.4	0.8	181.4	0.8	-0.02			
Body Mass Index	Participant	142	26.3	0.5	26.5	0.5	0.19	0.190	0.95	0.3443
	Non-part.	2505	27.2	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Participant	142	122.1	1.2	122.2	1.2	0.14	-0.069	-0.04	0.9659
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Participant	142	76.6	0.8	74.8	0.8	-1.76	-1.739	-1.60	0.1099
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Participant	142	96.7	4.1	108.8	3.5	12.06	14.339	2.59	0.0096
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Participant	142	173.4	4.3	181.5	4.1	8.04	10.835	1.83	0.0675
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.79			
HDL (mg/dL)	Participant	142	66.1	2.6	69.8	2.7	3.68	2.255	0.59	0.5526
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Participant	142	105.6	3.4	110.4	3.6	4.79	4.947	0.99	0.3235
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.15			
Triglycerides (mg/dL)	Participant	142	125.9	7.8	139.6	8.6	13.76	5.595	0.46	0.6428
	Non-part.	2505	132.2	1.8	140.4	2.0	8.16			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.33

Smoking Cessation: Mail Participants versus Non-participants

			PRE		POST					
	Participant Group	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Mail part.	31	160.7	7.6	161.7	7.6	1.00	1.022	0.40	0.6871
	Non-part.	2505	181.5	0.8	181.4	0.8	-0.03			
Body Mass Index	Mail part.	31	24.8	1.0	24.6	1.0	-0.12	-0.127	-0.30	0.7628
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Mail part.	31	122.7	2.6	123.8	2.5	1.11	0.893	0.27	0.7908
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Mail part.	31	76.1	1.7	71.7	1.7	-4.37	-4.347	-1.92	0.0546
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Mail part.	31	102.6	9.0	120.6	7.4	18.00	20.276	1.74	0.0817
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.27			
Cholesterol (mg/dL)	Mail part.	31	182.8	9.1	174.6	8.9	-8.19	-5.387	-0.43	0.6650
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Mail part.	31	57.2	5.6	63.1	5.7	5.88	4.459	0.56	0.5766
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Mail part.	31	105.2	7.2	106.0	7.9	0.76	0.924	0.09	0.9309
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Mail part.	31	96.2	16.3	103.1	18.5	6.90	-1.221	-0.05	0.9609
	Non-part.	2505	132.2	1.8	140.3	2.0	8.12			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.34

Smoking Cessation: Internet Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet part.	45	167.9	6.4	169.3	6.4	1.33	1.351	0.63	0.5270
	Non-part.	2505	181.5	0.8	181.4	0.8	-0.02			
Body Mass Index	Internet part.	45	25.4	0.8	25.5	0.8	0.14	0.139	0.39	0.6948
	Non-part.	2505	27.2	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Internet part.	45	120.9	2.2	120.7	2.1	-0.24	-0.451	-0.16	0.8732
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Internet part.	45	76.9	1.5	74.2	1.5	-2.75	-2.731	-1.43	0.1525
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Internet part.	45	88.2	7.5	104.7	6.2	16.57	18.836	1.93	0.0537
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.27			
Cholesterol (mg/dL)	Internet part.	45	176.0	7.7	190.8	7.4	14.75	17.550	1.69	0.0918
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Internet part.	45	69.5	4.7	73.0	4.8	3.47	2.054	0.31	0.7581
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Internet part.	45	109.6	6.0	112.7	6.2	3.04	3.201	0.37	0.7119
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Internet part.	45	121.1	13.8	172.9	15.4	51.85	43.749	2.08	0.0374
	Non-part.	2505	132.2	1.8	140.3	2.0	8.10			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.35

Smoking Cessation: Telephone Participants versus Non-participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)*	Telephone part.	66	184.9	5.2	186.6	5.2	1.68	1.713	0.98	0.3296
	Non-part.	2505	181.5	0.8	181.5	0.9	-0.03			
Body Mass Index	Telephone part.	66	27.7	0.7	28.1	0.7	0.36	0.354	1.22	0.2233
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Telephone part.	66	122.4	1.8	122.3	1.7	-0.09	-0.302	-0.13	0.8967
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Telephone part.	66	76.4	1.2	76.7	1.2	0.22	0.238	0.15	0.8791
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Telephone part.	66	99.9	6.1	105.8	5.1	5.95	8.221	1.03	0.3051
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.27			
Cholesterol (mg/dL)	Telephone part.	66	167.4	6.2	178.7	6.0	11.33	14.133	1.67	0.0952
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Telephone part.	66	68.0	3.8	71.0	3.9	2.96	1.541	0.28	0.7778
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Telephone part.	66	103.2	4.9	111.5	5.1	8.34	8.505	1.19	0.2348
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Telephone part.	66	142.0	11.4	135.0	12.5	-7.06	-15.151	-0.87	0.3821
	Non-part.	2505	132.2	1.8	140.3	2.0	8.09			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.36

Smoking Cessation: Telephone or Internet versus Mail Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet or Tele.	111	175.9	3.3	177.6	3.5	1.66	0.551	0.23	0.8206
	Mail	31	165.9	6.3	167.0	6.7	1.11			
Body Mass Index	Internet or Tele.	111	26.7	0.5	27.0	0.5	0.27	0.288	0.70	0.4859
	Mail	31	24.8	0.9	24.8	0.9	-0.02			
Systolic BP (mmHg)	Internet or Tele.	111	121.6	1.5	121.6	1.6	-0.08	-1.362	-0.33	0.7449
	Mail	31	123.0	2.9	124.3	3.1	1.28			
Diastolic BP (mmHg)	Internet or Tele.	111	76.7	1.0	75.7	1.1	-1.00	3.318	1.23	0.2182
	Mail	31	76.0	1.8	71.7	2.0	-4.32			
Glucose (mg/dL)	Internet or Tele.	111	95.0	2.6	105.3	4.6	10.27	-7.717	-0.69	0.4898
	Mail	31	103.1	4.9	121.0	8.6	17.99			
Cholesterol (mg/dL)	Internet or Tele.	111	170.4	4.5	183.6	5.0	13.24	22.582	1.56	0.1198
	Mail	31	183.5	8.5	174.1	9.6	-9.34			
HDL (mg/dL)	Internet or Tele.	111	68.7	2.8	71.6	3.1	2.90	-3.577	-0.41	0.6827
	Mail	31	57.0	5.4	63.5	5.9	6.48			
LDL (mg/dL)	Internet or Tele.	111	106.0	3.9	111.9	5.3	5.85	4.205	0.30	0.7665
	Mail	31	104.1	7.4	105.8	10.5	1.65			
Triglycerides (mg/dL)	Internet or Tele.	111	134.4	9.6	148.9	10.3	14.56	-2.381	-0.08	0.9398
	Mail	31	92.3	18.3	109.3	20.1	16.94			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.37

Smoking Cessation: Telephone versus Internet versus Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Telephone	66	185.2	4.8	186.8	5.0	1.60	-0.087	-0.04	0.9719
	Internet	45	166.5	5.8	168.1	6.2	1.69			
Body Mass Index	Telephone	66	27.7	0.6	28.1	0.6	0.35	0.166	0.41	0.6782
	Internet	45	25.3	0.8	25.4	0.7	0.19			
Systolic BP (mmHg)*	Telephone	66	122.4	2.0	122.4	2.0	0.00	0.243	0.06	0.9498
	Internet	45	121.0	2.4	120.7	2.5	-0.25			
Diastolic BP (mmHg)*	Telephone	66	76.4	1.2	76.7	1.4	0.24	3.015	1.15	0.2530
	Internet	45	77.0	1.4	74.2	1.7	-2.77			
Glucose (mg/dL)*	Telephone	66	99.8	3.0	105.7	5.6	5.90	-10.921	-1.05	0.2947
	Internet	45	88.1	3.7	105.0	6.8	16.82			
Cholesterol (mg/dL)	Telephone	66	166.8	5.7	179.5	6.6	12.68	-0.574	-0.04	0.9670
	Internet	45	176.3	7.1	189.5	8.1	13.25			
HDL (mg/dL)*	Telephone	66	68.4	3.6	70.5	4.1	2.04	-2.578	-0.31	0.7571
	Internet	45	69.0	4.4	73.6	5.1	4.62			
LDL (mg/dL)	Telephone	66	103.3	5.2	111.5	7.1	8.21	5.257	0.40	0.6877
	Internet	45	109.4	6.3	112.3	8.7	2.95			
Triglycerides (mg/dL)	Telephone	66	141.7	13.5	134.1	14.4	-7.61	-60.830	-1.87	0.062
	Internet	45	121.3	16.7	174.5	17.7	53.22			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.38

Stress Management: All Participants versus Non-Participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Participant	114	172.9	3.6	173.8	3.7	0.88	0.904	0.66	0.5073
	Non-part.	2505	181.0	0.8	181.0	0.8	-0.02			
Body Mass Index	Participant	114	25.9	0.5	26.1	0.5	0.15	0.150	0.66	0.5094
	Non-part.	2505	27.2	0.1	27.2	0.1	0.00			
Systolic BP (mmHg)	Participant	114	121.1	1.4	124.2	1.3	3.09	2.889	1.59	0.1111
	Non-part.	2505	122.8	0.3	123.0	0.3	0.20			
Diastolic BP (mmHg)	Participant	114	76.9	0.9	76.5	0.9	-0.38	-0.362	-0.30	0.7656
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Participant	114	106.9	4.7	102.9	3.8	-3.97	-1.691	-0.27	0.7837
	Non-part.	2505	105.1	1.0	102.8	0.8	-2.27			
Cholesterol (mg/dL)	Participant	114	173.7	4.7	176.0	4.6	2.25	5.066	0.78	0.4361
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Participant	114	66.1	2.9	63.7	3.0	-2.41	-3.850	-0.92	0.3596
	Non-part.	2505	64.6	0.6	66.0	0.6	1.44			
LDL (mg/dL)	Participant	114	102.0	3.8	105.3	3.9	3.31	3.459	0.63	0.5286
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.15			
Triglycerides (mg/dL)	Participant	114	143.2	8.7	134.9	9.7	-8.32	-16.481	-1.22	0.2213
	Non-part.	2505	132.2	1.9	140.3	2.0	8.16			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.39

Stress Management: Internet Participants versus Non-Participants

	Grouping Variable	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet part.	44	163.9	6.4	165.3	6.4	1.35	1.374	0.64	0.5195
	Non-part.	2505	181.5	0.8	181.5	0.8	-0.02			
Body Mass Index	Internet part.	44	25.9	0.8	26.0	0.8	0.12	0.113	0.32	0.7493
	Non-part.	2505	27.2	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Internet part.	44	121.3	2.2	120.0	2.1	-1.29	-1.494	-0.53	0.5992
	Non-part.	2505	122.9	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Internet part.	44	74.4	1.5	74.7	1.4	0.35	0.372	0.19	0.8457
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.03			
Glucose (mg/dL)	Internet part.	44	110.6	7.6	99.8	6.2	-10.78	-8.491	-0.86	0.3883
	Non-part.	2505	105.1	1.0	102.8	0.8	-2.29			
Cholesterol (mg/dL)	Internet part.	44	180.1	7.7	178.7	7.4	-1.42	1.375	0.13	0.8947
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Internet part.	44	55.4	4.7	61.9	4.8	6.42	5.001	0.75	0.4535
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Internet part.	44	102.7	6.0	108.9	6.2	6.26	6.419	0.74	0.4596
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Internet part.	44	162.5	13.9	157.0	15.5	-5.52	-13.625	-0.64	0.5200
	Non-part.	2505	132.2	1.8	140.3	2.1	8.11			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.40

Stress Management: Telephone Participants versus Non-Participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)*	Telephone part.	52	163.3	5.9	163.4	5.9	0.08	0.105	0.05	0.9580
	Non-part.	2505	181.5	0.8	181.5	0.8	-0.02			
Body Mass Index	Telephone part.	52	25.7	0.7	25.7	0.8	0.01	0.010	0.03	0.9755
	Non-part.	2505	27.2	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Telephone part.	52	121.1	2.0	123.0	2.0	1.88	1.671	0.64	0.5237
	Non-part.	2505	122.8	0.3	123.1	0.3	0.21			
Diastolic BP (mmHg)	Telephone part.	52	78.1	1.4	76.5	1.3	-1.65	-1.626	-0.92	0.3595
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Telephone part.	52	104.7	6.9	102.1	5.7	-2.56	-0.282	-0.03	0.9751
	Non-part.	2505	105.1	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Telephone part.	52	169.8	7.0	175.3	6.8	5.47	8.280	0.87	0.3842
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Telephone part.	52	70.6	4.3	62.5	4.4	-8.10	-9.534	-1.54	0.1224
	Non-part.	2505	64.6	0.6	66.0	0.6	1.44			
LDL (mg/dL)	Telephone part.	52	103.0	5.6	100.2	5.7	-2.81	-2.652	-0.33	0.7400
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.15			
Triglycerides (mg/dL)	Telephone part.	52	120.6	12.7	116.2	14.0	-4.44	-12.541	-0.65	0.5155
	Non-part.	2505	132.2	1.8	140.3	2.0	8.10			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.41

Stress Management: Internet or Telephone versus Mail Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Internet or tele.	96	162.7	3.4	163.7	3.4	0.93	-0.693	-0.18	0.8549
	Mail	18	163.4	7.8	165.0	7.9	1.63			
Body Mass Index	Internet or tele.	96	25.7	0.5	25.8	0.5	0.10	-0.534	-0.78	0.4346
	Mail	18	25.5	1.1	26.1	1.1	0.63			
Systolic BP (mmHg)	Internet or tele.	96	120.6	1.7	120.8	1.7	0.16	-17.127	-3.08	0.0021
	Mail	18	120.6	4.1	137.9	3.9	17.28			
Diastolic BP (mmHg)*	Internet or tele.	96	76.4	1.2	75.5	1.1	-0.92	-3.407	-0.83	0.4080
	Mail	18	79.6	2.8	82.0	2.6	2.49			
Glucose (mg/dL)*	Internet or tele.	96	108.0	3.9	101.5	4.2	-6.50	-15.707	-1.11	0.2682
	Mail	18	102.9	9.0	112.1	9.8	9.21			
Cholesterol (mg/dL)*	Internet or tele.	96	174.6	4.6	177.0	4.3	2.39	1.723	0.11	0.9118
	Mail	18	170.6	10.5	171.2	9.9	0.67			
HDL (mg/dL)*	Internet or tele.	96	63.8	3.3	62.6	3.3	-1.19	5.947	0.54	0.5927
	Mail	18	77.7	7.7	70.6	7.6	-7.14			
LDL (mg/dL)*	Internet or tele.	96	102.6	4.6	104.6	4.8	2.00	-10.296	-0.61	0.5413
	Mail	18	96.8	10.6	109.1	11.2	12.29			
Triglycerides (mg/dL)*	Internet or tele.	96	137.3	11.3	136.0	12.0	-1.29	34.987	0.79	0.4305
	Mail	18	162.4	26.4	126.1	28.0	-36.28			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.42

Stress Management: Telephone v Internet Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Telephone	52	163.0	4.9	163.6	4.8	0.61	-0.503	-0.16	0.8735
	Internet	44	163.8	5.4	164.9	5.2	1.12			
Body Mass Index	Telephone	52	25.5	0.6	25.6	0.6	0.09	0.014	0.03	0.9800
	Internet	44	25.9	0.6	26.0	0.7	0.07			
Systolic BP (mmHg)*	Telephone	52	120.6	2.4	123.0	2.0	2.36	4.545	1.07	0.2862
	Internet	44	120.7	2.6	118.5	2.2	-2.18			
Diastolic BP (mmHg)*	Telephone	52	78.2	1.6	76.4	1.5	-1.73	-1.867	-0.60	0.5517
	Internet	44	74.3	1.7	74.5	1.7	0.14			
Glucose (mg/dL)*	Telephone	52	106.3	5.7	101.5	4.6	-4.86	4.864	0.63	0.5330
	Internet	44	110.5	6.2	100.8	5.0	-9.73			
Cholesterol (mg/dL)*	Telephone	52	169.6	6.5	175.8	6.1	6.20	8.102	-1.61	0.1118
	Internet	44	180.4	7.1	178.5	6.7	-1.90			
HDL (mg/dL)*	Telephone	52	70.1	4.1	62.8	4.4	-7.35	-13.482	0.45	0.6573
	Internet	44	56.3	4.5	62.4	4.8	6.14			
LDL (mg/dL)*	Telephone	52	101.8	6.2	100.6	6.9	-1.17	-5.992	-0.44	0.6581
	Internet	44	103.6	6.8	108.4	7.5	4.82			
Triglycerides (mg/dL)*	Telephone	52	120.9	16.0	116.8	17.0	-4.10	0.226	0.01	0.9952
	Internet	44	161.9	17.4	157.6	18.5	-4.33			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.43

Back Care: All Participants versus Non-Participants

	Participant Group	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Participant	141	177.8	3.4	176.8	3.5	-1.01	-0.997	-0.82	0.4095
	Non-part.	2505	181.3	0.8	181.3	0.8	-0.02			
Body Mass Index	Participant	141	26.8	0.5	26.7	0.5	-0.15	-0.153	-0.76	0.4454
	Non-part.	2505	27.2	0.1	27.3	0.1	0.01			
Systolic BP (mmHg)	Participant	141	122.8	1.2	125.5	1.2	2.68	2.462	1.52	0.1295
	Non-part.	2505	122.9	0.3	123.1	0.3	0.22			
Diastolic BP (mmHg)	Participant	141	77.5	0.8	77.7	0.8	0.21	0.225	0.21	0.8368
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Participant	141	103.6	4.2	105.1	3.5	1.51	3.793	0.68	0.4973
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.28			
Cholesterol (mg/dL)	Participant	141	183.0	4.3	185.3	4.1	2.31	5.113	0.87	0.3861
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Participant	141	63.3	2.6	68.1	2.7	4.76	3.332	0.87	0.3818
	Non-part.	2505	64.6	0.6	66.0	0.6	1.43			
LDL (mg/dL)	Participant	141	106.0	3.4	102.1	3.4	-3.96	-3.827	-0.77	0.4393
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.14			
Triglycerides (mg/dL)	Participant	141	137.5	7.8	144.9	8.7	7.32	-0.899	-0.07	0.9405
	Non-part.	2505	132.2	1.8	140.4	2.1	8.22			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.44

Back Care: Mail Participants versus Non-Participants

			PRE		POST					
	Participant Group	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Mail part.	83	177.5	4.6	175.2	4.6	-2.32	-2.301	-1.47	0.1414
	Non-part.	2505	181.4	0.8	181.4	0.8	-0.02			
Body Mass Index	Mail part.	83	26.7	0.6	26.3	0.6	-0.39	-0.396	-1.53	0.1258
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Mail part.	83	122.0	1.6	125.2	1.6	3.19	2.978	1.43	0.1533
	Non-part.	2505	122.9	0.3	123.1	0.3	0.22			
Diastolic BP (mmHg)	Mail part.	83	78.5	1.1	78.4	1.1	-0.15	-0.131	-0.09	0.9256
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Mail part.	83	103.3	5.5	104.7	4.5	1.42	3.685	0.51	0.6106
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.26			
Cholesterol (mg/dL)	Mail part.	83	190.3	5.6	186.5	5.4	-3.76	-0.964	-0.13	0.8997
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.80			
HDL (mg/dL)	Mail part.	83	58.9	3.4	70.4	3.5	11.49	10.070	2.05	0.0402
	Non-part.	2505	64.6	0.6	66.0	0.6	1.42			
LDL (mg/dL)	Mail part.	83	102.4	4.4	101.4	4.5	-0.98	-0.821	-0.13	0.8971
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Mail part.	83	141.5	10.1	150.6	11.2	9.15	0.979	0.06	0.9494
	Non-part.	2505	132.2	1.8	140.4	2.0	8.17			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.45

Back Care: Telephone Participants versus Non-Participants

	Grouping Variable	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)*	Telephone part.	58	171.6	5.5	172.7	5.6	1.14	1.167	0.63	0.5307
	Non-part.	2505	181.5	0.8	181.5	0.8	-0.03			
Body Mass Index	Telephone part.	58	26.8	0.7	27.1	0.7	0.22	0.219	0.71	0.4762
	Non-part.	2505	27.3	0.1	27.3	0.1	0.00			
Systolic BP (mmHg)	Telephone part.	58	124.2	1.9	126.0	1.9	1.79	1.574	0.64	0.5251
	Non-part.	2505	122.8	0.3	123.1	0.3	0.22			
Diastolic BP (mmHg)	Telephone part.	58	75.9	1.3	76.7	1.3	0.79	0.810	0.49	0.6273
	Non-part.	2505	76.6	0.2	76.6	0.2	-0.02			
Glucose (mg/dL)	Telephone part.	58	104.5	6.6	106.0	5.4	1.50	3.783	0.44	0.6584
	Non-part.	2505	105.0	1.0	102.8	0.8	-2.29			
Cholesterol (mg/dL)	Telephone part.	58	173.0	6.6	183.9	6.4	10.86	13.662	1.52	0.1296
	Non-part.	2505	183.4	1.0	180.6	1.0	-2.81			
HDL (mg/dL)	Telephone part.	58	69.4	4.1	64.0	4.1	-5.41	-6.847	-1.17	0.2424
	Non-part.	2505	64.6	0.6	66.0	0.6	1.44			
LDL (mg/dL)	Telephone part.	58	110.8	5.3	103.7	5.4	-7.18	-7.016	-0.92	0.3577
	Non-part.	2505	104.2	0.8	104.0	0.8	-0.16			
Triglycerides (mg/dL)	Telephone part.	58	130.6	12.1	135.7	13.4	5.12	-3.017	-0.16	0.8695
	Non-part.	2505	132.2	1.8	140.4	2.0	8.13			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.46

Back Care: Telephone versus Mail Participants

	Participant Modality	N	PRE Prev HR/ Mean	PRE Std Error	POST Prev HR/ Mean	POST Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Distal Risk Factors										
Weight (lbs)	Telephone part.	58	173.9	4.2	174.9	4.1	1.03	3.104	1.78	0.0755
	Mail part.	83	174.2	3.5	172.2	3.4	-2.08			
Body Mass Index	Telephone part.	58	26.8	0.6	27.1	0.6	0.22	0.549	1.99	0.0467
	Mail part.	83	26.6	0.5	26.3	0.5	-0.33			
Systolic BP (mmHg)	Telephone part.	58	123.5	1.9	125.7	2.3	2.16	-1.187	-0.32	0.7485
	Mail part.	83	122.0	1.6	125.4	1.9	3.35			
Diastolic BP (mmHg)*	Telephone part.	58	75.7	1.4	76.5	1.3	0.84	0.958	0.42	0.6741
	Mail part.	83	78.6	1.2	78.5	1.1	-0.12			
Glucose (mg/dL)	Telephone part.	58	104.2	5.6	106.1	6.0	1.91	0.943	0.09	0.9306
	Mail part.	83	103.4	4.7	104.4	5.0	0.97			
Cholesterol (mg/dL)*	Telephone part.	58	172.6	6.1	183.8	7.3	11.23	14.986	1.25	0.2120
	Mail part.	83	190.2	5.1	186.5	6.0	-3.75			
HDL (mg/dL)	Telephone part.	58	69.9	4.1	64.5	4.5	-5.37	-17.318	-2.24	0.0253
	Mail part.	83	58.6	3.4	70.6	3.8	11.94			
LDL (mg/dL)	Telephone part.	58	111.6	5.3	103.5	5.0	-8.13	-7.778	-0.80	0.4258
	Mail part.	83	101.9	4.3	101.5	4.1	-0.36			
Triglycerides (mg/dL)	Telephone part.	58	129.2	12.1	138.3	15.8	9.15	-0.902	-0.04	0.9720
	Mail part.	83	140.9	10.1	151.0	13.1	10.05			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets.

Table 4.47

Telephone Participants who Completed versus Discontinued the Program

			PRE		POST					
	Program Status	N	Prev HR/ Mean	Std Error	Prev HR/ Mean	Std Error	Change	Odds of reduced risk/ B	Test Statistic	p-value
Proximal Risk Factors										
Excessive Alcohol Consumption Risk	Completed	81	1%	0.07%	1%	0.02%	0.0%	N/A	N/A	N/A
	Discontinued	531	6%	0.08%	4%	0.01%	-2.4%			
Poor Back Care Risk	Completed	81	58%	0.51%	49%	0.30%	-8.6%	0.873	-0.84	0.3987
	Discontinued	531	68%	0.12%	56%	0.08%	-12.2%			
Poor Nutrition Risk*	Completed	81	19%	1.79%	14%	1.34%	-4.9%	0.934	0.10	0.7476
	Discontinued	531	16%	0.65%	14%	0.57%	-1.9%			
Physical Inactivity Risk*	Completed	81	20%	0.21%	16%	0.06%	-3.7%	1.006	0.00	0.9719
	Discontinued	531	24%	0.08%	22%	0.03%	-1.5%			
Tobacco Use Risk*	Completed	81	4%	0.00%	1%	0.00%	-2.5%	0.903	0.07	0.7876
	Discontinued	531	5%	0.00%	3%	0.00%	-2.3%			
Elevated Stress Risk	Completed	81	26%	1.02%	22%	0.56%	-3.7%	1.251	1.72	0.1819
	Discontinued	531	27%	0.34%	25%	0.20%	-2.1%			
Depression Risk	Completed	81	19%	1.20%	21%	1.11%	2.5%	0.794	-1.02	0.3068
	Discontinued	531	33%	0.53%	29%	0.41%	-3.6%			
Distal Risk Factors										
Overweight or Obesity Risk	Completed	81	52%	0.04%	48%	0.06%	-3.7%	1.099	0.39	0.6935
	Discontinued	531	61%	0.01%	59%	0.01%	-1.5%			
Weight (lbs)	Completed	81	196.8	5.48	198.5	5.49	1.65	1.912	0.80	0.4224
	Discontinued	531	206.7	2.10	206.4	2.10	-0.26			
Body Mass Index	Completed	81	31.0	0.81	31.2	0.80	0.20	0.319	0.82	0.4101
	Discontinued	531	32.4	0.31	32.3	0.31	-0.12			
Blood Pressure (BP) Risk	Completed	81	26%	0.18%	14%	0.01%	-12.3%	1.380	2.04	0.0415
	Discontinued	531	16%	0.04%	17%	0.00%	0.8%			
Systolic BP (mmHg)*	Completed	81	127.2	1.80	122.3	1.67	-4.95	-4.858	-1.95	0.0517
	Discontinued	531	123.7	0.70	123.6	0.65	-0.09			

Diastolic BP (mmHg)	Completed	81	79.8	1.19	76.9	1.24	-2.94	-2.804	-1.93	0.0545
	Discontinued	531	77.0	0.46	76.9	0.48	-0.13			
Glucose (mg/dL)	Completed	81	102.7	5.13	100.2	5.05	-2.52	-2.561	-0.32	0.7464
	Discontinued	531	104.9	1.97	104.9	1.94	0.04			
Cholesterol Risk	Completed	81	26%	0.53%	21%	0.33%	-4.9%	0.925	-0.48	0.6324
	Discontinued	531	23%	0.14%	24%	0.21%	0.5%			
Cholesterol (mg/dL)	Completed	81	175.9	5.42	171.9	5.06	-4.00	-0.818	-0.10	0.9164
	Discontinued	531	181.6	2.08	178.4	1.95	-3.18			
HDL (mg/dL)	Completed	81	56.1	3.62	63.1	3.71	7.05	6.457	1.18	0.2361
	Discontinued	531	64.4	1.37	65.0	1.40	0.59			
LDL (mg/dL)	Completed	81	108.0	4.79	103.0	4.96	-5.04	-2.011	-0.27	0.7857
	Discontinued	531	106.7	1.85	103.6	1.91	-3.03			
Triglycerides (mg/dL)	Completed	81	145.6	11.54	115.1	11.90	-30.55	-31.294	-1.74	0.0821
	Discontinued	531	140.1	4.43	140.9	4.57	0.74			

Note. "Prev HR" indicates the prevalence of high risk; "Prev HR" and "Odds of reduced risk" apply to the categorical variables (i.e., the risk variables) and "Mean" and "β" apply to the continuous variables (i.e., non-risk variables); Unless otherwise noted by the variable name with an "*," the test statistic is a t-statistic. If there is a "*" by the variable name, then the test statistic is a Wald chi-square from a logistic regression in a single imputation dataset since there was no variance across the datasets. "N/A" indicates not applicable due to a quasi-separation of data points with no participants in the completed group decreasing their excessive alcohol consumption risk.

Table 4.48
Completed Cost Inventory

Cost Category	Cost Item	Source	Year 2007 Cost / unit	Unit	# of Units	Total	# of Parts	Total PP
Lifestyle Management Program Fees	Telephone	Vendor	$195.00	Participant	1	$195.00	1	$195.00
	Internet		$45.00	Participant	1	$45.00	1	$45.00
	Mail		$65.00	Participant	1	$65.00	1	$65.00
Incentive Costs	Points for registration	Vendor	$0.0025	Points	2,000	$5.00	1	$5.00
	Points for completion		$0.0025	Points	2,000	$5.00	1	$5.00
Consulting Fees	Hours on strategic design and program implementation	Consultant	$195.92	Hour	14.3	$2,802.34	2,688	$1.04
Administrative Fees	Implementation of data feed layout	Vendor invoices	$2,463.55†	Equivalent Annual	0.5	$1,231.78	2,688	$0.46
	Data feeds from HM vendors		$455.00	Quarterly feeds	4	$1,820.00	2,688	$0.68

Note. Costs are expressed in 2007 dollars and are not discounted; "Parts" indicates participants; †The equivalent annual cost (*E*) for the capital outlay was calculated using the annuitization procedure defined as $E = \frac{K-(S/(1+r)^n)}{A(n,r)}$ where *K* is the initial outlay ($11,000), *S* is the resale value ($0), *r* is the discount rate (6%), *n* is the useful life of the technology (5 years), and *A(n,r)* is the annuity factor given the cost is payable in advance (4.4651) (Drummond et al., 2007).

Table 4.49

Program Cost Calculations

Modality	Cost Type		Cost
All Modalities	PP Fixed Costs	Consulting Cost	$1.04
		Administrative Cost	$1.14
	PP Variables Costs	Program Cost	$133.20
		Incentive Cost	$6.35
	PP Total Costs		$141.73
	Discounted PP Total Cost		$137.66
Mail	PP Fixed Costs	Consulting Cost	$1.04
		Administrative Cost	$1.14
	PP Variables Costs	Program Cost	$125.00
		Incentive Cost	$9.90
	PP Total Costs		$137.08
	Discounted PP Total Cost		$133.15
Internet	PP Fixed Costs	Consulting Cost	$1.04
		Administrative Cost	$1.14
	PP Variables Costs	Program Cost	$93.61
		Incentive Cost	$5.11
	PP Total Costs		$100.90
	Discounted PP Total Cost		$98.00
Telephone	PP Fixed Costs	Consulting Cost	$1.04
		Administrative Cost	$1.14
	PP Variables Costs	Program Cost	$375.00
		Incentive Cost	$5.22
	PP Total Costs		$382.40
	Discounted PP Total Cost		$371.42
Telephone - completed program	PP Fixed Costs	Consulting Cost	$1.04
		Administrative Cost	$1.14
	PP Variables Costs	Program Cost	$370.50
		Incentive Cost	$7.00
	PP Total Costs		$379.68
	Discounted PP Total Cost		$368.78
Telephone - discontinued program	PP Fixed Costs	Consulting Cost	$1.04
		Administrative Cost	$1.14
	PP Variables Costs	Program Cost	$375.56
		Incentive Cost	$5.00
	PP Total Costs		$382.73
	Discounted PP Total Cost		$371.74

Note. "PP" indicates per participant cost; All costs are in 2007 US dollars.

Table 4.50

Estimated Changes in Program Cost, including outliers

		N*	Estimate**	LB 95% CI	UB 95% CI	t-value	p-value
12 month follow-up, including outliers							
Participant v Non-participant (ref)	LM (any modality) participant	2152	$20.05	-$17.86	$57.96	1.04	0.3000
	Month		$3.38	$0.12	$6.65	2.03	0.0420
	Participant x Month		-$3.19	-$8.82	$2.45	-1.11	0.2675
Mail participant v Non-participant (ref)	Mail participant	1618	-$24.71	-$52.71	$3.29	-1.73	0.0837
	Month		$3.69	$0.54	$6.85	2.29	0.0218
	Mail participant x Month		$3.61	-$2.46	$9.67	1.17	0.2440
Internet participant v Non-participant (ref)	Internet participant	1646	$1.98	-$57.07	$61.03	0.07	0.9476
	Month		$3.70	$0.59	$6.80	2.33	0.0196
	Internet participant x Month		-$0.59	-$7.69	$6.52	-0.16	0.8717
Telephone participant v Non-participant (ref)	Telephone participant	1860	$88.56	$17.24	$159.88	2.43	0.0149
	Month		$3.49	$0.16	$6.83	2.05	0.0401
	Telephone participant x Month		-$9.01	-$17.19	-$0.84	-2.16	0.0307
Internet or Telephone v Mail (ref) participant	Internet or Telephone participant	666	$87.12	$28.83	$145.42	2.93	0.0034
	Month		$7.36	$2.06	$12.67	2.72	0.0065
	Internet or Tele. part. x Month		-$9.23	-$17.57	-$0.89	-2.17	0.0301
Telephone v Internet (ref) participant	Telephone participant	534	$106.74	$24.76	$188.73	2.55	0.0107
	Month		$4.40	-$1.23	$10.03	1.53	0.1257
	Telephone participant x Month		-$8.19	-$18.02	$1.63	-1.63	0.1022
Completed v Discontinued (ref) participant	Completed participant	374	-$123.78	-$246.12	-$1.44	-1.98	0.0474
	Month		-$4.70	-$16.65	$7.25	-0.77	0.4406
	Completed participant x Month		$1.62	-$12.34	$15.58	0.23	0.8201
22 month follow-up, including outliers							
Participant v Non-participant (ref)	LM (any modality) participant	2152	-$7.03	-$47.41	$33.35	-0.34	0.7331
	Month		$2.70	$0.58	$4.81	2.5	0.0125

	Participant x Month		$2.86	-$3.32	$9.04	0.91	0.3638
Mail participant v Non-participant (ref)	Mail participant	1618	-$19.17	-$58.05	$19.72	-0.97	0.3340
	Month		$3.46	$1.28	$5.64	3.11	0.0019
	Mail participant x Month		$2.03	-$2.90	$6.96	0.81	0.4193
Internet participant v Non-participant (ref)	Internet participant	1646	-$25.25	-$92.80	$42.30	-0.73	0.4638
	Month		$3.16	$0.95	$5.37	2.8	0.0051
	Internet participant x Month		$6.30	-$7.76	$20.36	0.88	0.3800
Telephone participant v Non-participant (ref)	Telephone participant	1860	$50.02	-$11.92	$111.96	1.58	0.1135
	Month		$3.00	$0.72	$5.27	2.58	0.0099
	Telephone participant x Month		-$1.37	-$5.90	$3.17	-0.59	0.5547
Internet or Telephone v Mail (ref) participant	Internet or Telephone participant	666	$53.59	-$0.19	$107.37	1.95	0.0508
	Month		$5.96	$1.57	$10.34	2.66	0.0077
	Internet or Tele. part. x Month		-$0.65	-$9.24	$7.94	-0.15	0.8822
Telephone v Internet (ref) participant	Telephone participant	534	$96.95	$22.46	$171.44	2.55	0.0107
	Month		$11.06	-$2.36	$24.48	1.62	0.1063
	Telephone participant x Month		-$9.82	-$23.78	$4.14	-1.38	0.1681
Completed v Discontinued (ref) participant	Completed participant	374	-$120.89	-$226.99	-$14.79	-2.23	0.0255
	Month		-$1.33	-$6.82	$4.17	-0.47	0.6365
	Completed participant x Month		$6.34	-$1.18	$13.86	1.65	0.0983

Note. *N = 1,486 for non-participants, 132 for mail participants, 160 for Internet participants, and 374 for telephone participants; **Estimate is not discounted; "LB" indicates lower bound; "UB" indicates upper bound; "CI" indicates confidence interval; "v" indicates versus; "ref" indicates reference group; costs are expressed as per participant per month (PPPM).

Table 4.51

Estimated Changes in Program Cost, excluding outliers (trimming method)

		N*	Estimate**	LB 95% CI	UB 95% CI	t-value	p-value
12 month follow-up, excluding outliers							
Participant v Non-participant (ref)	LM (any modality) participant	2152	$21.72	-$7.71	$51.15	1.45	0.1481
	Month		$2.31	$0.17	$4.46	2.11	0.0348
	Participant x Month		-$2.24	-$6.79	$2.31	-0.96	0.3350
Mail participant v Non-participant (ref)	Mail participant	1618	-$6.72	-$32.51	$19.08	-0.51	0.6099
	Month		$2.61	$0.47	$4.74	2.39	0.0169
	Mail participant x Month		$3.38	-$2.01	$8.78	1.23	0.2192
Internet participant v Non-participant (ref)	Internet participant	1646	-$11.55	-$40.59	$17.49	-0.78	0.4357
	Month		$2.54	$0.39	$4.70	2.31	0.0207
	Internet participant x Month		$1.65	-$3.73	$7.04	0.6	0.5473
Telephone participant v Non-participant (ref)	Telephone participant	1860	$70.30	$16.61	$123.99	2.57	0.0103
	Month		$2.22	$0.07	$4.38	2.02	0.0433
	Telephone participant x Month		-$7.70	-$13.69	-$1.70	-2.52	0.0118
Internet or Telephone v Mail (ref) participant	Internet or Telephone participant	666	$55.81	$7.03	$104.59	2.24	0.0249
	Month		$4.52	-$0.89	$9.93	1.64	0.1013
	Internet or Tele. part. x Month		-$5.57	-$13.11	$1.97	-1.45	0.1478
Telephone v Internet (ref) participant	Telephone participant	534	$101.43	$38.10	$164.75	3.14	0.0017
	Month		$3.87	-$1.39	$9.12	1.44	0.1492
	Telephone participant x Month		-$7.88	-$16.45	$0.68	-1.8	0.0713
Completed v Discontinued (ref) participant	Completed participant	374	-$106.53	-$206.59	-$6.47	-2.09	0.0369
	Month		-$5.42	-$15.06	$4.22	-1.1	0.2703
	Completed participant x Month		$0.36	-$12.61	$13.34	0.05	0.9562
22 month follow-up, excluding outliers							
Participant v Non-participant (ref)	LM (any modality) participant	2152	$6.10	-$23.11	$35.31	0.41	0.6821
	Month		$1.97	$0.75	$3.19	3.17	0.0015

	Participant x Month		$0.93	-$2.32	$4.18	0.56	0.5746
Mail participant v Non-participant (ref)	Mail participant	1618	-$3.47	-$38.21	$31.28	-0.2	0.8449
	Month		$2.49	$1.10	$3.88	3.52	0.0004
	Mail participant x Month		$1.82	-$2.68	$6.31	0.79	0.4283
Internet participant v Non-participant (ref)	Internet participant	1646	-$23.15	-$57.07	$10.77	-1.34	0.1811
	Month		$2.25	$0.87	$3.62	3.21	0.0013
	Internet participant x Month		$3.17	-$3.10	$9.45	0.99	0.3219
Telephone participant v Non-participant (ref)	Telephone participant	1860	$43.69	-3.38667	90.76832	1.82	0.0689
	Month		$2.23	0.90131	3.55092	3.29	0.001
	Telephone participant x Month		-$1.48	-4.68831	1.72635	-0.91	0.3655
Internet or Telephone v Mail (ref) participant	Internet or Telephone participant	666	$28.11	-$22.06	$78.27	1.1	0.2721
	Month		$3.45	-$0.69	$7.60	1.63	0.1026
	Internet or Tele. part. x Month		-$0.77	-$6.38	$4.83	-0.27	0.7870
Telephone v Internet (ref) participant	Telephone participant	534	$89.59	$27.83	$151.35	2.84	0.0045
	Month		$6.03	-$0.49	$12.55	1.81	0.0698
	Telephone participant x Month		-$5.72	-$12.91	$1.47	-1.56	0.1191
Completed v Discontinued (ref) participant	Completed participant	374	-$110.98	-$196.16	-$25.79	-2.55	0.0107
	Month		-$1.61	-$5.36	$2.15	-0.84	0.4023
	Completed participant x Month		$7.52	-$0.62	$15.66	1.81	0.0701

Note. *N = 1,486 for non-participants, 132 for mail participants, 160 for Internet participants, and 374 for telephone participants; **Estimate is not discounted; "LB" indicates lower bound; "UB" indicates upper bound; "CI" indicates confidence interval; "v" indicates versus; "ref" indicates reference group; costs are expressed as per participant per month (PPPM).

Table 4.52
Summary Measures Calculations

	PV Program Costs	PV Program Benefits Analytic Horizon		Summary Measures 12 month horizon		22 month horizon	
		12 month	22 month	ROI	NPV	ROI	NPV
Including outliers							
All modalities	$137.66	-$37.14	$57.59	--	--	--	--
Mail	$74.92	$42.03	$73.94	--	--	--	--
Internet	$50.71	-$6.82	$67.49	--	--	--	--
Phone	$197.00	-$105.07	$64.00	$0.53	-$91.93	--	--
Completers	$201.23	--	--	--	--	--	--
Discontinuers	$196.37	--	--	--	--	--	--
Internet or Telephone versus Mail	$79.61	-$107.55	$127.32	$1.35	$27.94	--	--
Telephone versus Internet	$146.29	-$95.51	$236.35	--	--	--	--
Completers versus Discontinuers	$4.86	$18.88	-$28.32	--	--	--	--
Excluding outliers (trimming method)							
All modalities	$137.66	-$26.10	$42.16	--	--	--	--
Mail	$74.92	$39.44	$53.21	--	--	--	--
Internet	$50.71	$19.26	$48.05	--	--	--	--
Phone	$197.00	-$89.71	$47.57	$0.46	-$107.29	--	--
Completers	$201.23	--	--	--	--	--	--
Discontinuers	$196.37	--	--	--	--	--	--
Internet or Telephone versus Mail	$79.61	-$64.90	$73.80	--	--	--	--
Telephone versus Internet	$146.29	-$91.88	$128.91	--	--	--	--
Completers versus Discontinuers	$4.86	$4.24	-$34.30	--	--	--	--

Note. All costs are per participant (PP) and are in 2007 US dollars; "ROI" indicates return on investment; "NPV" indicates net present value; "—" indicates that there was no significant change in the program benefits; therefore, not ROI or NPV was calculated

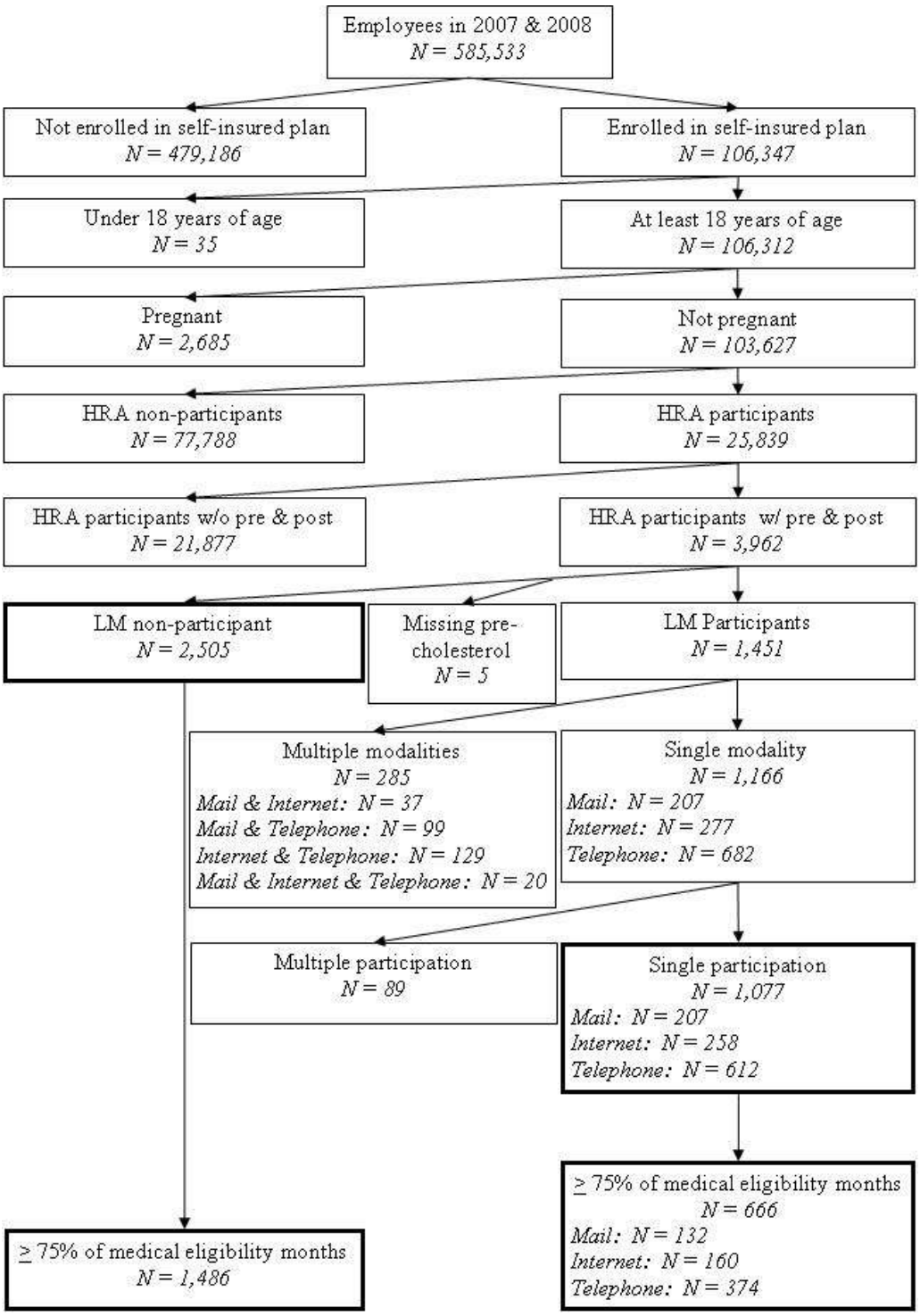

Figure 4.1. Participant flow chart

Note. Bolded boxes represent sample used in analyses. The "single modality" and "non-participant" samples were used to test AIMS 1 & 2 and the "≤ 75% of medical eligibility months" population was used to test AIM 3.

CHAPTER 5 – DISCUSSION & IMPLICATIONS

Discussion

Impact of Modality on Health Risks

Proximal Health Risks for Participants versus Non-participants

There was only partial support for the set of hypotheses proposed in AIM 1 of this study. When examining the proximal risk factors (poor nutrition, poor back care, excessive alcohol consumption, physical inactivity, tobacco use, elevated stress, and depression), the mail participants and the Internet participants both significantly reduced their risk on a few risk factors (physical inactivity and elevated stress) compared to non-participants. The mail participants also were more likely to reduce their risk of poor back care compared to non-participants, but the Internet participants did not since the program did not have a module for poor back care. The telephone participants significantly decreased their risk on all proximal risk factors with the exception of a strong, though not significant, trend for the reduction of poor nutrition risk.

Telephone modality. The success of the participants in the telephone modality at reducing their proximal risk factors compared to non-participants provides evidence that the telephonic program is an effective means of creating change in proximal risk factors. The program was also effective at reducing the prevalence of high cholesterol risk and levels of triglycerides. These results are consistent with those found by Gold and colleagues (2000) in their evaluation of the same telephonic LM program. They found that the intervention was effective at reducing the odds of being high risk for poor back care, poor eating, depression risk, elevated stress risk, tobacco use, and high cholesterol risk as well as the total number of

participants' risk factors (Gold et al., 2000). Similarly, this study found that there were no changes in overweight or obesity risk. These findings are also supported by a large amount of research in the topic areas of physical activity (Chen et al., 1998; Eakin et al., 2007; Green et al., 2002; Williams et al., 2008), nutrition (Eakin et al., 2007; Pierce et al., 2007; VanWormer et al., 2006) and smoking cessation (McBride & Rimer, 1999; Parker et al., 2007; Stead et al., 2004; Valery et al., 2008).

The present study further showed that the telephonic intervention was successful at reducing the risk for high blood pressure and excessive alcohol consumption, outcomes that were not covered by Gold and colleagues (2000) study and that were found to have no significant changes in another, unpublished, study of this intervention (Health Management Vendor, 2009). This study also differed from the vendor study in that it found no significant changes in high cholesterol risk (Gold et al., 2000). The study by Gold and colleagues (2000) is one of a limited number of published studies regarding the effectiveness of telephonic programs at reducing levels of high cholesterol (DeBusk et al., 1994; Hyman et al., 1996; Wilson, 1991); therefore, the results from this study do not run counter to a well established literature base and, in fact, contribute to the limited literature base. Aside from the study by Gold and colleagues (Gold et al., 2000), there has been little to no literature published regarding the effectiveness of telephonic interventions at reducing levels of stress or poor back care; therefore, the finding that the telephonic intervention was effective for reducing levels of elevated stress risk and poor back care is a notable contribution to the field.

Mail and Internet modalities. The finding that the mail- and Internet-based modalities are effective at reducing the prevalence of elevated stress is consistent with the limited amount of literature available addressing this topic. There were only two studies found in the literature for

Internet-based programs of which the study by Zetterqvist and colleagues (2003) found that the program was successful at reducing levels of stress and van Straten and colleagues (2008) found that their program was successful at increasing recovery from burnout (work related stress). Similarly, no articles were found addressing mail-based programs addressing back care; therefore, the results from this study are a contribution to the literature.

The results in the literature provide mixed evidence for the effectiveness of mail and Internet modalities at decreasing risk for physical inactivity; therefore, the finding that these modalities are effective at decreasing physical inactivity risk is consistent with the slight majority of the studies in the literature base also indicating support (Jenkins et al., 2009; Norman et al., 2007; Vandelanotte et al., 2007). Furthermore, the physical activity program was only participated in by 6.3% of the mail participants and 16.7% of the Internet participants; thus, this lower level of participation may have limited the apparent impact on behavioral outcomes that could not be tested within topic area. However, the popular weight management programs also addressed and should have impacted physical activity. Similarly, there was mixed evidence regarding the effectiveness of Internet-based nutrition programs in a large literature review, and the two workplace based studies included in the review were split in terms of their effectiveness results (Norman et al., 2007). Thus, the unfavorable findings in this study are not inconsistent with the literature broadly and are a contribution to the mixed literature base. Furthermore, the Internet nutrition program was only participated in by 10.9% of the participants; thus, this lower level of participation may have limited the apparent impact on behavioral outcomes that could not be tested within topic area. However, the popular weight management programs also addressed and should have impacted healthy eating behaviors.

The finding that the Internet- and mail-based programs were not effective at reducing the risk for smoking and the mail-based program was not effective at reducing the risk for poor nutrition are counter to the literature (Brug et al., 1996; Kristal et al., 2000; Lancaster et al., 2000; McDaniel & Stratton, 2006; Myung et al., 2009; Strecher, 1999; Velicer et al., 1993; Walters et al., 2006). The cause for the discrepancy is uncertain. Unfortunately, the only study of the vendor's mail based program is an unpublished one and does not indicate which risk factors the mail-based program was successful at reducing; rather, it only indicates that the mail-based program was effective at reducing the overall number of risks from 3.85 to 3.55 over a 1.2 year period (Health Management Vendor, 2009). These topic areas had lower participation levels than some of the other topic areas; thus, this lower level of participation may have limited the apparent impact on behavioral outcomes that could not be tested within topic area. Another potential explanation for this discrepancy is the differential levels of engagement in the programs. Unfortunately, due to the minimal available process measures for this study, it is impossible to answer this question. Therefore, it is not clear if the program did not work and caution should be used when considering implementing it, or if the results are the result of problems with engagement levels.

Distal Health Risks for Participants versus Non-participants

Unfortunately, during the period between the pre and post HRA, the changes in the noted proximal risk factors rarely translated into changes in the distal risk factors. Specifically, the participants in the mail modality only decreased their blood pressure (risk and diastolic levels) and increased glucose levels compared to non-participants. There were positive results for Internet-based LM programs for reducing the risk of overweight and obesity, which are unexpected given the lack of change in nutrition or physical activity behaviors in this study, but

are in line with the mixed literature base (Moore et al., 2008; Norman et al., 2007). Lastly, the telephone participants only demonstrated a significant reduction in their risk for high blood pressure and triglyceride levels compared to non-participants. The minimal number of changes in the distal outcomes for the mail and Internet modalities are somewhat expected given the few changes in proximal risk factors. However, the minimal number of changes in the telephone group is somewhat surprising given the overwhelming number proximal risk factors that significantly decreased.

The finding that the Internet-based program was effective at reducing prevalence of overweight and obesity runs counter to the findings that the program did not decrease weight or BMI. In summary, this happened because a higher portion of those who lost weight crossed below the threshold defining high risk, while a lower portion of those who gained weight increased above the high risk threshold. This is discussed in more detail in a later section.

A likely reason for the lack of positive changes in the distal risk factors is the follow-up period of the study. Since the pre and post measurements were no more than 12 months apart, with a mean of 8.9 months, it is possible that these changes in proximal behavioral outcomes did not have enough time to translate into distal biometric outcomes. The following studies experienced similar phenomenon within a comparable timeframe. Consistent with these results, the unpublished study of this telephonic intervention found that there were not statistically significant reductions in levels of blood pressure or cholesterol over an average period of 1.2 years (Health Management Vendor, 2009). The literature review by Eakin and colleagues (2007) found favorable results for changes in behavioral outcomes but minimal evidence of changes in distal biometric outcomes during a maximum follow-up period of 12 months. Specifically, 20 of the 26 studies included in this literature review demonstrated significant changes in physical

activity and dietary behaviors. However, the reported distal outcomes (blood pressure, BMI, weight) for the physical activity intervention failed to achieve any significant reductions within a maximum of 12-month period. One study within this literature review found positive changes for cholesterol, blood pressure, and BMI; however, the sample for this study was comprised of individuals with CHD, which does not describe the population in this study of lifestyle management programs but rather a population in a disease management program (Vale, 2005). Within this literature review, another study did find positive changes for cholesterol and blood pressure (Kris-Etherton, Taylor, Smickilas-Wright, & et al, 2002).

Finally, a study by Kim and colleagues (2010) found similar results to the present study regarding significant differences in changes in nutrition behavior but no significant differences in weight or BMI when comparing telephone participants to those in the usual care group after a 6-month follow-up. Furthermore, they found that obese and overweight individuals, regardless of participant group, lost a significant amount of weight over the timeframe, but normal weight participants did not (Kim et al., 2010). This pattern was also true of overweight and obese individuals in this study who lost 3.6 pounds ($p < .0001$) in the non-participant group and 3.0 pounds ($p = .0019$) in the telephone participant group, which was not a significant difference between groups. Though it remains unclear why non-participants also lost weight, we do know that, regardless of participation group, obese and overweight individuals lost a significant amount of weight during the intervention period. Furthermore, this is not the first study of this type to realize this finding. Future research is needed to investigate this phenomenon, which may be driven by many things not measured in this study such as the diffusion of the intervention to the non-participants or changes in organizational culture that would impact LM

participants and non-participants a like (Crump, Earp, Kozma, & Hertz-Picciotto, 1996; Goetzel & Ozminkowski, 2008; Hunt et al., 2007).

Internet or Telephone versus Mail Modalities

The comparison of the mail participants to the other modalities (Internet and telephone) did not support the hypothesis that the other modalities would perform better than the mail modality; rather, they performed equally. The only exception to this was that the mail group was more likely to reduce their poor back care risk. This was the only outcome that was significantly in the opposite direction of the hypothesis and was partially the result of the fact that the Internet program did not have a back care module; therefore, the effectiveness of the telephone modality at reducing back risk was diluted by the Internet participants. Interestingly, a direct comparison of the telephone participants to the mail participants indicates that the telephone group was only 0.83 times as likely to reduce their back risk than the mail participants ($p = .0416$). With regards to the other outcomes, although the telephone participants performed significantly better than non-participants on more outcomes than the mail participants, the effect of the telephone participant success across the other variables was also diluted by the lack of findings for the Internet participants.

Given that the direct comparison of modalities is an emerging literature, these results are a contribution to the field despite the limitations of this study. Most of the literature to date has compared mail interventions to telephone interventions or to Internet interventions. The findings from this study appear to be inconsistent with the existing literature. Current studies in the literature have found that mail-based interventions were more effective at changing behavior and were more cost effective than purely telephone-based interventions (Marcus et al., 2007); however, telephonic interventions have also been shown to be more effective at changing

physical activity behavior than the mail-based interventions (Jenkins et al. 2009). A study of mail- versus Internet-based physical activity interventions found that neither produced behavior change but that the mail-based participants had better information recall than did the Internet participants (Marshall et al., 2003a).

A meta-evaluation of the literature also shows that telephonic interventions with supplemental mailed materials, such as this study, have been more successful at producing smoking cessation than mail materials alone (Pan, 2006). This is also true mail- versus Internet-based smoking cessation interventions. A review by Myung and colleagues (2009) found that the overwhelming majority of the studies testing Internet smoking cessation interventions outperformed print self-help interventions. The finding that the telephonic interventions are more effective than the mail-based interventions has also been found for weight management interventions with significant weight loss at 6 months; however, consistent with this study the weight management intervention showed no difference between the two modalities at 12 months (Jeffery et al., 2003; Sherwood et al., 2006).

Lastly, an unpublished work that examined the mail only intervention and telephone intervention found that the telephone-based intervention was more effective than the mail-based intervention at reducing total number of high risks as well as the following risk factors: back care, physical activity, stress management, and weight management (Health Management Vendor, 2009). Similar to the present study, the unpublished study by the health management vendor found that the programs showed similar reduction in the following risk factors: blood pressure, cholesterol, nutrition, and tobacco (Health Management Vendor, 2009).

Telephone versus Internet Modality

The comparison of the telephone participants to the Internet participants supported the hypothesis that they would perform equally well. The only notable exception to this was for depression risk, where telephone participants were more likely to reduce their risk. Telephone participants were also more likely to reduce their poor back care risk, but that is to be expected with the absence of a back care module in the Internet program. Although it seems counterintuitive that the two programs would not perform statistically different given the notably better outcomes for the telephone versus the Internet participants when compared to the same group of non-participants, the high variance in the estimated modality parameter precluded the t-statistic from being significant.

Though there were notable limitations to this study, which are discussed in a following section, these results are a contribution to the literature. There is a large gap in the literature when it comes to making the comparison of telephonic versus Internet interventions. A workplace based intervention for weight management testing the relative effectiveness of telephone and Internet programs has been described in the literature; however, the results have yet to be published (van Wier et al., 2006).

All Modalities

When combining all of the LM program participation modalities, the overall LM program was successful at reducing their proximal risk factors compared to non-participants. Based on the prior results, these effects appear to be driven by the participants in the telephone modality. These results are consistent with the literature that, in general, supports the statement that LM interventions are effective means to reduce negative health behaviors (Dishman & Buckworth, 1996; Glanz et al., 1998; Goetzel, Ozminkowski, Bruno et al., 2002; Gold et al., 2000; Harden et

al., 1999; Hillsdon & Thorogood, 1996; Janer et al., 2002; Jenkins et al., 2009; Katz et al., 2005; Moher et al., 2003; Myung et al., 2009; Norman et al., 2007; Ozminkowski & Goetzel, 2000). And interventions that are theory based and tailored, like the current one under study according to the vendor, are effective (Cardinal, 1995; Cardinal & Sachs, 1995; Marcus, Bock et al., 1998; Marcus, Emmons et al., 1998; Marcus et al., 2007).

Modalities by Program Topic

The sample size prevented the analysis of the proximal health risk outcomes for all topic areas except for weight management. Although the distal health outcomes are pertinent to many of the topic areas, they are not relevant to all topic areas. For example, the distal outcomes measure was related to weight, blood pressure, cholesterol, and blood glucose. These outcomes are most closely related to the nutrition, physical activity, and weight management topic areas. Therefore, it is somewhat expected that the smoking cessation, stress management, and back care programs were not effective at changing the majority of these outcomes. It is possible that given a larger sample size, tests of the proximal outcomes measures such as tobacco use, poor back care, elevated stress, and depression risks would have shown significant decreases. This is a noted limitation of this study.

Nutrition program. The sample size for the nutrition program was too small to test the proximal outcomes and the categorical distal outcomes; therefore, it is unclear if poor nutrition behavior changed among participants in this topic area. Improvements in eating behavior are generally accompanied by decreases in weight, cholesterol, blood glucose, and blood pressure (Appel et al., 1997; Moore et al., 2008); however, these changes are most pronounced when combined with physical activity (Katz et al., 2005). This was not the case with this sample, who

demonstrated no significant changes in distal outcome measure when combining all modalities or in any of the modality comparisons.

Physical inactivity program. Similar to the nutrition program, the sample size for the physical activity program was too small to test the proximal outcomes and the categorical distal outcomes; therefore, it is unclear if physical inactivity changed among participants in this topic area. Improvements in physical activity are generally accompanied by decreases in weight, blood pressure, cholesterol, and blood glucose (Centers for Disease Control and Prevention, 1999); however, these changes are most pronounced when combined with physical activity (Katz et al., 2005). This was not the case with this sample, who demonstrated no significant changes in distal outcome measure when combining all modalities or in any of the modality comparisons.

Weight management program. The weight management program combined nutrition and physical activity messages along within an overarching theme of weight management. This sample size was large enough to test all of the outcomes, proximal and distal, for comparisons that included the telephone modality. The results for the overall program indicated significant decrease in physical inactivity, poor back care, and depression risk; as well as a significant decrease in the prevalence of overweight or obesity and BMI. Although it was not significant, there was also a trend for a decrease in weight. These results are consistent with the literature that indicates that weight management programs create an increase in physical activity and a reduction in weight outcomes (Eakin et al., 2007). Increases in physical activity and decreases in weight are also associated with a decrease in levels of depression (Annesi & Unruh, 2008; Chiriboga et al., 2008; Delahanty, Conroy, & Nathan, 2006; Delahanty, Meigs, Hayden, Williamson, & Nathan, 2002) and back pain (Leboeuf-Yde, 2000). Inconsistent with the

literature there were no increases in healthy eating behavior or decreases in cholesterol, blood glucose, or blood pressure (Eakin et al., 2007).

When looking at the comparison of participation modalities, the telephone modality was quite successful at reducing health risks when compared to non-participants, but the mail and Internet modalities were not successful generally. The telephonic program was significantly more effective than the Internet program at reducing a number of outcomes: poor back care, physical inactivity, elevated stress, and depression. However, the Internet modality was significantly more likely to reduce their prevalence of overweight or obesity.

The literature supports the findings that weight management programs delivered by telephone are effective; however, the literature finds that even more outcomes are generally affected than improved in this study. Specifically, a review of the literature by Eakin and colleagues (2007) also covered studies that incorporated physical activity and nutrition interventions using the telephone as the primary intervention modality, and they found that 75% of the four studies produced positive behavioral (diet and physical activity) or biometric (BMI, blood pressure, and cholesterol) outcomes. Furthermore, the effectiveness of weight loss programs at improving weight related outcomes delivered by telephone has been supported further by other studies not included in this review (Boucher et al., 1999; Kim et al., 2010; Sherwood et al., 2006; VanWormer et al., 2009). The literature does not demonstrate the same effectiveness when it comes to Internet weight management programs; rather, this evidence is mixed (Moore et al., 2008; Norman et al., 2007).

Distal Risk Outcomes versus Biometric Outcomes

An interesting observation from these results is that some of the distal risk factors changed significantly (e.g., overweight or obesity) but their associated biometric measurement

(e.g., weight) did not. This same phenomenon has been seen in other studies investigating changes in similar risk factors. For example, a study by Goetzel and colleagues (2010) found that though there were no significant changes in weight or BMI among intervention participants, there was a significant increase in the prevalence of overweight employees.

In this study, participants in the Internet modality were significantly more likely to reduce their risk for overweight or obesity compared to non-participants; however, their weight and BMI did not change significantly and actually increased slightly. There are a few possible explanations for this oddity. First, the definition for overweight or obesity risk not only includes BMI, but for some BMI classes it also includes a waist circumference criteria; thus, a decrease in waist circumference without a decrease in weight, could move someone out of the high risk category. In fact, 4.7% of participants and 2.4% of nonparticipants did decrease their waist circumference but did not reduce their weight substantially enough to move out of the high risk category based on weight alone. A second possibility is that for those who lost weight, they tended to lose enough to push them below the BMI threshold that defines the high risk group and those who gained weight did not cross this threshold. This also occurred. Of those whose BMI changed, 11.6% of participants and 7.5% of non-participants dropped below the overweight or obesity risk threshold and 5.8% of participants and 6.1% of nonparticipants increased above the threshold; thus, there was a net decrease of overweight or obesity risk for both groups, but more notably for the participant group.

The other cases of difference between categorical and continuous measures were for the blood pressure outcomes. In the case of the telephone versus non-participant analysis, the high blood pressure risk factor significantly decreased for the participant group, but the biometric measures of systolic and diastolic blood pressure both decreased, but not significantly. When

combining the sizable but not significant decreases in the two biometric measures, the overall blood pressure risk reduced significantly. In the case of the telephone versus Internet modalities, participants in the telephone modality experienced more of a decrease in high blood pressure risk, but no significant changes in systolic or diastolic blood pressure levels. The diastolic level decreased and the systolic level actually increased slightly. This discrepancy can be explained by the same principle of crossing the thresholds used to categorize people as high risk. Specifically, an estimated 14.5% of the telephone participants and 9.7% of the Internet participants reduced their systolic or diastolic blood pressure enough to cross the threshold to lower risk levels and 13.0% of telephone participants and 14.1% of Internet participants crossed the threshold to high risk level. Thus, there was a net decrease in risk for the telephone participants but an increase for the Internet participants.

Impact of Dose Received on Health Risks

Although this study only indicates that participant engagement *may* be a critical component in producing change in outcomes, the literature indicates that it *is* a critical component. Both this study and the literature clearly demonstrate that participant engagement must be measured as a part of intervention studies. Participant engagement or treatment adherence is a critical factor in the realizing intervention effectiveness.

Mail Modality

There was only one individual in the mail participant group that discontinued the program. Without further process measure it is unclear whether those that continued the program were engaged in the program and read the materials or if they were not engaged and found it easier to throw the mailed materials in the trash rather than call the LM vendor to discontinue the program.

A study of a mail-based physical activity intervention also found that participant engagement affects outcomes, specifically that participant engagement and satisfaction accounted for 20% of the variance in physical activity levels (Chen et al., 1998). Since participant engagement is critical to the effectiveness of the intervention, low levels of engagement in mail-based interventions are of serious concern. A study by Levy and Cardinal (2004) found that 83.7% of participants in the mail-based physical activity intervention reported receiving and reading the information sent to them but that only 35.3% reported completing the self-help worksheets. Similarly, a study on a mail-based nutrition intervention found that almost all participants reported receiving the manual (99.7%) and 49% who received it reported reading at least half of the manual; however, only 9.5% of those reading the manual completed any of the written assignments (e.g., dietary self assessment, 7.7% or goal setting, 1.8%), which were core components of the intervention (Kristal et al., 2000). The utilization of other components of the intervention was quite varied (Kristal et al., 2000).

Internet Modality

On the other end of the spectrum, there were only six participants who completed the Internet program. Today with an estimated 79% of American adults using the Internet and 67% of all adults having looked online for health information in 2009 (Taylor, 2009), it is clear that the Internet modality would have great public appeal. Furthermore, the anonymity of the Internet makes people more willing to admit vulnerabilities to a computer versus a person (Robinson et al., 1998), further making the Internet an enticing modality for a LM program. However, this study suggests that despite these advantages, completing all six modules of the program is too much for most of the participants.

Program engagement is related to outcomes. A study by Strecher and colleagues (Strecher et al., 2008) found that in a study of Internet smoking cessation program that the cumulative number of Web sections opened was related to subsequent smoking cessation (OR = 2.26; CI = 1.72-2.97). Each section opened, on average, contributed to an 18% higher likelihood of quitting smoking (OR = 1.18; CI = 1.11-1.24) (Strecher et al., 2008). Furthermore, in a review of the literature, Vandelanotte and colleagues (2007) found that more than five contacts with the Internet-based program was associated with better outcomes.

Since participant engagement is critical to the effectiveness of the intervention, the low levels of engagement in Internet interventions are of serious concern. One of the common findings of research on Internet-based behavior change programs is that participants spend only a relatively meager amount of time accessing their online intervention (Eysenbach, 2005). This implies minimal participant exposure to the critical behavior change ingredients of the program, which could potentially reduce program impact. Even when there are high rates of participant engagement at the start of the program, consistent evidence indicates that there is a low rate of long-term engagement in Internet-based programs (Eysenbach, 2005). For example, of the participants in an Internet intervention, only 46% visited the physical activity intervention website and the majority of the visits (77%) were in the first two weeks of the intervention (Leslie, Marshall, Owen, & Bauman, 2005). In a different study focused on Internet-based smoking cessation programs, 36.1% of participants in the Enhanced condition (interactive, tailored website) and 60.7% in the Basic condition (static website) stopped using the program on the day they enrolled in the program (Danaher, Boles, Akers, Gordon, & Severson, 2006).

Telephone Modality

The analysis comparing the completers in the telephone intervention to those who discontinued the telephone program did not support the hypothesis that those who complete the program would be more likely to reduce their health risk factors. Recall that the definition of completion for the telephone program was those who received a minimum of three one-on-one calls out of a possible five or met their goal. Without additional process measures indicating level of participant engagement, it is difficult to interpret these results.

A plausible explanation for this finding is that the definition of completion was set too low since only three out of a possible five calls had to be completed. Thus, the effect of those who truly completed the program (i.e., those who completed the program as a result of reaching their goal or completing all five calls) is being diluted by those who are being counted as having "completed" the program after only three or four calls despite not having reached their goal. Unfortunately, the program status variable and its operational definition were set by the program vendor and additional break down of call information was not available to further investigate this issue. Interestingly, the vendor administering this program and implementing the operational definition of program completion is incentivized to have a low threshold for the definition as their performance is measured by their ability to engage the participant and have them complete the program. Depending on the clients' relationship with the vendor, there may even be fees at risk for such performance.

An interesting point here that should not be lost in the discussion of the definition of completion is that although there was no difference between those who completed the program and those who did not, the overall participant group still outperformed non-participants. Thus, it appears that completing at least three calls, or fewer if goals are met, produces significant

behavior change. However, without a true definition of program completion (i.e., completed all calls or met goals) it is unclear how effective the program really can be.

Return on Investment

The discounted program costs were varied, primarily due to the resource intensity of the LM intervention. The Internet program was the least costly ($50.71 PP), followed by the mail program ($74.92 PP), and the telephone program was by far the most costly modality ($197.00 PP). The total program costs also varied by the prevalence of those who completed programs, but this had a minimal impact on costs.

Though there was some evidence of reduced medical claims costs over the 12 month analytic horizon, there was no evidence of lasting reductions in medical claims costs over the 22 month analytic horizon. Furthermore, there was no evidence of program benefits outweighing program costs over any analytic horizon when comparing program modalities to non-participants. The only instance of program benefits outweighing the program costs were when comparing the Internet or telephone modality to the mail modality, which suggests that if one is to implement one of these programs that any modality but mail is recommended from a financial outcomes perspective. The overall lack of program benefits and favorable ROI is not surprising given the modest findings for AIMS 1 and 2 and the high cost for the telephone program, which was the one modality that showed significant reductions in proximal health behaviors and reduced medical claims costs (program benefits). Reductions in claims costs, a tertiary outcome, are generally preceded by reductions in biometrics, the secondary outcome, which are generally preceded by behavioral changes, the primary outcome. Thus, since there were no consistent changes in biometric outcomes, a lack of significant changes for medical claims outcomes is anticipated. Interestingly, the telephone modality experienced significant decreases in

discounted medical claims costs after 12 months ($105.77 PP) despite the lack of changes in biometric outcomes; however, this effect was not present at 22 months.

The only significant incremental change in medical claims costs when comparing participation modalities was for the combined telephone or Internet participants compared to the mail participants over the 12 month analytic horizon. This finding is driven primarily by the significant decrease in medical claims costs for the telephonic participants compared to non-participants and somewhat by the decrease in claims cost for Internet participants and increase in claims costs of mail participants compared to non-participants, though neither of these two changes were significant. This decrease in discounted monthly medical claims costs ($107.55 PP) was more than the discounted cost of the program ($79.61 PP).

Limitations

Measurement

Process measures. One of the limitations of this study was a lack of process measures. The collection and analysis of process measures beyond the program status variable would have aided in the interpretation of the study findings. The use of program status as a measure of dose received (extent to which employees engaged in the intervention) is difficult to interpret given the operational definitions of the program status variable (Lichstein, Riedel, & Grieve, 1994; Shadish, Cook, & Campbell, 2002).

Per the definition of completion for the mail-based participants (all six mailers were sent), the dose received is more of a measure of dose delivered (amount of the intervention implemented) (Lichstein et al., 1994; Shadish et al., 2002). For example, though all but one participant in the mail program completed the program, the dose received is unclear in terms of the extent to which these mailers were received, read, and available tools used. The dose received for the Internet participants appears to be low since there were only six people who

technically completed the intervention; however, true completion rates *may* be higher. Since the definition of completion is a participant who has completed the post-assessment, it is possible that more than six participants completed the core program content, but did not complete the post-assessment, which is considered a measurement tool versus an intervention component. As discussed previously, the definition of completion of the telephone-based program was the completion of only three out of a possible five calls or participants reaching their goal. Thus, this does not represent those who truly completed the program as a result of reaching their goal or completing *all five calls*. Further research using valid process measures, particularly valid measures of dose received, is needed.

Productivity measures. Productivity (e.g., absence, disability, presenteeism) measures were not available for this study, which may have understated program benefits, particularly for the telephone-based program. There is evidence to indicate that reduction in health risk factors lead to improvements in productivity. Burton and colleagues (2006) found that an increase or decrease in each risk factor was associated with a commensurate change of a 1.9% productivity loss over time, an estimated $950 (2002 dollars) per year per change in risk factor. Another study found that there was a significant relationship between obesity and lower levels of self-reported productivity; specifically, a 1.18% reduction in productivity compared to similar coworkers, which equated to $506.00 in presenteeism costs and $433.00 in absenteeism costs per obese employee per year in 2006 dollars (Gates et al., 2008). Depression, stress, and other mental illnesses are particularly costly in terms of reduced productivity (absenteeism and presenteeism) at $28 per day or $7,000 per employee with mental health conditions per year in 2004 dollars (Goetzel et al., 2004).

HRA reliability statistics. The lack of reliability statistics for the HRA is another measurement limitation of this study. However, since data exists for similar HRAs indicating adequate reliability, the limitation is significantly mitigated (Anderson et al., 2000; Edington et al., 1999).

Study Design

Quasi-experimental design. The study design limitations were a reflection of the complicated and uncontrolled nature of field research. First, the design of this study was a quasi-experimental one that exposes the study to selection bias since random assignment is not utilized. Propensity scores were used to correct for selection bias by evening out the experimental and control groups on significantly related baseline variables. However, it should be noted that this approach does not correct for differences in unobserved variables or differences between those included versus excluded from the study sample. Unfortunately, there were significant differences across many of the demographic and eligibility variables at most steps along the sample selection process. This limits the generalizability of the findings in this study, which is a common problem in quasi-experimental studies since they not only do not use random assignment, but they also do not use random selection.

Multiple participation. Participants in the LM program were allowed to participate in multiple programs. Thus there were individuals who participated in multiple modalities and multiple topic areas within each modality. To adjust for the potential impact of this multiple participation on the outcomes, these participants were not included in this analysis and the breakdown of these groups was presented in Figure 4.1. Further analysis is needed to investigate the possible synergistic effectiveness of participating in different combinations of modalities, multiple topic areas, and multiple times within the same topic area.

Sample size within topic area. Analyses were conducted for each topic area to further probe the impact of participation in particular topic areas versus the entire range of topics within a modality. Unfortunately, the sample size within each topic area within each modality was too small to test many of the proximal behavioral outcomes. These outcomes would theoretically change first and then would be followed by changes in the distal outcomes. Though the majority of the distal outcomes could be tested, they generally showed no change. Therefore, it is not clear whether the programs were effective at changing proximal health risks within topic areas despite not exhibiting changes in distal outcomes or if the lack of changes in distal outcomes reflects a lack of change in proximal outcomes. Furthermore, some samples within topic areas could not be investigated at all (e.g., blood pressure or cholesterol) or comparisons of participants versus non-participants or between modalities that could not be tested due to small sample sizes. Additional research is needed focusing on the impact of participation modality specifically within topic areas.

Black box evaluation. This study was in part a black box evaluation and was executed to the best of the researcher's ability given the available information. In other words, the evaluation was in part an assessment of outcomes that was made with minimal insight into what was actually causing those outcomes. This is because despite the declaration from the LM program vendor that the program is theory based, little is known about the details of how the program operationalized this theory in terms of methods and specific strategies used to create change in the determinants. Due to the proprietary nature of vendor programs, many details about program theory and the translation to specific methods and strategies must be protected to maintain a competitive advantage; however, consumers or researchers acting on their behalf should be privy to enough information to know whether the programs that they are purchasing

are effective. Therefore, the industry needs to become more transparent in terms of program development and process measures for program implementation.

Program Costs

There were a few limitations encountered when calculating program costs, specifically with regards to the LM program fees and employee costs. The LM program fees were only available at the aggregate, per participant, level. The lack of a breakdown of these fees (e.g., personnel, postage, printing, Web-maintenance) is a limitation to the generalizability and replicability of the ROI analysis for those who would implement such programs not utilizing this vendor.

The definition of program completion also impacts program costs. For example, the according to the current definition of completing the mail program, a participant could receive the incentive for completing the program when they may have never read a single mailing. Thus, inflating the program cost. Although the validity of the completion definitions in this study are questionable, the program cost calculations were calculated according to the current definitions because that is what was actually paid out and no further data was available to do sensitivity analyses based on alternate definitions. Fortunately, the incentive in this study was nominal; so, the impact to program costs was nominal.

Some employers may choose to hire an employee to manage the program; however, this employer chose to use consulting services to fill that function. Thus, for employers looking to have an employee fulfill these duties, the costs may differ. Thus, this is another limitation to the generalizability and replicability of the ROI analysis, but the knowledge of the amount of time spent on the LM program assists in generalizing these results to other staffing scenarios.

Conclusions

Based on the results and discussion, the following conclusions were drawn as they apply to similar samples as the one studied herein:

1. Overall, the tested LM program was an effective means to change proximal health risk behaviors, but not distal health risks or health care costs. The effect on the proximal, behavioral outcomes was primarily driven by the telephone modality.
2. The tested telephonic LM program was an effective means to change proximal health risk behaviors, but lacks the ability to change distal biometric health risks aside from high cholesterol risk and triglyceride level.
3. The tested telephonic LM program was an effective means to reduce health care claims over a 12 month horizon, but the effect is not lasting. Furthermore, at 12 months the cost of the tested telephonic program was too high compared to the benefits from the program to produce an ROI greater than one or a positive NPV.
4. The tested mail and Internet based LM programs were effective at reducing only a few proximal behavioral health risk factors; however, in general, they were not effective at reducing distal biometric health risk factors or medical claims costs.
5. Little is known about the impact of program completion versus discontinuation on outcomes due to limited sample size and invalid definitions of program completion. Per the current definition, completion of the tested telephonic LM program was no more effective at changing health risk factors and medical claims costs than discontinuation of the program prior to the completion of three calls.
6. Little is known about the impact of modality on outcomes within specific topic areas due to limited sample size.

7. Further interpretation of these outcomes is not possible since this evaluation was in part a black box evaluation and the near absence of available process measures.

Implications

Necessity of Participant Engagement

Despite the importance of participant engagement and evidence of low levels of engagement in many programs, many studies fail to examine this critical process measure. A fairly recent review of the physical activity Internet-based interventions found that most studies included some process measures, but that very few reported objective website usage data (Vandelanotte et al., 2007). The authors continue to recommend more measurement of engagement in the field of Internet-based health promotion (Vandelanotte et al., 2007). Similarly, a recent review of the mail-based physical activity intervention literature found that few studies included process measures and that only one tied engagement to outcomes (Jenkins et al., 2009).

The recommendation to include process measures is feasible to implement. First, the operational definitions for "engagement" must be defined (Strecher et al., 2008). Then, measurement approaches must be identified and implemented. For Internet-based programs methods such as those described by Danaher and colleagues (2006) are appropriate and include the number, duration, and pattern of visits to the site, and the number and types of pages viewed; however, the authors also point out that no single, universally accepted, measure exists. This type of measurement is rapidly growing in other domains such as advertising (Danaher, Mullarkey, & Essegaier, 2004) and technology (Joachims, Granka, Pan, & Gay, 2005). For mail-based interventions, mail-in written assignments and process evaluation surveys are examples of effective means to gather such information.

The recent reviews of the physical activity mail and Internet-based interventions highlighted the importance of measuring engagement and the need to identify elements that can improve the engagement of participants (Jenkins et al., 2009; Vandelanotte et al., 2007). Participant engagement may be reduced when the participant lacks the time to fully participate in the program, they forget to do it, are unclear as to the correct program procedures, are disappointed by initial results of engaging in the program, do not have access to a setting in which to execute the program, or lose motivation to change (Shadish et al., 2002). These reasons for low levels of engagement lend themselves to potential solutions. For example, assigning homework to be submitted, using family members to encourage engagement, giving clear instruction regarding intervention expectations and procedures, providing necessary equipment and setting to engage in the intervention, and implementing appropriate reinforcements or incentives (Shadish et al., 2002). Ultimately, this is a critical component of intervention effectiveness and more research is needed to determine how to best engage participants to maintain adherence to the intervention.

Attention to Measurement

Black Box Evaluation

Per Rossi , Lipsey, and Freeman (2004), evaluations should be conducted on programs based on sound program theory; in other words, black box evaluations should be avoided. Without a sound theoretical foundation, the results of the evaluation are ambiguous. Specifically, if the program theory is not well defined, then it is nearly impossible to define what the program is supposed to be doing. This results in an inability to identify the appropriate process measures to be evaluated to determine if the program is being delivered as intended. Additionally, if the program theory is not well defined, it may be possible to identify the impact outcomes; however, it will be very difficult to identify the intervening variables. These

intervening variables in conjunction with the process evaluation results should be used to interpret why the program did or did not produce the desired outcomes; therefore, the ability to draw these conclusions is greatly limited when conducting a black box evaluation.

Process Evaluation

Even if the program being evaluated is theory based, if the process measures are not identified or measured then the outcomes evaluation cannot be fully interpreted. As a result of the critical nature of capturing participant engagement data, process evaluation is an important measurement issue that should be included in all intervention studies. Process evaluation is a critical component of a program evaluation because without it the information provided by the impact evaluation is incomplete (Rossi et al., 2004). This is particularly poignant when the program evaluation, as in portions of this study, shows minimal to no impact. Without process data, it is impossible to decipher whether a lack of significant differences was a result of the program itself or the program delivery. Furthermore, it is nearly impossible to retrospectively collect process measures; therefore, the evaluation plan, including the process evaluation, should be part of the intervention planning process (Bartholomew et al., 2006; Green & Kreuter, 2005; Rossi et al., 2004). In the case of this study, employees who participated in the mail or Internet programs did not reduce many health risks in comparison to non-participants, while those in the telephone program did. This may be a result of the mail and Internet interventions not being effective or it may be a result of program delivery.

Process evaluations generally consist of measures of program dose delivered, the amount of the intervention implemented; dose received, the extent to which employees engaged in the intervention; and fidelity, the integrity of the delivered intervention (Lichstein et al., 1994; Shadish et al., 2002; Steckler & Linnan, 2002). In this case, the dose received is also unclear for

the mail group since the completion measure (defined by all six mailers being sent) was more of a measure of dose delivered versus engagement in the intervention via reading and filling out the materials. The opposite is true of the Internet participants, all but nine participants discontinued the program; therefore, the lack of findings for the Internet group may be a result of dose received or the program may not be effective. Unfortunately, the sample size was too small for the group that completed the program to statistically test if those who completed the program per the vendor's definition were successful at changing their health risks. As for the telephone participants, the completion measure was an informative measure of dose received; however, as previously discussed, it was not a valid measure of full program completion.

There were no measures of program fidelity available despite the fact that there were opportunities for low levels of fidelity, particularly for the telephonic intervention which involves person-to-person interaction. Since the telephonic intervention was found to be effective, this suggests that even if there were low levels of fidelity, the program was still effective. At the same time, if there were low levels of fidelity, the program may be delivered differently the next time and effectiveness would likely differ in other samples; thereby, limiting the generalizability of these findings. It is important to include process measures when testing the effectiveness of programs because without it the information provided by the evaluation is incomplete and interpretations are ambiguous. Therefore, the results of this study do not indicate that the mail and Internet programs are not effective at changing certain health outcomes, what they do suggest is that further attention to process measures, particularly dose received, is needed.

Continuous and Categorical Measurement of Risk Factors

Measurement is a critical component of program evaluation. This study demonstrated that it is important to measure both categorical outcomes as well as continuous outcomes because they can produce different results. Thus, if only continuous outcomes are measured, they may mask the movement of individuals in or out of high risk groups. This movement in and out of the high risk group is important to capture as evidence indicates that improvements in these categorical risk factors are related to cost savings (Anderson et al., 2000; Goetzel et al., 1998).

Inclusion of Productivity Measures

Productivity (e.g., absence, disability, presenteeism) measures were not available for this study; however, whenever possible they should be included as means to capture more sources of program benefits. There is evidence to indicate that reduction in health risk factors lead to improvements in productivity. This evidence includes commensurate changes in productivity for change in overall number of risk factors (Burton et al., 2006); a relationship between obesity and lower levels of presenteeism (Gates et al., 2008); and lower levels of absenteeism and presenteeism for those with depression and other mental health conditions (Goetzel et al., 2004). Each of these then translates into a notable change in annual costs, up to $7,000 per employee with depression or mental health conditions per year (Burton et al., 2006; Gates et al., 2008; Goetzel et al., 2004).

Validity

Another important measurement issue is regarding the operational definition of variables and how that impacts their validity. The operational definition of program completion does not appear to truly measure completing all components of the intervention. Thus, by the very nature

of the term validity, measuring what one intends to measure (Cattell, 1946; Kelley, 1927), the completion measure is not valid.

Use of Appropriate Statistical Methods

Multiple Imputation Methods

The issue of how to handle missing data is one that must be confronted in most workplace health promotion evaluations. Unfortunately, this issue is handled in a wide variety of ways including listwise deletion, single imputation (e.g., mean imputation), and MI. The failure to appropriately address missing data can limit the ability to make valid inferences from research studies due to the distortion of estimates, standard errors, and hypothesis tests (Little & Rubin, 1987). Listwise deletion is a popular way to handle missing data because it is easy to execute and uses a single sample for all analyses (Naydeck et al., 2008); however, this approach is inefficient and will produce biased results when data is MAR (Briggs et al., 2003). Single imputation is another option for addressing missing data that has been used in the field of workplace health promotion program evaluation (Goetzel et al., 2009; Goetzel et al., 2010); however, it is not the best choice because the imputation of a single value substantially underestimates the error variance as it does not account for the uncertainty associated with the imputed value (Kline, 2005).

This study demonstrated the utilization of sophisticated MI methods (MCMC and regression) for handling missing data, which successfully captures the residual error from the estimation procedure and the prediction error from the estimated coefficients. Further research is needed on methods to impute multivariate missingness of categorical data as no good method currently exists. Lastly, it should be noted that widely available statistical software, including SAS v9.2 used herein, makes the MI process and analysis of the multiple datasets reasonably simple.

Non-Normal Distribution and Longitudinal Data

This analysis demonstrated the utilization of appropriate techniques for estimating changes in medical claims costs that are often overlooked. Specifically, the issue of the distribution of medical claims cost is often not properly addressed (e.g., use of a 2PM with a smearing factor) or completely overlooked (e.g., use of an ANCOVA). For example, in the field of health promotion the well known "HERO studies" utilized a OLS 2PM, which did not account for the correlation of longitudinal data, and, despite mentioning that data were log-transformed, did not describe the retransformation process (Anderson et al., 2000; Goetzel et al., 1998). Other studies looking at health promotion programs, including workplace health promotion programs, used OLS regression techniques without accounting for the skewed distribution of medical claims costs (Aldana, Merrill, Price, Hardy, & Hager, 2005; Serxner, Gold, Grossmeier, & Anderson, 2003). The failure to utilize the appropriate statistical methods to estimate changes in medical claims costs will result in inaccurate estimates of the mean as well as the standard error, which ultimately affects the statistical significance of the findings.

Call for Standardized Evaluation Methodology

As Chapman (2005) noted in his recent review of the workplace health promotion ROI literature, there is a tremendous amount of variation in the methods used, including the use of various statistical tests. It is imperative that the field adopt an accurate and consistent methodology for evaluating workplace health promotion programs to ensure that information being used to make programming decisions is accurate and as generalizable as possible.

Future Research

Based on the prior discussion of the results and limitations of the study, there are a number of research areas that require additional investigation. In particular, attention should be given to answering the following questions.

1. What is the relationship between the effectiveness of distance health promotion programs and key process measures (dose delivered, dose received, and fidelity)?
2. What are effective methods of increasing participant engagement?
3. When implemented under ideal conditions, which modality is the most effective at changing behaviors and producing an ROI?
4. Within specific program topics, which modality is the most effective at changing behaviors and producing an ROI?
5. Is there a synergistic effect of combining modalities (e.g., telephone and mail) in distance health promotion programs?
6. Is there an incremental benefit of participating in multiple programs within the same intervention modality?

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