

**Relationships Between Barriers, Motives, Retention and Effectiveness in a
Commercial Weight Loss Program**

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Science

In

Human Nutrition, Foods & Exercise

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1st May 2009

Blacksburg, VA

Keywords: Weight loss, Obesity, Barriers, Motives, Retention, Effectiveness,
Commercial.

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ABSTRACT

Data from seven work sites that had purchased a commercial weight loss program for their employees was used to determine (a) the most prevalently identified barriers and motives for weight loss, (b) the relationship between barrier identification and subsequent attrition at 3 and 6 months post program initiation, (c) the relationship between motive identification and subsequent attrition at 3 and 6 months, (d) the relationship between barrier identification on weight loss at 3 and 6 months, (e) the relationship between motive identification on weight loss at 3 and 6 months, (f) the effectiveness of the program at the end of three and six months of participation (g) the reach of the program into the eligible employee population, and (h) the proportion of the targeted employee population that ultimately benefited from the program and the degree to which they benefited (i.e., effectiveness that accounts for reach and retention). The most frequently selected barriers were being stressed, having too many opportunities to eat unhealthy foods, and a lack of time to exercise. The most frequently selected motives were to look better, a sense of it being the ‘right time’, and to improve health. Chi square test revealed that those participants who selected a given barrier or motive were more likely to be retained than those who did not select a given barrier at the beginning of the program. When we controlled for age and gender, we found that women who selected motives at the beginning of the program were more likely to be retained on this program than men. Age of the participants did not influence their retention on the program. Logistic regression analysis when controlling for gender & age indicated that women and older adults were somewhat more likely to be retained on the program at both 3 and 6 months of participation. Multivariate regression analysis indicated that there was no significant association

between selection of total motivators and barriers and weight loss at 3 & 6 months of participation. Intention to treat analyses using baseline value carried forward for participants lost to attrition revealed that participants lost a significant ($p < .01$), yet modest, 2.1 lbs of weight at 3 and 2.5 lbs of weight at 6 months of participation. Follow-up analyses were conducted to determine the overall proportion of the workforce that benefited (i.e., lost weight) at 6 months. Of the 1607 participants who were retained at 6 months 1088 were successful in losing weight and lost, on average 9.4 pounds (95% CI: 8.8 to 9.9 pounds), a clinically significant 4.4% of initial body weight. Thus, 10.1% of the total employee population benefited from the weight loss program and lost a clinically relevant amount of weight. The findings of this study indicate that information on motives and barriers most frequently identified by the participants can be used to customize weight loss programs in order to enhance retention of its participants. Also presenting reach by effectiveness data to the employers could help them in making more sophisticated decisions while choosing a commercial weight loss program for their employees.

Dedication

Dedicated to Dishant & Rishi.

Acknowledgements

Writing this thesis has been a very pleasurable experience. I would like to take this opportunity to thank my advisor, committee members, friends and family, who have helped me to successfully completing this thesis. I would like to especially thank my committee chair & advisor Dr. Paul Estabrooks, who not only suggested this topic for my thesis but also provided with all the necessary guidance and insight into my research. He continuously stimulated my thinking with his boundless knowledge. I am also very grateful to my other committee members, Dr. Hosig, Dr. You & Dr. Davy for their insightful comments, critique, enlightening ideas & warm encouragement. In addition, I extend deep appreciation to Dr. You, Abdo Salem from statistics department & my friend, Dr. Maneesh Thakkar who provided me with guidance in statistical analysis of my data. I am indebted to the Newman library of Virginia Tech, where I conducted most of my textual research.

Also along this journey, I owe special gratitude to my son Rishi, who has been great kid, my parents and parents in-law, sister & brother in law who have always been a great morale support during difficult times. Also, many thanks to my friends Amy, Courtney, Jennie, Serena & Fabio for their encouragement and hope during difficult times.

Finally, a big “thank you” to my husband Dishant, who patiently supported me over the years and shared every moment of joy and stress along my journey as a student. His complete & incomparable support helped me get through this thesis successfully.

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Chapter 1. Introduction

The Problem

Obesity is the seventh leading cause of death in the U.S. (Williams et al, 2007) and is a serious public health issue. In 2006 ninety-seven million U.S. adults (66.3%) were either overweight or obese (DHHS, 2008). The seminal Framingham heart study (Hubert, 1986) provided crucial evidence for the need to elevate the public health priority of dealing with obesity. That study was the first to document that for every pound of weight increase between the ages of 30 and 42, there is one percent increase in mortality. Obesity is also associated with a number of chronic metabolic conditions including dyslipidemia, hypertension, and diabetes (Vasan, et al, 2005).

Obesity is also related to issues that carry over into the workplace. Obesity and the resultant chronic metabolic conditions, incur large expenditures that are jointly borne by the employee and employer (Whitmer, et al., 2003). In the U.S., health care costs have doubled from 1991 to 2001 and are expected to double again by 2012. According to Blue Cross Blue Shield of Massachusetts for every one percent increase in body mass index an individual's annual health care costs increased by \$120. Whitmer, et al, (2003) report that, of the \$5200 per employee the average employer spent on health care in 2001 only 1-2% was directed at prevention while the remainder was primarily used to treat chronic conditions. This approach continues to persist despite the well-established fact that 50-70% of these chronic diseases are associated with modifiable factors that can be prevented.

Various strategies have been used to address the issue of overweight and obesity at work sites. However, to date the primary mode of addressing obesity is through small group programs that meet frequently and are associated with a small reach into the

employee population (Estabrooks & Glasgow, 2007). Conversely, a number of researchers have attempted to improve the reach of programs by offering interventions that can be delivered electronically. Although the assumption is that internet-based programs will have broader reach (due in part to removing the barrier of making time for small group meetings) there is a paucity of literature that demonstrates the number of employees that are reached by internet based programs. For example, of five studies reviewed that used internet based health promotion interventions at worksites, only three studies reported the reach of the intervention which ranged from 6 to 60% of the population (Tate, et al, 2001, Aldana, et al 2006, White & Jacques, 2007, Faghari et al 2008 , Petersen, et al, 2008, Prochaska, et al, 2008).

There is also evidence that internet-based approaches may be associated with high levels of attrition (Couper, et al, 2007). Unfortunately, not all studies report the attrition rates among their participants. For example, only three studies of internet-based weight loss programs have provided information on attrition rates related specifically to the intervention (i.e., in contrast to the overall study). They report attrition rates of 44 to 98% (Tate, et al, 2001, White & Jacques, 2007, Petersen, et al, 2008).

To address this issue of high attrition rates, some internet based programs provided live support to help employees overcome their barriers associated with weight loss as well as motivating them to adopt and sustain participation in weight loss programs. Various studies have attempted to identify the barriers (Gallagher, et al, 2006) as well as motives (Cheskin, & Donze, 2001, French, et al, 1998, Galuska, et al, 1999, Young, et al, 2001, Herriot, et al, 2008, Jeffery, & Wing, 1995, Rodin, 1993, Ruelaz, et al, 2007, Sabinsky, et al, 2007, Wolfe, & Smith, 2002, Williams, Saizow, & Ryan, 1999) that are most often associated with weight loss. Some of the barriers identified in previous studies are 'slipping back to old habits; lack of time for exercise, job

commitments and expense of healthy eating' (Gallagher, et al, 2006). Improvement in physical appearance has been the most frequently reported motive (Cheskin, & Donze, 2001). Yet no researcher has examined the relationship between individual motives and barriers that participant identify at baseline with subsequent program attrition or with the extent of participant weight loss.

Still, a number of studies have demonstrated that internet-based interventions within a worksite context can successfully engage participants to lose weight (Faghari et al, 2008, Petersen, et al, 2008, Tate, Wing & Winett, 2001). Further, many commercial weight loss programs have been developed based upon this extant literature (e.g., weight watchers work), but little information is provided on the degree to which research-based motives and barriers are translated into commercial practice or whether these types of programs are associated with high attrition and/or significant weight loss.

The Goals

The general goal of this study is to determine if there are specific barriers and motives that influence the retention and effectiveness within a commercially available weight loss program. A secondary goal was to determine the reach of the program into the worksite populations and examine effectiveness within the context of reach and retention (i.e., proportion of the targeted employee population that ultimately benefited from the program and the degree to which they benefited). We partnered with the program developers of IncentaHEALTH™, a commercially available program that was developed to support employee weight loss via the promotion of a healthful diet and regular physical activity using an internet and incentives based approach. It was informed by the findings of Jeffery and associates (Jeffery et al, 2000) and the National Weight Control Registry (<http://www.nwcr.ws/>). Within the program records are collected on participant barriers and motives through checklists as well as some basic demographic

information, retention records, and objectively verified assessment of body weight over time. The program was designed to be attractive to participants, initiate weight loss through sound nutrition, physical activity, and resource identification, and enhance retention through the provision of dynamic information and a stepped process in the provision of monetary incentives. The program was available to the employees of the worksites that purchased this program for a fee.

This study, which was approved by the Virginia Tech Institutional Review Board, used de-identified archival records from incentaHEALTH to achieve the following purposes.

To determine:

- (a) the most prevalently identified barriers and motives for weight loss,
- (b) the relationship between barrier identification and subsequent attrition at 3 and 6 months post program initiation,
- (c) the relationship between motive identification and subsequent attrition at 3 and 6 months,
- (d) the relationship between barrier identification on weight loss at 3 and 6 months,
- (e) the relationship between motive identification on weight loss at 3 and 6 months,
- (f) the effectiveness of the program at the end of three and six months of participation
- (g) the reach of the program into the eligible employee population, and
- (h) the proportion of the targeted employee population that ultimately benefited from the program and the degree to which they benefited (i.e., effectiveness that accounts for reach and retention).

The archival records were collected from seven medium sized worksites that had purchased the weight loss program for their employees and included the barriers and motives checklists. The sample of worksites used reflects the entire population of those available at the time of the data extraction (March through June 2008).

Study Hypotheses & Rationale

The hypotheses developed for this study were informed by, first, the extant literature on barriers and motives to weight loss and, second, by the list of barrier and motive items available for selection within the IncentaHEALTH™ program. A number of studies in the past have attempted to identify the barriers and motivators most frequently associated with weight loss. Some of those identified include slipping back to old habits; lack of time for exercise, job commitments and expense of healthy eating as most frequently selected barriers (Gallagher, et al, 2006). According to Herriot, et al, (2008), previous unsuccessful attempts at losing weight could discourage one from joining a weight loss program. Thus, in the case of this study, it was hypothesized that the following barriers to be most frequently reported: 1) lack of time for exercise 2) lack of time to cook, 3) healthy foods and vegetables are too expensive 4) previous failure at weight loss.

Women most frequently report improvement in physical health and appearance as a motive for losing weight (Cheskin, & Donze, 2001), where as men report better appearance (Wolfe, & Smith, 2002), better performance at work (Sabinsky, Toft, Raben, Holm, 2007), better health (Wolfe, & Smith, 2002) and long-term fitness (Cheskin, & Donze, 2001) to be strong motives. Physician's recommendation to lose weight and better health are also often identified as strong motives (Galuska, Will, Serdula, & Ford, 1999, O'Brien et al., 2007) by both men and women. Thus, it was hypothesized that the following motives will be identified most often by employees: 1) to improve appearance

2) to help me maintain or improve my health, 3) to help me be more productive and 4) physician referral to lose weight.

Although literature is available on barriers associated with weight loss, there is no study to our knowledge that associated these barriers with attrition of participants of the study. As attrition is one of the major concerns of an Internet based weight loss program (Couper, Peytchev, Strecher, Rothert, & Anderson, 2007), addressing this may lead to significant contribution to the body of literature. Similarly, the relationship between motive identification and subsequent attrition has not been documented. Some studies in the past have recognized the influence of barriers on weight loss (DiBonaventura, & Chapman, 2008, Mauro, et al, 2008). However, no quantification is available on the predictive power of perception of a barrier or motives on weight loss.

Finally, there is some question in the literature about the sufficiency of evaluating behavioral programs (such as worksite weight loss strategies) by effectiveness alone (Glasgow et al., 2004). The traditional form of evaluating worksite programs has been to present information on effectiveness and attrition (although attrition is less frequently reported). However, the overall benefit in a given worksite could be argued to be a combination of reach, effectiveness, and retention (Glasgow et al., 2006). A number of studies conducted in past report their effectiveness in terms of mean number of pounds lost by the participants. Typically, the participants who have been retained until the end of the program are included in this analysis (Aldana et al 1993, 2006, Anderson et al, 1993, Atlantis et al, 2006, Blair, et al 1986, Briley et al, 1992, Brownell et al, 1984, 1985, Cohen et al, 1987, Collins et al, 1986, Erfurt et al, 1991, Edye et al 1989, Faghri et al 2008, Follick et al, 1984, Forster et al, 1985, 1988, Frankle et al, 1986, Garofalo, 1994, Goetzel, et al 1994, Grandjean et al 1996, Hermann-Nickell, 1989, Jeffery et al, 1985, Jeffery et al, 1989, Jeffery et al, 1993, Kelly, 1979, Kneip et al, 1985, Lando et al, 1993,

Larsen and Simons, 1993, Lloyd et al, 2002, Loper & Barrows, 1985, Nelson et al, 1987, Petersen et al, 2008, Phillips & Philbin, 1992, Pritchard et al 1997, Prochaska, et al, 1992, 2008, Reppart & Shaw, 1978, Rose et al 1980, Sangor & Bichanich, 1977, Schumacher et al 1979, Seidman et al, 1984, Shannon et al 1987, Sherman et al, 1989, Shi 1992, Stunkard et al, 1989, Sumner, et al 1986, Tate et al 2001, White & Jacques, 2007, Williams et al 2007, Winick et al, 2002, Worick and Peterson, 1993, Zandee & Oermann, 1996, Zimmerman, et al, 1988). Intent to treat analysis of entire employee population is rarely considered, but from an internal validity perspective, it is the preferred method of presenting weight loss data (Atlantis et al, 2006, Edye et al 1989, Loper & Barrows, 1985, Reppart & Shaw, 1978, Tate et al, 2001). Thus, information on the reach and retention as well as effectiveness of the programs on the entire employee population is scarce. Our final goal is to compare an imputed effectiveness (using baseline value carried forward for missing values) measure with a metric that includes reach, effectiveness, and retention. This is an exploratory purpose and thus no formal hypothesis is being proposed.

The thesis is divided into five chapters. The preceding introduction is the first chapter. Chapter 2 provides a review of literature on obesity incidence and severity, work place as a potential avenue for weight loss programs, use of the internet for weight loss programs, barriers and motivators associated with weight loss, commercial weight loss programs and problem of retention of participants on weight loss programs. The description of study population and methodology used in the study is described in Chapter 3. Chapter 4 presents the results of the study and the testing of study hypotheses. Chapter 5 concludes the thesis with a discussion of the study results, limitations of the study and recommendations for future research and practice in the area of health education.

Review of Literature

Obesity incidence and severity - The prevalence of overweight and obesity has become a global epidemic (Barberia, Attree, & Todd, 2008; Must, Spadano, Coakley, Field, Colditz, & Dietz, 1999). Not only are the developed countries at greater risk of obesity (Barberia, Attree, & Todd, 2008) but the developing nations are also catching up at a rapid pace (Co & Chan, 2008; Zhao, Hu, Wang, Yang, Kong, Chen, (2008). In the United States, two out of every three persons are either overweight or obese, in contrast to one out of every four persons in 1960s (CDC-NHANES, 2007). Much of the increase is related specifically to a nearly twofold increase in obese adults over a span of thirty years, from 15% in 1976-80 to 32.9% in 2003-2004 (USDHHS, 2007). Similarly, the rate of increase in overweight children and teens has seen a three-fold increase in the same span of time (USDHHS, 2007). A study by Doshi, Polsky and Chang (2007) reported a rapid increase in persons with type II (BMI – 35-39.0) and type III (BMI>40) obesity, with a significant rise among working aged adults (from 32.5% in 1997 to 39.3% in 2002).

Individuals who are overweight or obese are at a heightened risk for loss of years of life (Fontaine, Redden, Wang, Westfall, Allison, 2003). Nevertheless, years of life lost account for only a small proportion of the toll of obesity (Manson & Bassuk, 2003). Sturm and Wells (2001) estimated that the morbidity associated with obesity is equivalent to that of poverty, smoking and drinking. In a recent brief, Alley, Chang and Doshi (2008) indicated that there has been an improvement in the life expectance of obese persons since 1960s due to advances in medical technology. However, the reduction of premature death is contrasted with greater disability in this population (Alley, Chang and Doshi, 2008). When the data from 1988-1994 National Health and Nutrition Examination Survey (NHANES) was compared with data from 1999-2004 NHANES, obese people

were found to have a significant reduction in their ability to perform functional tasks like walking a quarter of a mile, walking up 10 steps, stooping/crouching, etc. (Allen, & Chang, 2007).

The direct and indirect medical costs associated with overweight and obese in U.S. alone accounts for \$117 billion annually (Stein & Colditz, 2004) and accounts for 5.3% of U.S. national health expenditure (Finkelstein et al, 2005). Obese individuals below 65 years of age incur 36% higher annual medical expenditure as compared to normal weight persons (Finkelstein et al, 2005). The medical expense is much larger among obese who manage to survive beyond 65 years. Cost savings achieved by treating obesity is comparable to that associated with curing other metabolic disorders like diabetes or cardiovascular diseases (Wolf, 1998).

The confluence of increased rates of obesity among children, adolescents and young adults, along with greater life expectancy, higher physical disability and the high health care costs involved, calls for immediate and effective population based interventions (Williams, Vogt, Stevens, Albright, Nigg, Meenan & Finucane, 2007).

According to the literature, people have attempted to lose weight but with varied levels of success. In a population-based survey, Jeffery, et al. (2000), reported that 75% of women and 47% of men had attempted to lose weight at some point in time. However, Institute of Medicine (1995) reported that most individuals regain some amount of lost weight in the first year after the weight loss program and almost all regain all the lost weight at the end of five years after the program (Befort, Stewart, Smith, Gibson, Sullivan & Donnelly, 2008). As much as five to ten percent weight loss can prevent various risks associated with obesity (U.S.D.H.H.S., N.I.H., 2007). Befort, Stewart, Smith, Gibson, Sullivan & Donnelly (2008) suggest maintenance of small amounts of weight loss over a period of time in opposition to high amounts of weight loss over a

short duration. In a review by Wing and Phelan (2005), they stated that about 20% of the people successfully lose 10% of their weight and maintain it over a year's period of time and that individuals who maintain weight loss for over one year are less likely to regain that lost weight.

Worksites as a potential avenue for weight loss interventions - Adults spend more waking hours at work than at home. Worksites can therefore, be a good avenue for conducting population-based weight loss interventions (Williams, Vogt, Stevens, Albright, Nigg, Meenan & Finucane, 2007). They can also facilitate reaching a large number of people (Hennrikus, & Jeffery, 1996). Adults from various ethnic backgrounds and socioeconomic strata can be targeted simultaneously (Pratt, Lemon, Fernandez, Goetzel, Beresford, French, Stevens, Vogt & Webber, 2007). Worksites provide a physical, social, psychological and an economic environment that can influence the health of the workers and also their families indirectly (Chu, Driscoll, & Dwyer, 1997, Pratt, Lemon, Fernandez, Goetzel, Beresford, French, Stevens, Vogt & Webber, 2007). Policies can be implemented at worksites that promote healthier lifestyle, thus, further leading to sustainable lifestyle alterations (Pratt, Lemon, Fernandez, Goetzel, Beresford, French, Stevens, Vogt & Webber, 2007). These changes could include making healthier options available in vending machines, making avenues available for physical activity or providing incentives for maintaining the BMI within the normal range.

There is also a sound rationale for employers to be interested in preventing obesity among their employees. First, obese individuals are more likely to take benefit of employment-based health insurance (Fong, Franks, 2008). Second, obesity is associated with greater absenteeism at work and also reduced productivity. A study by Finkelstein, Fiebelkorn & Wang (2005) examined data from 2001-2002 National Health Interview Survey (NHIS), and found that the people with grade II and grade III obesity lost two

more days of work than persons with normal weight. Further, the cost of obesity varies by gender. Cost of obesity for a full time female employee was almost 14 times more than that of a similar weight status male employee. Those belonging to type III obesity incurred 21% of the total cost of obesity. With an upsurge in the number of people belonging to type III category, as reported by Doshi, Polsky and Chang (2007), this cost is likely to be on a rise too. Given the 66% prevalence of overweight and obesity in United States, the total cost incurred to an organization would be substantial. Cawley, Rizzo, Haas, (2007) estimated that the national aggregate cost of obesity related absenteeism was \$4.8 billion. Implementing health promotion programs can lead to reduction in absenteeism and employee turnover (Renaud, Kishchuk, Juneau, Nigam, Téreault Leblanc, 2008).

Snacking behavior at work may also influence weight status. An article released in Chicago Defender (2007) reported that approximately 72% of American employees ate at least one unhealthy snack at least once a week at work. Around 25% of the employees ate unhealthy snacks at work three or more times a week. This did not account for other meals of the day i.e. breakfast, lunch or dinner. Young adults (18-25 yrs old) were more likely to eat unhealthy snacks at work on most days of the week. They were also more likely to be sedentary at their job and allow stress to influence their diet. Less than 50% of the employees had healthy snack options available at workplace vending machines.

Various interventions have been conducted at workplaces. These include, increasing availability of healthier food options in vending machines, at cafeterias and official meetings; making avenues available for physical activity like walking paths, tailoring messages that promote healthy diet and nutrition, identifying and training opinion leaders, developing teams in leadership of the opinion leaders (Wilson, et al, 2007). Even though a number of worksite weight loss interventions have been developed

and studied, few, if any were developed with the intention to be sustained once the research study was completed (Aldana et al 1993, 2006, Anderson et al, 1993, Atlantis et al, 2006, Blair, et al 1986, Briley et al, 1992, Brownell et al, 1984, 1985, Cohen et al, 1987, Collins et al, 1986, Erfurt et al, 1991, Edye et al 1989, Faghri et al 2008, Follick et al, 1984, Forster et al, 1985, 1988, Frankle et al, 1986, Garofalo, 1994, Goetzal, et al 1994, Grandjean et al 1996, Hermann-Nickell, 1989, Jeffery et al, 1985, Jeffery et al, 1989, Jeffery et al, 1993, Kelly, 1979, Kneip et al, 1985, Lando et al, 1993, Larson and Simmons, 1993, Lloyd et al, 2002, Loper & Barrows, 1985, Nelson et al, 1987, Petersen et al, 2008, Phillips & Philbin, 1992, Pritchard et al 1997, Prochaska, et al, 1992, 2008, Reppart & Shaw, 1978, Rose et al 1980, Sangor & Bichanich, 1977, Schumacher et al 1979, Seidman et al, 1984, Shannon et al 1987, Sherman et al, 1989, Shi 1992, Stunkard et al, 1989, Sumner, et al 1986, Tate et al 2001, White & Jacques, 2007, Williams et al 2007, Winick et al, 2002, Worick and Peterson, 1993, Zandee & Oermann, 1996, Zimmerman, et al, 1988).

Use of Internet for weight loss programs - There has been a tremendous increase in the number of people with access to the Internet. The number of US residents using Internet has risen from 8% in 1984 (Harvey-Berino, Pintauro, Buzzell, & Gold, 2004) to 57% in 2000 to 80% in 2007 (Ho, 2007) Thus, it can be effectively used as a channel to deliver health promotion interventions (Tate, Wing, & Winett, 2001) and reach a large number of people (Glasgow, et al., 2007, Hunter, et al, 2008, Petersen, et al, 2008).

A number of work site interventions have used Internet based programs to promote healthy lifestyle and weight loss (Booth, et al, 2008). These include increasing physical activity (Faghri et al, 2008), nutrition or behavioral interventions. Findings of the studies include short-term (Jones M, et al., 2008, Hunter, et al., 2008, Tate, Jackvony & Wing 2003, Williamson, et al., 2006) and sustained weight loss (Harvey-Berino, et al,

2004, Hunter, et al, 2008), reduction in binge eating (Jones, et al., 2008), improvement in eating habits (Petersen, et al, 2008), and reduction in body fat (Williamson et al., 2005). Interventions using Internet are also found to be cost effective (Southard, Southard, & Nuckolls, 2003).

Internet based interventions have employed various strategies to promote health oriented behavior change. These interventions target enhancement of knowledge or an alteration in behavior. Most behavioral interventions have been more successful than knowledge based ones (Tate, Jackvony & Wing, 2003). In a few studies, the intervention group that received individually targeted behavioral emails from a professional therapist was more successful at losing weight than the control group that received web-based information (Tate, Wing, Winett, 2001, Rothert, et al., 2006, Williamson, et al, 2005).

McCoy, Couch, Duncan & Lynch (2005) reported that Internet-based weight loss programs targeting physical activity and behavioral modifications are likely to be accepted by people. Studies have also compared Internet-based interventions with print-based (i.e., hard copy) interventions with differing findings. One study found both Internet-based and printed material equally effective in the promotion of physical activity (Marshall, et al, 2003). However, a study by Womble, et al, (2004), reported less effectiveness of an internet weight loss program in comparison with the control group that was provided with a weight loss manual.

When effectiveness of interventions delivered in person was compared to those delivered via Internet, some concluded equal effectiveness of internet-based support to frequent-in-person support for maintenance of weight loss (Harvey-Berino, et al, 2004, Micco, et al, 2007). However, Harvey-Berino, Pintauro, & Gold (2002), report greater participation and enhanced satisfaction with their group assignment when participating in interpersonal therapy, than Internet-based counseling. Findings of Gold, et al (2007),

suggest that internet based intervention with a behavioral component and professional guidance are more successful in achieving and maintaining weight loss among its participants, when compared to self-help web-based programs.

Often factors like lack of means of transportation or the costs involved may limit participation in weight loss programs, especially among the lower socioeconomic sections of the society. Internet can be a viable option for these individuals. However, according to Glasgow, et al, (2007) Internet-based interventions may not reach individuals most at risk, despite their high ability to recruit a large number of people (Jorgensen, Polivka, & Lennie, 2002). Further, high attrition rates have been one of the major shortcomings reported by various Internet based weight management interventions (Couper, et al, 2007, Franklin, et al, 2006, Glasgow et al 2007).

Barriers for weight loss - Various studies indicate a relationship between perceived barriers and success at weight loss (Gallagher, et al, 2006, Jorgensen, Polivka, & Lennie, 2002). Individuals with high-perceived barriers are more likely to be unsuccessful at losing weight and maintaining it, as compared to those with fewer perceived barriers (Gallagher, et al, 2006). They are unable to form long-term healthy habits or resist the temptation to relapse to tastier high fat foods or more comfortable sedentary lifestyle. The most frequently reported barriers by this group of people, as stated by Gallagher, et al (2006), include lack of time, job commitments and the expense of healthy eating. According to Herriot, et al, (2008), previous unsuccessful attempts at losing weight could also be a barrier to joining a weight loss program. None of the studies reviewed attempted to study a relation between perceived barriers and attrition rates of participants in the study. Neither did any of the studies attempt to identify a relationship between perception of a barrier and motives and their ability to predict weight loss.

Motives for weight loss - “People do not generally change their behavior without good reasons that outweigh the pain and annoyance associated with giving up long standing habits.” - Hall B. (2008, pg. 13). Motives are an operationalization of these good reasons. It is challenging for employers to convince their employees to adopt healthy behaviors and lifestyle and maintain these habits over a long period of time. Worksites can play a significant role in promoting adoption of healthy behaviors as they act as a source of peer support that acts as a positive internal motivating factor. Other external factors like availability of incentives, health insurance deductions, etc provide additional motivation to initiate and maintain a healthy behavior (Hall, 2008).

A number of studies have tried to investigate factors that would motivate people to lose weight (Cheskin, & Donze, 2001, French, Jeffery, Story, Neumark-Sztainer, 1998, Galuska, Will, Serdula, Ford, 1999, Young, et al, 2001, Herriot, et al, 2008, Jeffery & Wing, 1995, Rodin, 1993, O'brien et al, 2007, Ruelaz, et al, 2007, Sabinsky, et al, 2007, Wolfe, & Smith, 2002, Williams, Saizow, & Ryan, 1999). Researchers have attempted to study gender differences in motivational factors. While women are more likely to want to lose weight to improve their health and appearance (Cheskin, & Donze, 2001), a variety of factors seem to motivate men. Conflicting evidence exists on whether appearance motivates men to lose weight (Wolfe, & Smith, 2002, Sabinsky, et al, 2007). Other motivators for men include improving performance at work (Sabinsky, et al, 2007), better health (Wolfe, & Smith, 2002) and long-term fitness (Cheskin, & Donze, 2001). Physician's recommendation to lose weight has also been positively associated with a motive to lose weight for men and women (Galuska, et al, 1999). O'Brien et al (2007) report health as the most frequently selected motive. Intrinsic factors like positive body image (Cheskin & Donze, 2001), positive attitude towards weight loss and perception of weight loss as a sustainable change (Herriot, et al, 2008) are more likely to motivate one

to lose weight and be successful at it. Extrinsic factors like societal pressure are less likely to be encouraging (Cheskin, & Donze, 2001). However, Rodin, (1993) and Young, et al, (2001) reported contradictory findings and supported a positive role of societal pressures on weight loss. Tangibility of the results of weight loss may also cause difference in motivation towards it. According to Cheskin, & Donze, (2001), abstract outcomes of weight loss like reduction in blood lipid levels are less likely to motivate one to lose weight than tangible outcomes like reduction in fatigue.

Thus, in summary, an Internet based weight loss program conducted at work sites can have a far-reaching effect. It will enable a large number of people to participate in the program and thus, contribute towards improving the public's health. Also, perceived motivators and barriers may significantly influence the weight loss attempts made by individuals. As the source of these motives and barriers can range from personal to behavioral to environmental factors, through this study we attempt to identify the factors that may have the most significant influence on weight loss as well as those that can predict retention of the participants in the study.

Commercially Available Weight Loss Programs

Although numerous commercial and organized self-help weight loss programs are available in the US and millions of adults enroll into these, there have been rare attempts at scientific comparison of their features, benefits and cost effectiveness. Such data is essential for a common person to make informed choices. We came across one such review by Tsai & Wadden (2005) in which they compared some of the prominent commercial and organized self-help weight loss programs available in the US including Weight Watchers, Jenny Craig, L A Weight Loss (non-medical commercial weight loss programs), Health Management Resources, OPTIFAST, Medifast/Take shape for life (medically supervised proprietary programs), eDiets.com (Internet based commercial

weight loss programs), Take Off Pounds Sensibly & Overeaters Anonymous (organized self help programs) on the basis of their components, cost and efficacy. They summarize that minimal scientific evidence is available to recommend any of these programs except for Weight Watchers that has sponsored three randomized controlled trials and two case series. The findings of these studies suggest that those who regularly attended Weight Watcher's meetings lost a clinically significant 5% of their initial body weight and kept it off for over 3 to 6 months. There was some criticism to this review article (Gothelf, 2005) as it did not include a number of studies by Health Management Resources that collected data from cohorts at dozens of medical centers to determine the number of participants who completed various phases of treatment and the extent of weight loss achieved by them. However, a limitation to inclusion of such data was that despite its presence, it is not available to the general public or scientific community, as it has not been published in any peer-reviewed journals. Tsai & Wadden suggested conducting naturalistic studies to determine retention and extent of weight loss achieved by the participants in commercially available programs.

Methodology

Research design - This is an archival records study of a commercially available worksite-based, internet-delivered weight loss program. The archival records included gender, age, barriers and motives, assessed at program initiation, retention (3 & 6 months), and weight loss (at 3 & 6 months of participation in the program). For the purpose of this study, attrition and weight loss were considered dependent variables at both 3 & 6 months, while barriers and motives were the independent variables.

Subject selection and criteria - The seven worksites used reflect the total number that had engaged with the commercial program and had all aspects of the archival data available at the time of the study (i.e., the barrier and motive assessments were not

collected during earlier iterations of the program).

All employees who initiated the program were included in the analyses. All archival data was de-identified and program participants had complete anonymity in regards to the research team. Program eligibility criteria included that participants were employed by the worksite and had a BMI greater than or equal to 25.

Measurement Instruments

Body weight - A computerized and calibrated weighing station was used to measure the body weight of the participants. Weights were taken with participants wearing normal everyday clothes and with shoes on. The HealthSpot™, which included the calibrated scale and a built in digital camera that captured an image of the participant during a weigh-in, was used to objectively obtain weight data from participants at each quarterly weigh-in (i.e. at the beginning of the program, at three and at six months).

Barriers selected by each participant - At the beginning of the program, each participant was asked to choose from a list of 26 barriers, the ones that they considered would impact their achievement of weight loss goals (Appendix 1). The barriers were selected by the commercial weight loss program based on experience with participants during earlier iterations of the program. Barriers and motives that were provided were categorized as personal, behavioral and environmental factors. For example, personal barriers included items such as ‘I don’t enjoy physical activity’; behavioral barriers included items such as ‘I reach to unhealthy foods when I feel depressed or stressed’ and environmental barriers included item such as ‘the weather gets in the way of my exercise’. The selection of each barrier was coded as a ‘1’ in the data set. In addition to examining the selection of individual barriers, a total barrier score was computed by summing the total number of barriers that were identified by each participant.

Motives selected by each participant - At the beginning of the program, each

participant was also asked to choose from a list of thirteen motives for losing weight those that were most personally relevant (Appendix II). The motives were also selected by the commercial weight loss program based on experience with participants during earlier iterations of the program. Similarly, motives that were provided could be categorized as personal, behavioral and environmental factors. For example, personal motives included items such 'to look better or at least fit into my clothes', behavioral motives included items such as 'to help me be more productive' and environmental motives included items such as 'to set an example for my family'. In addition to examining the selection of individual motives, a total motive score was computed by adding together the total number of motives that were identified by each participant. Each motive selected was calculated as one point.

IncentaHEALTH™ Program Characteristics - The program participants received daily e-mail support, access to a comprehensive web site with educational and skill related information, and monthly monetary incentives. The monetary incentives were based upon the percentage of body weight lost, documented at quarterly assessments. The participants were allowed to tailor their diet as per their preferences and also choose between home or gymnasium based exercise program at either a beginner, intermediate or advanced level of exercise. The program was available to the employees for no cost. However, the employer of these work sites paid incentaHEALTH™ to make the program available to their employees.

The program included environmental changes within the worksites that can be summarized in 3 forms. First, motivational posters and recruitment signs were posted throughout the worksite. These signs were updated periodically but remained for the entire program. Second, a private weigh station termed HealthSpot™ was installed within the worksite. Although the area would provide privacy for participant weigh-ins, signs

and posters were used around the HealthSpot™ to highlight its presence. Third, active recruitment and kickoffs were combined and offered at each worksite.

Self-monitoring of weight - An important component of the program included weigh-ins by the participants, at the beginning, at three and six months of participation in the study, to report objectively on weight loss. The HealthSpot™, which included a calibrated scale and a built in digital camera that captured an image of the participant during a weigh-in, was used to obtain weight data from participants at each quarterly weigh-in. The participants were informed of the camera and the images were used to provide motivation to the participants over the course of the program. In addition the camera provided a validation check to ensure that participants did not artificially alter their weight, for example, by leaning on a desk and provided verification that it was actually the program participant who completed the weigh-in. The camera and weight station were linked via a computer that provided a connection to the Internet for the two-way transmission of data to program staff. To protect participant information all data was encrypted.

Incentives - Tangible incentives seem to be effective in enhancing short term, but not long-term weight loss (Estabrooks & Glasgow, 2007). The monetary incentive base of the program was developed primarily to enhance recruitment to the weight loss program by enhancing participants' perceptions of positive outcomes related to weight loss. The monetary rewards were based on participant quarterly weigh-ins and the monetary amount of incentive was identical to the percentage of body weight lost. Participants who lost 1, 2, 3, 4, or 5% of their body weight were compensated with 1, 2, 3, 4, or 5 dollars per month respectively. Dollar amounts for participants that lost more than 5% of initial body weight then increase by increments of 5 (e.g., 5-9% weight loss = \$5; 10-14%=\$10; 15-19%=\$15; >20%=\$20). These incentives were based on quarterly

weight ins and all percentage weight lost was calculated based on a participant's initial weight. For example, if a participant lost 5% of initial body weight, she would receive \$5 for each month of the following quarter. After the 2nd quarter she may have lost an additional 5% then each month for the next quarter she would receive \$10 per month (cumulative loss of 10% since program commencement).

Diet and Exercise - All interested participants were required to complete the PAR-Q test to determine if it is necessary to secure a physician's approval to participate in the program. Those participants screened for physician's approval by the PAR-Q received a description of the physical activity components of the intervention and a checklist of specific exclusion criteria that included: overt cardiovascular disease that was not stabilized, severe hypertension, tachycardias/bradycardias, uncontrolled metabolic disease, high-degree AV blocks, unstable angina, uncontrolled dysrhythmias, recent ekg changes & cardiac events, acute myocarditis/pericarditis, or any other condition that could be detrimental to the health of the participant based on the description of the program. The employees were instructed to take both materials to their physician and if her/his physician indicated that any of these conditions are present, the participant was excluded from the exercise components of the program.

In order to initiate and sustain weight loss, the INCENT program used a balanced diet that reduced fat and caloric intake plus added regular exercise as program components that enhanced initial weight loss and aided in slowing weight regain. The nutritional guidelines associated with the program include many suggestions provided by the National Weight Control Registry (Riedel, et al, 2001). These strategies include choosing low-fat food options, eating a number of smaller meals/snacks throughout the day with the majority eaten or prepared at home, and frequent self-monitoring of intake. Similarly, participants would work their way up to regular bouts of moderate to vigorous

intensity physical activity for approximately 250-300 minutes per week and would regularly self-monitor their progress (Riedel, et al, 2001).

Participants were encouraged to eat six times per day, every two to three hours. Each meal included a balance of carbohydrates in the form of fruits, vegetables or whole grains and low-fat proteins. Participants were provided with a daily meal plan that included options related to the type of foods selected. Fruit and starchy vegetables (e.g., corn, potato, squash) options were promoted as complex carbohydrates that were to be consumed with most meals. Three meals also included a serving of non-starchy vegetables. Participants were encouraged to monitor serving sizes using 'rules of thumb'. Specifically, a serving of protein was defined as approximately the size of the palm of one's hand or a deck of cards, while a serving of fruit or vegetables was defined as equitable to the size of the participant's clenched fist.

A number of studies have determined that health promotion programs that include menu of programmatic options were more successful than those were that simply prescribe a standard program (Heany & Goetzel, 1997). Participants had the option of selecting a foundation, intermediate, or advanced physical activity program. The advanced option was not available initially and was introduced as an option following the first 3 months of the program. Participants also had the option of selecting physical activities that are more suitable to their home environment or activities that are more suitable for a fitness facility environment. Participants were encouraged to select an option that was reflective of their current level of health and fitness. The program suggested at all recruitment sessions for the participant's to begin with the foundation option and progress to the intermediate level at the completion of the first 12 weeks of the program. Once a participant had completed the intermediate level, they had the opportunity to sustain or move into the advanced option. The program did not actively

push participants into the advanced level as the intermediate level included the amount (five days of exercise each week) and type of physical activity (both cardio and strength training) suggested to be sustainable and produce longer-term weight loss. To avoid injury, the first and last 5 minutes of each physical activity session included warming-up and cooling-down. The purpose of the warm-up was to slowly bring the participant's heart rate up to the desired training heart rate. The cool-down was designed to slowly decrease the participant's heart rate down from the training heart rate.

Electronic support - The INCENT program also has a comprehensive website that is described as an electronic support system. The electronic support system includes the daily e-mail support, video explanations of exercises, links to sample recipes, discussion forums, and links to an electronic fitness advisor. There is also an online progress report that includes participant photos from each weigh-in and specific information on weight lost and incentives earned. The electronic support system was user friendly and hence barriers to using it were minimal. The participants also received eating and physical activity self-monitoring recording sheets so that they could log their experiences and use them to bolster confidence.

Finally, participants had the ability to e-mail specific queries and ask advice of a health education specialist. Also, to avoid unhealthy weight loss practices such as the use of diet pills or purging, e-mail messages highlighted the dangers of these unsafe practices.

Attrition – For the purpose of this study, the unavailability of data on weight of the participant at the end of every quarter was regarded as a drop out. However, for those participants who weighed themselves at six months but not at three months, their data was treated as missing data at the 3 month time point rather than as attrition.

Data collection and analysis

The archival data records were generated by recording the weight of each participant at the beginning, three and six months of program participation. In addition, the number and the specifics of the barriers and motives selected by the participant were recorded at the beginning of the program. Finally, all demographic information was collected prior to the participants beginning the program.

Data analyses - To achieve each of the study purposes the following statistical tests were completed.

Aim a. To determine the most prevalently identified barriers and motives for weight loss simple frequencies were completed based upon participant selections from the list provided.

Aims b & c. To determine the relationship between barrier and motive identification with subsequent attrition at 3 and 6 months post program initiation a series of statistical tests were completed. First, chi square analyses were completed for each barrier and motive (i.e., selected versus not selected) when contrasted with attrition at 3 and 6 months. To avoid the potential of benefitting from chance due to the multiple comparisons, a correction factor was used by dividing the probability value ($p=.05$) by the number of test completed (26 barriers; 13 motives). This resulted in the use of a probability of 0.001 as the indicator of significance in the chi squared analyses. In addition, based upon the distribution of responses the total number of barriers selected were categorized into those that identified no barriers, those that identified 1 to 10 barriers, and those that identified more than 10, were entered into a logistic regression to predict attrition at 3 and 6 months. Similarly, based upon the distribution of responses the total number of motives selected were categorized into those that identified no motives, those that identified 1 to 7 motives, and those that identified more than 7, were entered

into a logistic regression to predict attrition at 3 and 6 months.

Aims d & e. To determine the relationship between barrier and motive identification on weight loss at 3 and 6 months was tested using multiple regression models. Due to the nature of the weight loss outcome (i.e., continuous variable) multiple regression was used rather than chi square analyses. Further, due to the number of barriers and motives, only the relationships between the total number of barriers and motives were examined within the regression models.

Aim f. To determine the effectiveness of the program at the end of three and six months of participation an initial intention to treat analysis was completed using paired t-tests and baseline assessment carried forward for participants that were lost to follow-up.

Aim g. To determine the reach of the program into the eligible employee population was completed using simple frequency calculations using the total employee population and the total projected eligible population as the denominators and the participants engaged as the numerator.

Aim h. To determine the proportion of the targeted employee population that ultimately benefited from the program and the degree to which they benefited the participants' weight assessments at 6 months were examined based on those who lost weight and were retained at 6 months. Additionally, the proportion of the population that benefited was assessed by using the total worksite population and total eligible populations as denominators and those that lost weight as the numerator.

Results

The 7 worksites included in this study provided employment for a total of 10513 people (Figure 1).

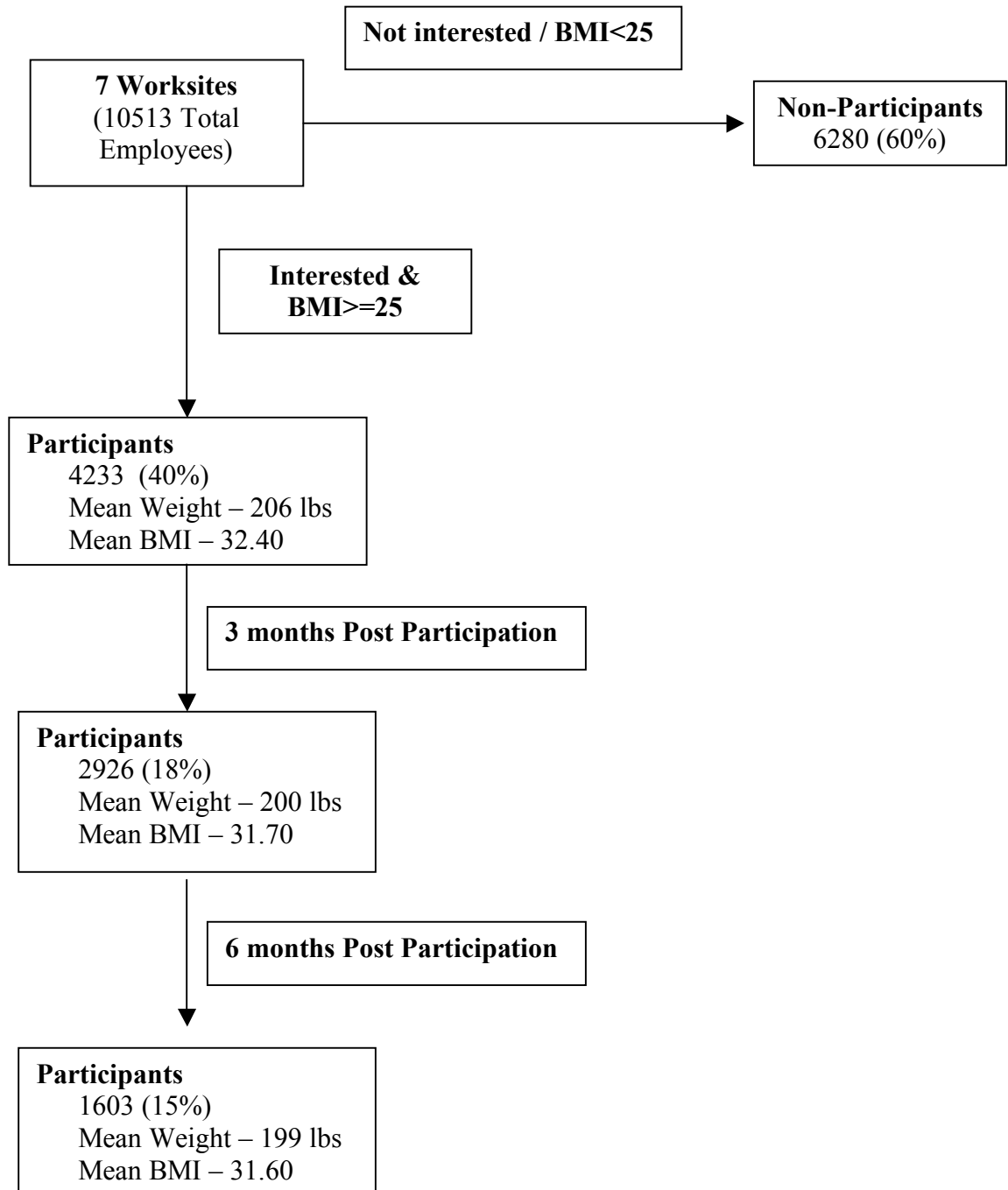


Figure 1. Flow diagram of participant recruitment and retention across 6 months of delivery.

Data from 4233 employees across the work sites qualified to be included for analysis (BMI ≥ 25). Sixty six percent of these employees were females and 34% of the employees were males. The age of the participants ranged from 18 to 71 years with mean age being 44.1 years. The baseline mean weight of the participants was 206 (± 43.99) pounds ranging between 121 pounds and 440 pounds. As only those participants with a BMI of 25 and above were included in the analysis, the BMI of the participants ranged from 25 to 67 kgs/m^2 with mean BMI being 32.40.

Figure 1 also provides some of the data necessary to address study Aim g—the reach of the program. Based upon the current prevalence of overweight and obesity in the United States, it was projected that approximately two thirds of the employees across the worksites would be overweight or obese and, therefore, eligible for the study. Thus the reach of the program into the total population of employees was approximately 40% (Figure 1). However when considering the employees that would be eligible for the program, the reach is approximately 60%.

Aim a - To identify the most prevalently selected barriers and motives by the participants.

The total number of barriers chosen by the participants ranged from 0 to 25. The mean number of barriers chosen was 3.46. The median number of barriers was 2.0 and 45% of the participants did not identify any personally relevant barriers. The frequency of selection of each of the barriers is summarized in Table 1 below.

Table 1. Frequency and percentage of participants that identified specific barriers

Barrier	Frequency	Percentage
There are too many opportunities for me to eat unhealthy foods.	1306	30.9
No time to exercise.	1283	30.3
I'm too tired.	1160	27.4
I get discouraged because I don't see changes fast enough.	1127	26.6
I don't have time to cook, so we buy a lot of fast food.	770	18.2
I've tried diets before and it never lasts.	756	17.9
I can't seem to keep track of calories.	662	15.6
The weather gets in the way.	626	14.8
I don't enjoy physical activity or it bores me.	587	13.9
Many of my family's favorite foods are unhealthy and they don't want to change.	549	13
I don't know how to make vegetables appetizing.	547	12.9
I'm worried that I won't succeed, so I make excuses and sabotage my efforts.	483	11.4
I don't get enough encouragement to keep me motivated.	483	11.4
Fruits and vegetables spoil too quickly.	415	9.8
My family's social activities revolve around eating big meals.	387	9.1
I travel a lot.	147	9.1
I'm intimidated by the in-shape people in the gym.	336	7.9

Table 1. Continued.

Barrier	Frequency	Percentage
Healthy foods and vegetables are too expensive.	322	7.6
I don't know how to pick good fruits and veggies.	314	7.4
I can't afford the gym.	300	7.1
I don't have the right equipment.	244	5.8
I have health conditions that prevent me from exercising.	171	4
No safe or convenient place to exercise.	151	3.6
I can never find the info I need when I need it.	98	2.3

The total number of motives selected by the participants ranged from 0 to 12. The mean number of motives selected was 3.49. The median number of motives was 3.0 and 44% of the participants did not identify any personally relevant motives. The frequency of selection of each of the motives is summarized in Table 2 below.

Table 2. Frequency and percentage of participants that identified specific motives

Motive	Frequency	Percentage
To look better or at least fit into my old clothes.	1954	46.2
It's time to lose weight. I'm done procrastinating.	1762	41.6
To help me maintain or improve my health so I can be of help to my family, friends and community.	1663	39.3
To lift my spirits. To feel better about myself and improve my confidence.	1452	34.3
To decrease my stress level.	1302	30.8
To help me be more productive.	1224	28.0

Table 2. Continued.

Motive	Frequency	Percentage
To learn more about the types of food that will help avoid obesity, cancer, heart disease and diabetes.	1.93	25.8
The cash incentives will help keep me motivated.	982	23.2
To learn more about the types of activities that help avoid obesity, cancer, heart disease and diabetes.	959	22.7
To be in a program with my co-workers will help keep me motivated.	935	22.1
To set an example for my family.	919	21.7
My physician told me to lose weight.	532	12.6

Aim b & c - Identify a relationship between the selection of barriers and motives and attrition at 3 & 6 months

Chi square analyses were completed for each barrier and motive (i.e., selection versus non-selection) contrasted with retention at 3 and 6 months. Table 3 below includes the data and statistical outcomes related to 3 month attrition. Table 4 includes the data and statistical outcomes related to 3 month attrition.

Table 3. Chi square analyses relating barrier and motive identification to participant attrition at 3 months.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
To look better or at least fit into my old clothes.	59	35	251.1	<0.001
It's time to lose weight. I'm done procrastinating.	53.4	31.8	202.6	<0.001
To lift my spirits. To feel better about myself and improve my confidence.	42.9	27.1	117.0	<0.001
To decrease my stress level.	37.8	24.9	82.24	<0.001
To help me be more productive.	35.3	23.6	69.08	<0.001
To learn more about the types of food that will help avoid obesity, cancer, heart disease and diabetes.	31.3	21.2	55.56	<0.001
The cash incentives will help keep me motivated.	32.2	15.7	160.4	<0.001
To learn more about the types of activities that help avoid obesity, cancer, heart disease and diabetes.	27.5	18.6	47.7	<0.001
To be in a program with my co-workers will help keep me motivated.	25.8	19	27.57	<0.001
To set an example for my family.	27.5	16.9	70.13	<0.001
My physician told me to lose weight.	15.1	10.5	19.93	<0.001

Table 3. Continued.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
I reach for unhealthy foods when I feel depressed or stressed.	44.7	24.3	194.6	<0.001
There are too many opportunities for me to eat unhealthy foods.	40.6	22.7	157.5	<0.001
No time to exercise.	39.5	22.6	141.7	<0.001
I'm too tired.	35.1	21	105.2	<0.001
I get discouraged because I don't see changes fast enough.	34.4	20.2	108.6	<0.001
I don't have time to cook, so we buy a lot of fast food.	23.9	13.4	78.38	<0.001
I can't seem to keep track of calories.	20.2	11.8	56.93	<0.001
The weather gets in the way.	20.2	10.2	83.62	<0.001
I don't enjoy physical activity or it bores me.	17.8	10.6	44.77	<0.001
Many of my family's favorite foods are unhealthy and they don't want to change.	17.5	9.2	64.19	<0.001
I don't know how to make vegetables appetizing.	39.5	22.6	141.7	<0.001

Table 3. Continued.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
I'm worried that I won't succeed, so I make excuses and sabotage my efforts.	14	9.2	23.78	<0.001
I don't get enough encouragement to keep me motivated.	14.9	8.5	42.61	<0.001
Fruits and vegetables spoil too quickly.	13.2	7	45.77	<0.001
My family's social activities revolve around eating big meals.	12.3	6.5	42.56	<0.001
I can't afford the gym.	7.5	6.7	1.046	0.168
I don't have the right equipment.	6.6	5.1	4.497	0.02
I have health conditions that prevent me from exercising.	5.1	3.1	11.04	0.001
I can never find the info I need when I need it.	3	1.7	7.57	0.004

Table 4 Chi square analyses relating barrier and motive identification to participant attrition at 6 months.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
To look better or at least fit into my old clothes.	59	35	251.1	<0.001
It's time to lose weight. I'm done procrastinating.	53.4	31.8	202.6	<0.001
To help me maintain or improve my health so I can be of help to my family, friends and community.	49.5	30.7	155.5	<0.001
To lift my spirits. To feel better about myself and improve my confidence.	42.9	27.1	117.0	<0.001
To decrease my stress level.	37.8	24.9	82.24	<0.001
To help me be more productive.	35.3	23.6	69.08	<0.001
To learn more about the types of food that will help avoid obesity, cancer, heart disease and diabetes.	31.3	21.2	55.56	<0.001
The cash incentives will help keep me motivated.	32.2	15.7	160.4	<0.001
To learn more about the types of activities that help avoid obesity, cancer, heart disease and diabetes.	27.5	18.6	47.7	<0.001

Table 4. Continued.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
To be in a program with my co-workers will help keep me motivated.	25.8	19	27.57	<0.001
To set an example for my family.	27.5	16.9	70.13	<0.001
My physician told me to lose weight.	15.1	10.5	19.93	<0.001
I reach for unhealthy foods when I feel depressed or stressed.	44.7	24.3	194.6	<0.001
There are too many opportunities for me to eat unhealthy foods.	40.6	22.7	157.5	<0.001
I'm too tired.	35.1	21	105.2	<0.001
I get discouraged because I don't see changes fast enough.	34.4	20.2	108.6	<0.001
I don't have time to cook, so we buy a lot of fast food.	23.9	13.4	78.38	<0.001
I've tried diets before and it never lasts.	22.5	14	51.46	<0.001
I can't seem to keep track of calories.	20.2	11.8	56.93	<0.001
The weather gets in the way.	20.2	10.2	83.62	<0.001
I don't enjoy physical activity or it bores me.	17.8	10.6	44.77	<0.001
Many of my family's favorite foods are unhealthy and they don't want to change.	17.5	9.2	64.19	<0.001

Table 4. Continued.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
I don't know how to make vegetables appetizing.	39.5	22.6	141.7	<0.001
I'm worried that I won't succeed, so I make excuses and sabotage my efforts.	14	9.2	23.78	<0.001
I don't get enough encouragement to keep me motivated.	14.9	8.5	42.61	<0.001
Fruits and vegetables spoil too quickly.	13.2	7	45.77	<0.001
My family's social activities revolve around eating big meals.	12.3	6.5	42.56	<0.001
I travel a lot.	4.3	2.8	7.38	0.004
I'm intimidated by the in-shape people in the gym.	9.9	6.3	17.96	<0.001
Healthy foods and vegetables are too expensive.	9.7	5.9	21.14	<0.001
I don't know how to pick good fruits and veggies.	9	6.1	12.59	<0.001
I can't afford the gym.	7.5	6.7	1.046	0.168
I don't have the right equipment.	6.6	5.1	4.497	0.02
I have health conditions that prevent me from exercising.	5.1	3.1	11.04	0.001

Table 4. Continued.

Barrier/Motive	% Retained that selected	% Drop out that selected	χ^2	Sig.
I can never find the info I need when I need it.	3	1.7	7.57	0.004

Aim b & c – Logistic regression – selection of total motives and barriers and retention at 3 & 6 months of participation on the program.

Table 5 Logistic regression - selection of total motives and barriers and retention at 3 months of participation on the program.

95.0% C.I.for EXP(B)				
	B (SE)	Exp(B)	Lower	Upper
Included				
Total barriers	.066 (.011)***	1.068	1.045	1.092
Total Motives	.067(.013)***	1.069	1.043	1.096
Constant	-.647 (.45)***	.524		

Note $R^2 = .041$ (Hosmer & Lemeshow), $.055$ (Cox & Snell) & $.073$ (Nagelkerke). Model

$\chi^2 (2) = 238.689$, *** $p < .0001$.

Table 6. Logistic regression - selection of total motives and barriers and retention at 6 months of participation on the program.

95.0% C.I.for EXP(B)				
	B (SE)	Exp(B)	Lower	Upper
Included				
Total barriers	.048 (.011)***	1.049	1.026	1.072
Total Motives	.076(.013)***	1.079	1.052	1.106
Constant	-.945 (.47)***	.389		

Note $R^2 = .035$ (Hosmer & Lemeshow), .046 (Cox & Snell) & .062 (Nagelkerke). Model $\chi^2 (2) = 197.965$, *** $p < .0001$

Total barriers (standardized beta=1.07; 95% CI 1.05-1.09) and motives (standardized beta=1.07; 95% CI 1.05-1.09) significantly predicted the retention of participants at 3 months ($R^2 = .041$, $p < .001$). Similarly, total barriers (standardized beta=1.05; 95% CI 1.03-1.07) and motives (standardized beta=1.08; 95% CI 1.05-1.09) significantly predicted the retention of participants at 6 months ($R^2 = .035$, $p < .001$). Contrary to hypotheses the more barriers identified the more likely participants were to be retained. Consistent with hypotheses the more motives identified the more likely the participants were to be retained. The regression analyses were also completed while controlling for age and gender however the changes in explained variance were modest and the relationships between total motives and barriers remained consistent.

Aim d & e – Multiple regression – selection of total motives and barriers and weight loss at 3 & 6 months of participation on the program.

Table 7 Multiple regression - Selection of total motives and barriers and weight loss at 3 months of participation on the program while controlling for age and gender.

Model		B	Std. Error	Beta
1	(Constant)	3.950	.272	
	TOTBAR	-3.984E-02	.055	-.024
	TOTMOT	.107	.065	.056
2	(Constant)	5.148	.845	
	TOTBAR	-7.798E-03	.055	-.005
	TOTMOT	.122	.064	.063
	GENDER	-1.960	.382	-.126*
	AGE	2.972E-04	.017	.000

Note – $R^2 = .002$ for Step 1; $\Delta R^2 = .015$ for Step 2 ($ps < .001$). * $p < .001$

Table 8 Multiple regression - Selection of total motives and barriers and weight loss at 6 months of participation on the program while controlling for age and gender.

Model		B	Std. Error	Beta
1	(Constant)	4.453	.430	
	TOTBAR	1.754E-02	.086	.007
	TOTMOT	.128	.099	.046
2	(Constant)	6.011	1.325	
	TOTBAR	5.687E-02	.087	.024
	TOTMOT	.140	.098	.051
	GENDER	-2.279	.599	-.101*
	AGE	-3.454E-03	.027	-.003

Note – $R^2 = .003$ for Step 1; $\Delta R^2 = .010$ for Step 2 ($ps = .001$). * $p < .001$

The regression model examining the relationship between total barriers and motives while controlling for age and gender was statistically significant ($R^2 = .002$, $p < .01$), but predicted very little variance in weight loss at 3 months. However, neither total barriers (standardized beta = $-.005$) or motives (standardized beta = $.06$) significantly contributed to the model. Similarly, the regression model examining the relationship between total barriers and motives while controlling for age and gender was statistically significant ($R^2 = .01$, $p < .01$), but predicted a practically insignificant amount of variance in weight loss at 6 months. Again, neither total barriers (standardized beta = $.02$) or motives (standardized beta = $.05$) significantly contributed to the model.

Aim f - Effectiveness of the program at 3 & 6 months of participation

Paired sample T tests were used to compare mean weight of participants both at 3 & 6 months with the baseline mean weight of participants. At 3 months the participants lost a significant amount of weight ($t = 21.75$, $p < .001$). The participants lost, on average, 2.1 pounds ($SD = 6.3$) with a 95% confidence interval of 1.9 to 2.3 pounds. Similarly, at 6 months the participants lost a significant amount of weight ($t = 20.43$, $p < .001$). The participants lost, on average, 2.5 pounds ($SD = 7.9$) with a 95% confidence interval of 2.2 to 2.7 pounds. This weight loss reflected approximately 1.25% of initial body weight lost, on average, by each participant.

Aim g – Reach of the program

We calculated the reach of the program by dividing the number of employees that participated on the program by the total number of employees in the worksites being studied at that point of time. We found that a total of 4198 employees participated in the program, which accounted for 60% of the eligible employee population and 40% of total employee population.

Aim h - Reach by effectiveness of the program

We calculated reach by effectiveness of the program by dividing the total number of participants that lost weight on the program by the total number of employees in the participating worksites. Follow-up analyses were conducted to determine the overall proportion of the workforce that benefited (i.e., lost weight) at 6 months. Recall that Figure 1 indicated that when reach and retention data were computed, it was found that 4129 employees (60% of eligible population & 40% of total employee population) participated in the program. At three months post initiation, 1928 participants (28% of eligible population & 18% of total employee population) were retained and at 6 months, 1607 participants (23% of eligible population & 15% of total employee population) were retained on the program. Of the 1607 participants who were retained at 6 months 1088 were successful in losing weight and lost, on average 9.4 pounds (95% CI: 8.8 to 9.9 pounds), a clinically significant 4.4% of initial body weight. Thus, 10.1% of the total employee population and 16% of the eligible population benefited from the weight loss program and lost a clinically relevant amount of weight.

Discussion

This study attempted to examine the impact of a commercial weight loss program that targets overweight employees. The top three barriers most often selected by the participants included: I reach for unhealthy foods when I feel depressed or stressed, there are too many opportunities for me to eat unhealthy foods, and no time to exercise. Similarly the motives most frequently selected by the participants were: to look better or at least fit into my old clothes, it's time to lose weight. I'm done procrastinating, and to help me maintain or improve my health so I can be of help to my family, friends and community. Although these barriers and motives were not developed on any theoretical basis, some could be considered with the lens of Bandura's Social Cognitive Theory (1997), which posits that an individual, his/her behaviors, and the environment interact to produce outcomes. For example, it was observed that the most frequently reported barriers and motives were personal ones, either belonging to personal affective or personal cognitive categories. As this is a commercial weight loss program it did not list barriers and motives across the complete realm of the components of triadic reciprocal causation of the social cognitive theory and, as such, leaves some room for improvement of barrier identification.

The barriers and motives most often reported in this study have also been reported in previous studies, for example; lack of time to exercise (Befort et al, 2008, Fletcher, et al, 2008, French et al, 1998, Gallagher, et al, 2006, Johnson et al, 1990, Kruger et al, 2007, Lynch et al, 2007), eating unhealthy foods when depressed or stressed (Chang et al, 2008) among the barriers and appearance (Chang et al, 2008, Cheskin & Donze, 2001, Fletcher, et al, 2008), to fit into clothes (Chang et al, 2008, Fletcher, et al, 2008) and health concerns (Cheskin & Donze, 2001, Young et al, 2001) among the motives for weight loss. Thus, our findings coincide with the findings from previous trials.

We found a vast number of significant relationships between barriers and retention at 3 and 6 months. Interestingly, those participants who selected a given barrier were more likely to be retained than those who did not select a given barrier at the beginning of the program. Further, when the total number of barriers was considered, those that identified more barriers were less likely to drop-out. We did not come across any study that examined the relationship between barrier identification and attrition in a weight loss program. However, according to DiBonaventura & Chapman, 2008, participants on a weight loss program, often underestimate the barriers that they might face while being on the program, especially those related to diet. Thus, there occurs a discrepancy between original intentions and behavior. Hence, we postulated that, those participants who did not foresee the possible barriers that they may face while following the weight loss program would be more likely to drop out of the program earlier than those who did foresee possible barriers. To some extent our findings do support this claim.

When gender and age were controlled for, we observed that females were more likely to be retained on the program than men at both three and six months of participation but the predicted variance was so small that it may not be practically significant. We did not come across any data on differential attrition rates among males and females on weight loss program. We also did not observe any impact of age on retention of the participants. This observation was in contradiction with the findings of Winick, Rothacker, & Norman (2002) & Tate, Wing, & Winett (2001) who reported higher attrition among younger participants as compared to older participants.

As in case of barriers, those participants who selected motives at the beginning of the program were more likely to be retained for longer period of time than those who did not select any motives. When we controlled for age and gender, we found that women

who selected motives at the beginning of the program were more likely to be retained on this program than men. Age of the participants did not influence their retention on the program. Again, in our review of literature we did not come across any study that examined any possible relationship between selection of motives and attrition. Based on the findings of this study, and observations made by DiBonaventura & Chapman, 2008, we would postulate that the participants who selected motives were more likely to be self-aware, had clarity on the purpose of joining the weight loss program and hence, were more likely to be retained for longer than those who did not select any motives.

Our regression model was not able to predict any significant relationship between perception of barriers and motives and weight loss. Based on past findings of Gallagher et al (2006) and Kruger, Blanck, & Gillespie (2006), we postulated that the participants who were more successful would perceive fewer or no barriers to weight loss as compared to unsuccessful participants. The findings of this study did support these postulations. When we controlled for age and gender we found that women were less likely to lose weight on this program than men both at 3 & 6 months of participation but age of the participants did not influence their extent of weight loss. These findings contradict the findings of Chiriboga et al, 2008, who reported weight loss among women but weight gain among men over a twelve-month period of time. However, some other studies do report that women do tend to gain weight over time (Dawson-Hughes, & Harris, 1992, Power, Lake & Cole, 1997, Rissanen et al, 1991, Shah, Hannan, & Jeffery, 1991, Sidney et al, 1998, Van Staveren et al, 1986, Williamson, Kahn, & Byers, 1991).

This program was effective as it led to significant weight loss among its participants at the end of three and six months of participation. When the mean weight of the participants at three and six months were compared to the mean baseline weight, it was found that the participants lost a significant amount of weight at three months and

after six months of participation on the program. An overall intention to treat analysis with last assessment carried forward imputation indicated a statistically significant but small weight loss. Some of the previous studies report a much higher rate of effectiveness (Forster et al, 1985, Frankle et al, 1986, Jeffery et al 1985, Lloyd et al, 2002, Prochaska et al, 1992, Sangor & Bichanich, 1977, Schumacher et al, 1979, Seidman et al, 1984). But these studies usually involve high intensity interventions and the final analysis is based on homogenous, highly motivated individuals who are available for final assessments (Anderson et al, 1993, Faghri et al, 2008, Forster et al, 1988, Frankle, et al, 1986, Schumacher, et al, 1979, Seidman et al, 1984). Thus, the public health significance of these interventions is unknown. This information provides strong internal validity, but from external validity point of view, the samples were unlikely to be representative of participants and settings (Glasgow, Vogt, & Boles, 1999). Further, seldom do more intensive trials of weight loss interventions present data on the reach into the target population and it may be that there is an inverse relationship between reach and retention. When considering the intention to treat analyses in the context of organizational decision makers, the overall impact of the intervention will likely not be compelling. From public health impact point of view of work site based weight loss interventions, it is important to determine the percentage of employees that were reached, the percentage of employees that lost weight and those that were retained on the program over a period of time. This information is crucial for an employer while deciding on choice of an appropriate weight loss program for its employees. There is paucity of information with these regards. We did not come across any study in the literature that provided the above-mentioned data for a commercial weight loss program—or a research based program. A number of previous studies have reported data on reach of their programs (Aldana et al, 1993, 2006, Atlantis et al, 2006, Blair et al, 1986, Brownell et al, 1984, Cohen, Stunkard, & Felix, 1987,

Erfurt, Foote, & Heirich, 1991, Garofalo, 1994, Faghri et al 2008, Lando et al, 1993, Larson and Simmons, 1993, Petersen et al, 2008, Shi 1992, Williams et al, 2007) with the percentage of employees reached ranging from 1.9 to 69% and an average of 30.7% reach. The commercial program that we studied reached 60% of the target population and may reflect more accurate picture of potential reach than studies examining the efficacy of weight loss programs in a randomized controlled trial protocol.

Intention to treat analysis is considered a scientifically sound means of reporting data on weight loss programs. However, we were surprised to find that very few studies report this data (Cohen, Stunkard, & Felix, 1987, Faghri, et al, 2008). When we analyzed our data using this method, we found that with last assessment carried forward for missing values, participants lost 2.5 lbs weight at the end of 6 months of participation, which accounts for merely 1.25% of their original body weight and would lead to a conclusion that the program was not very effective. However, when reach, effectiveness and retention data are compiled together, it was observed that at six months, 1607 participants, 15.3% of the total employee population, were retained on the program. Of these, 1088 (10.3% of entire employee population) were successful at losing weight on the program. On an average, these participants lost 9.4 lbs of weight on the program accounting for a significant 4.4% of their initial body weight. This data clearly indicates that the program had an impact at the worksite level. Thus, different methods of presenting the same data can lead to very different conclusions about a program. Using reach, retention, and effectiveness data provides a richer source of information to truly indicate what proportion of an employee population will benefit, and to what degree.

Conclusion

Worksite health professionals are faced with numerous decisions related to promotion programs that will be offered to their workforce. Decisions are typically made on information related to effectiveness (i.e., does it work?) or reach (i.e., does it engage a lot of people?). Rarely is the information on effectiveness and reach combined to allow for more sophisticated decision-making. A number of weight loss based studies have been conducted at worksites on an experimental basis. Very few studies have dealt with the combined impact of reach and effectiveness of commercial weight loss programs (Dansinger, et al, 2005, Herriot et al, 2008, Lowe, Kral, & Miller-Kovach, 2008, Tsai & Wadden, 2005, Witherspoon & Rosenzweig, 2004). In a review of effectiveness of commercial weight loss programs, Tsai and Wadden (2005) report that since most studies do not report or control for attrition rates, the effectiveness data reflects only the best case scenarios. In absence of availability of adequate data, the evidence for use of these programs is suboptimal.

Researchers have also reported high attrition rates in worksite based weight loss programs (Aldana, et al 2006, Faghari et al, 2008, Goetzel, et al, 1994, Petersen, et al, 2008, Prochaska, et al, 2008, Tate, et al, 2001, White & Jacques, 2007) as well as Internet based interventions (Couper, et al, 2007). In order to enhance participation and reduce attrition in these programs, various studies have attempted to identify barriers (Gallagher, et al, 2006) and motives (Cheskin, & Donze, 2001, French, et al, 1998, Galuska, et al, 1999, Young, et al, 2001, Herriot, et al, 2008, Jeffery, & Wing, 1995, Rodin, 1993, Ruelaz, et al, 2007, Sabinsky, et al, 2007, Wolfe, & Smith, 2002, Williams, Saizow, & Ryan, 1999) associated with weight loss. Employers and commercial weight loss programs have tried to either offer programs that overcome the barriers faced by employees or offered participants with information on means to overcome them, for

example, free of cost programs offered on site (Aldana, et al, 1993, 2006, Anderson et al, 1993, Atlantis, et al, 2006, Blair et al, 1986, Briley, et al, 1992, Collin et al, 1986, Edye, et al 1989, Erfurt et al, 1990, Erfurt, Foote, & Heirich, 1991, Faghri, et al 2008, Follick, et al 1984, Fowler et al, 1985, Frankle, et al, 1986, Garofalo, 1994, Goetzel, et al, 1994, Gomel et al, 1993, Grandjean, et al, 1996, Hermann-Nickell, 1989, Jeffery et al, 1993, Kelly, 1979, Kneip et al, 1985, Lando et al, 1993, Larsen and Simmons, 1993, Loper & Barrows, 1985, Nelson et al, 1987, Petersen, et al, 2008, Pritchard, Nowson, & Wark, 1997, Prochaska, et al, 1992, Reppart & Shaw, 1978, Rose et al, 1980, Sangor & Bichanich, 1977, Schumacher, et al, 1979, Seidman, et al, 1984, Shannon, et al, 1987, Sherman, et al, 1989, Shi, 1992, Sumner, et al, 1986, Tate, Wing, & Winett, 2001, White & Jacques, 2007, Williams et al, 2007, Winick, Rothacker, & Norman, 2002, Zandee & Oermann, 1996, Zimmerman et al, 1988). Similarly, they have tried to incorporate motives like monetary or material incentives or group based competitions and sessions to enhance and sustain participation (Aldana, et al, 1993, 2006, Atlantis, et al, 2006, Blair et al, 1986, Briley, et al, 1992, Brownell, et al, 1984, Collins et al, 1986, Erfurt et al, 1990, Follick, et al, 1984, Forster, et al, 1985, Fowler et al, 1985, Frankle, et al, 1986, Garofalo, 1994, Hermann-Nickell, 1989, Jeffery et al, 1989, 1993, 1995, Kelly, 1979, Kneip et al, 1985, Lando et al, 1993, Larson and Simmons, 1993, Loper & Barrows, 1985, Nelson, et al, 1987, Petersen, et al, 2008, Phillips & Philbin, 1992, Prochaska, et al, 1992, Reppart & Shaw, 1978, Rose et al, 1980, Sangor & Bichanich, 1977, Schumacher, et al, 1979, Shannon, et al, 1987, Sherman et al. 1987, Shi, 1992, Stunkard, et al, 1989, Sumner, et al, 1986, White & Jacques, 2007, Williams et al, 2007, Winick, Rothacker, & Norman, 2002, Worick and Peterson, 1993, Zimmerman et al, 1988). Commercial weight loss programs like Weight Watchers have also targeted worksite employees (Frankle et al, 1986). However, no scientific study has looked at effectiveness of these initiatives, with

regards to retention or extent of weight loss achieved. Thus, this study provides an example of combining the reach and effectiveness outcomes of a commercial internet and incentive-based program delivered at worksites.

Limitations of this research

Since this was a pilot study using archival records, there are several limitations to this research. No control group was used. Hence, there was limited ability to measure individual changes and whether the program prompted these behavior changes. As we used archival data from a commercial weight loss program we have no information on demographics of the participants. Also the list of barrier and motives was prepared on the basis of those most frequently reported previously by the participants of the commercial program. Hence, they are not theoretically based. They also lack variety.

Recommendations for future research

Since obesity is one of the major public health concerns and needs to be tackled at societal level as compared to individual level, interventions with broad reach and effectiveness are called for. Listed below are recommendations that are made if this program were to be repeated in a worksite:

- Using Social cognitive theory to form the list of barriers and motives. This would cover the complete realm of personal, behavioral and environmental facts that might motivate or act as a barrier to the weight loss attempts of the participants and thus, provide us with a more realistic and wholesome approach to the issue.
- Presence of a control group against which to compare the observations made on the program would provide us with further information on effectiveness of the program.
- Having more information on the demographics of the participants would allow us to compare those information on those who participated verses those who did not,

thus more information on representativeness of the participants can be obtained.

- Using organizational level measures like adoption, implementation and maintenance can be used to measure the public health impact of the intervention, thus guiding employers to make better decisions related to adoption of weight loss programs. This information may be useful for policy makers too.

Appendix

Appendix A

List of Barriers

1. I don't enjoy physical activity or it bores me.
2. The weather gets in the way.
3. No safe or convenient place to exercise.
4. No time to exercise.
5. I have health conditions that prevent me from exercising.
6. I'm too tired.
7. I don't have the right equipment.
8. I can't afford the gym.
9. I'm intimidated by the in-shape people in the gym.
10. I can't seem to keep track of calories.
11. I don't know how to make vegetables appetizing.
12. Healthy foods and vegetables are too expensive.
13. Fruits and vegetables spoil too quickly.
14. I don't know how to pick good fruits and veggies.
15. I reach for unhealthy foods when I feel depressed or stressed.
16. Many of my family's favorite foods are unhealthy and they don't want to change.
17. I don't have time to cook, so we buy a lot of fast food.
18. There are too many opportunities for me to eat unhealthy foods.
19. I'm worried that I won't succeed, so I make excuses and sabotage my efforts.
20. I've tried diets before and it never lasts.
21. My family's social activities revolve around eating big meals.
22. I travel a lot.

- 23. I can never find the info I need when I need it.
- 24. I don't get enough encouragement to keep me motivated.
- 25. I get discouraged because I don't see changes fast enough.
- 26. None of these apply.

Appendix B

List of Motives

1. To lift my spirits. To feel better about myself and improve my confidence.
2. To look better or at least fit into my old clothes.
3. To help me maintain or improve my health so I can be of help to my family, friends and community.
4. To set an example for my family.
5. To learn more about the types of food that will help avoid obesity, cancer, heart disease and diabetes.
6. To learn more about the types of activities that help avoid obesity, cancer, heart disease and diabetes.
7. To decrease my stress level.
8. To help me be more productive.
9. To be in a program with my co-workers will help keep me motivated.
10. The cash incentives will help keep me motivated.
11. It's time to lose weight. I'm done procrastinating.
12. My physician told me to lose weight.
13. None of these apply.

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