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A Behavioral Health Intervention for Decreasing Weight Gain in First Year University Students

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A BEHAVIORAL HEALTH INTERVENTION FOR DECREASING WEIGHT GAIN
IN FIRST YEAR UNIVERSITY STUDENTS

by

Sonia E.A. Marrone

Bachelor of Arts (Honours), University of Winnipeg, 2002

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A Dissertation

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment

of the requirements

for the degree of

Doctor of Philosophy

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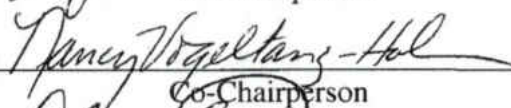
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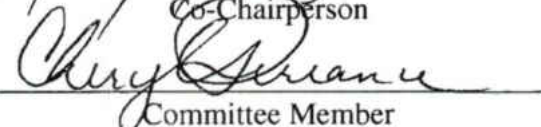
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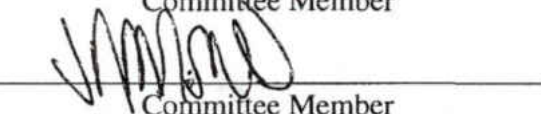
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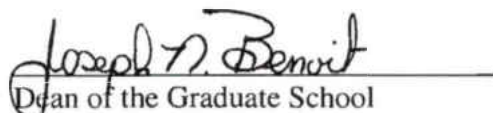


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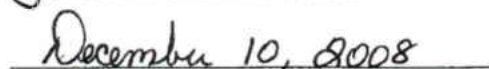


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This dissertation meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.



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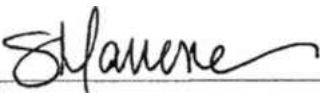
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Title A Behavioral Health Intervention for Decreasing Weight Gain in First
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ABSTRACT

The purpose of the current study was to evaluate two interventions proposed to improve health behaviors and decrease weight gain among first-year university students, utilizing a health risk appraisal (HRA), telephone health coaching, and monthly health-related emails. The HRA assessed and provided individualized feedback for several behavioral health risk factors. Participants were randomly assigned to one of three groups: (1) Health coaching (HC): HRA with individualized feedback, health coaching and health-related emails; (2) Minimal intervention: HRA with individualized feedback and monthly health-related emails; and (3) Control: HRA without feedback. Analysis of covariance (ANCOVA) tests were performed, adjusting for baseline levels for the following outcomes: physical activity, dietary habits, body mass index (BMI), and waist circumference. In addition, multiple regressions were conducted using baseline measures to prospectively predict behavioral health measures at post-assessment.

Results showed that there were no significant differences in health behaviors from baseline to post-assessment when comparing the three experimental groups. However, when the HC and minimal groups were combined and compared to controls, results showed group differences. Both groups showed decreases in vigorous physical activity from baseline to post-assessment, however the combined intervention group reported significantly more vigorous physical activity than controls. Additionally, results showed that the combined intervention group had significantly greater BMI values at the post

assessment than the control group. Results of the multiple regressions revealed that the following baseline variables predicted changes at post-assessment: baseline strength training positively predicted moderate physical activity; baseline perceived stress and fruit intake negatively predicted vigorous physical activity; male gender was associated with higher high fat food intake; and baseline waist circumference positively predicted BMI. Contrary to expectations, positive outcomes were not found with the interventions evaluated. This may have been due to a low number of health coaching contacts compared to previous studies as well as a potential volunteer bias because participants showed lower rates of obesity and overweight compared to young adults in the general population. However, the results also revealed prospective predictors that can identify students more likely to make behavioral health changes and can be used to inform health promotion interventions for college students.

CHAPTER I

INTRODUCTION

A epidemiological study completed by the World Health Organization (WHO) indicates that in the vast majority of 48 countries studied worldwide, 50% to 75% of adults aged 35 to 64 years were either overweight or obese (WHO Monica Project, 1988). Obesity is clearly a growing global epidemic across both industrialized and developing countries. In the United States and Canada, overweight and obesity are becoming major public health concerns. The most common classification of overweight and obesity in North America is the body mass index (BMI), which is the ratio of weight to height measured in either kg/m^2 or lbs/inches^2 (McTigue et al., 2003). A healthy or ideal BMI falls between 18.5 and 24.9 with BMIs under 18.5 and over 25 being in the unhealthy range (National Heart, Lung, & Blood Institute, 1998). BMIs between 25 and 30 are considered overweight and those 30 or greater are considered obese.

Data from the 2003-2004 U.S. National Health and Nutrition Examination Survey (NHANES) indicated that 66.3% of adults, aged 20 years and older, were overweight or obese (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). Of the total percentage of those considered overweight or obese (with a BMI over 25), 32.2% had a BMI greater than 35, and 4.8% had a BMI greater than 40. The prevalence of obesity among adult populations, aged 20 to 74 years, in the United States has more than doubled in the past 40 years, increasing from 13.4% in 1960 to 30.9% in 2000 (Flegal, Carroll, Ogden, & Johnson, 2002). Rates of overweight and obesity have also significantly

increased among children and adolescents in the United States, with the most recent estimate being that 17.1% of children and adolescents are considered overweight (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). In Canada, rates of obesity are comparable to the United States with 33.9% of adults over the age of 20 years being classified as overweight and 15.2% being classified as obese (Vanasse, Demers, Hemiari, & Courteau, 2006).

Obesity-Related Consequences

Several studies have established that obesity is associated with a number of mortality and morbidity risk factors. Longitudinal data from the Bogalusa Heart Study indicate that obesity plays an integral role in the development cardiovascular disease (CVD) among adults and is associated with other medical diseases and complications such as diabetes, hyperlipidemia, hypertension, and insulin resistance (Berenson, 2005). This group of disorders that is often associated with being overweight or obese has come to be defined in the medical literature as 'syndrome X', 'insulin resistance syndrome' or most commonly as 'metabolic syndrome' (WHO, 1999; Zimmet, Magliano, Matsuzawa, Alberti, & Shaw, 2005). While there has been considerable debate on the diagnostic criteria and etiology of the metabolic syndrome, many health organizations, including the World Health Organization (WHO), recognize this group of symptoms as a public health concern that warrants further scientific investigation (Federspil, Nisoli, & Vettor, 2006). According to the WHO (1999), the metabolic syndrome is defined as either glucose intolerance, impaired glucose tolerance, or diabetes and/or insulin resistance, in addition to two or more of the following conditions: obesity (BMI >30 and/or elevated waist circumference); dyslipidemia, [high triglycerides and lowered high density lipoprotein

(HDL) cholesterol]; hypertension, (blood pressure higher than 140/90 mm Hg); or microalbuminuria (albumin excretion greater than 20 $\mu\text{g}/\text{min}$). A study by Sattar and colleagues (2003) found that men with four to five symptoms associated with the metabolic syndrome had a 3.7 times greater risk of having CVD and a 24.5 times greater risk of having diabetes, compared to men with none of these symptoms. These data support the argument that the number of metabolic syndrome symptoms is positively related to the relative medical risks.

Despite significant decreases in the rate of smoking, high cholesterol, and high blood pressure among North American populations since the 1960s, CVD continues to be the leading cause of death among individuals with a BMI greater than 30 (Dorn, Schisterman, Winkelstein, & Trevisan, 1997). The prevalence of CVD among obese and overweight individuals is significantly higher than individuals in the healthy weight range. Among a nationally representative sample, Wang and colleagues (2002) found that the prevalence of CVD among overweight (28%) and obese (39%) individuals was higher than that for individuals with a BMI in the healthy range (20%). Moreover, a longitudinal study that examined the relationship between BMI and mortality among 1308 U.S. White adults found that even after controlling for education, age, and tobacco use, there was a significant linear relationship between BMI and all-cause mortality for men under the age of 65 years, with the lowest risk for men with BMIs between 23 and 27 (Dorn et al., 1997). This relationship has also been observed for women. Data from the U.S. Women's Health Initiative Observational Study (WHI-OS) examined the relationship between weight status (as measured by BMI) and mortality among women, aged 50 to 79 years (McTigue et al., 2006). The results found that the risk of mortality

significantly increased with increasing weight category, with women in the extreme obese weight category (BMI greater than 40) showing the highest risk of all-cause and CVD-related mortality.

There are also psychosocial factors associated with obesity that may affect a person's subjective quality of life. Several studies have found a relationship between depression and obesity, where higher BMI is associated with increased risk of depression (Anderson, Cohen, Naumova, & Must, 2006; Simon et al., 2006; Wadden et al., 2001). A U.S. longitudinal study that followed 661 children evaluated the influence of depression and anxiety on weight status into adulthood (Anderson et al., 2006). Results indicated that even after controlling for socioeconomic status, psychopharmacological drug use, and smoking status, there was a moderate positive relationship between BMI z-scores and depression for women, indicating that increases in BMI is associated with depression. However, this relationship was not observed among men. Another study also found that individuals with a BMI greater than 30 showed a 1.27 greater risk of being diagnosed with a mood disorder and were 1.28 times more likely to be diagnosed with an anxiety disorder than those with a BMI less than 30 (Simon et al. 2006). Additionally, there are mediating factors that should be considered when examining the relationship between obesity and depression. Body image which is influenced by societal expectations of body shape and size has been shown to mediate the relationship between obesity and depression among children and adolescents (Allen, Byrne, Blair, & Davis, 2006) as well as adults (Darby, Hay, Mond, Rodgers, & Owen, 2007). Additionally, discrimination in various areas including employment (Baum & Ford, 2004; Puhl & Brownell, 2001) and healthcare (Foster et al., 2003) has also been found to be associated with obesity and may

play a mediating role in the relationship between obesity and depression and/or anxiety. Overall, obesity has been shown to be associated with several areas of a person's overall psychosocial functioning (Hassan, Joshi, Madhaven, & Amonkar, 2003; Vaidya, 2006).

Obesity-Related Costs

Overweight and obesity are associated with substantial healthcare expenditures (Wyatt, Faan, Winters, & Dubbert, 2006). It has been reported that approximately 5.5% to 7.0% of all medical expenditures in the U.S. involve the treatment of obesity-related medical problems (Thompson & Wolf, 2001). These figures are far less in other countries but still range from 2.0% to 3.5% in Europe, Canada, New Zealand, and Australia. Similarly, Wang and colleagues (2002) reported that the prevalence of CVD was 1.5 to 2 times greater in obese individuals compared to individuals with a BMI in the normal range and that the medical costs of an individual with CVD were more than double that of an individual without CVD. Thus, if the prevalence of CVD in the U.S. could be reduced through weight control, the medical costs of 60 million individuals would be substantially decreased. Overall, these estimates highlight the enormous economic cost associated with obesity.

Obesity Prevention

The magnitude of the public health concern over the increasing prevalence of obesity and related chronic diseases has provided an important impetus to evaluate methods of treating and preventing obesity among children, adolescents, and adults. There are three main methods of prevention, based on the timing of intervention. Primary prevention includes interventions that are targeted at the general population or potential sub-populations that are at-risk for overweight or obesity. These interventions attempt to

prevent the onset of overweight and associated conditions such as diabetes and typically target schools, families or worksites (Berry, Urban & Grey, 2006). Secondary prevention involves interventions for populations that are already overweight with the goal of preventing the progression of overweight and the occurrence of associated diseases (Berry et al., 2006). Finally, tertiary prevention interventions are intended to decrease the likelihood of further morbidity or mortality among individuals who have experienced complications from obesity (Berry et al., 2006).

From a public health perspective, the main focus of population-based interventions is on the primary prevention of obesity. Programs that target primary prevention of obesity typically fall into three general categories: school-based; worksite-based; and community-based. Each of these areas of obesity prevention is briefly reviewed.

School-based prevention. School-based prevention efforts involving children and adolescents typically take a comprehensive approach by modifying the environment as well as educational practices in order to prevent obesity. Recommendations from the CDC Task Force on Community Preventive Services suggest that interventions for school-based obesity prevention should include physical activity and nutrition interventions and should specifically increase the amount of time students are physically active participating in non-competitive sports during the school day (Katz et al., 2005). One of the largest and most comprehensive school-based interventions to be evaluated to date is the Child and Adolescent Trial for Cardiovascular Health (CATCH: Leupker et al., 1996). This was a multi-site intervention, with 56 intervention schools and 40 control schools involved and included a sample of over 5000 children from the third- to the fifth-

grade. CATCH consisted of the following interventions: (1) modifying school lunches to reduce fat and sodium; (2) introducing classroom curriculum focusing on health; (3) increasing the amount of moderate-to-vigorous physical activity; and (4) involving the family in prevention efforts through home-based and community-based programming. Overall, the results of the study indicated that children in the intervention schools, compared to control schools, showed higher levels of self-reported moderate-to-vigorous physical activity, lower levels of self-reported dietary fat intake, and the percentage of fat in school lunches was significantly lower. However, there were no significant differences for blood pressure, cholesterol, or body mass between children in the intervention and control schools (Leupker et al., 1996). Further follow-up of the original CATCH sample indicated that children in the intervention group did not differ from children in the control group 2.5 years following the original trial on measures of anthropometry (BMI and skinfolds), cholesterol, and blood pressure, suggesting that changes in risk factors such as physical activity and dietary habits among children may not prevent excessive weight gain later in childhood (Webber et al., 1996). Several other school-based interventions have found similar results where, despite positive changes in physical activity levels and dietary habits, healthy changes in body composition were not discerned (Caballero et al., 2003; Paradis et al., 2005; Sallis et al., 1997). Recently, however, preliminary results from a school-based obesity prevention study conducted with 1013 children in the fourth- and fifth-grades across four states has shown positive changes in BMI through increasing fruit and vegetable intake and increasing physical activity (Spiegel & Foulk, 2006). This study evaluated the outcome of Wellness, Academics, and You (WAY), a multidisciplinary curriculum-based intervention based on

the theory of reasoned action and constructivism. Classroom teachers received training to teach the curriculum, which was integrated throughout the school year into several subjects. Following intervention classes, a 10-minute aerobic routine designed to range from moderate to vigorous physical activity was performed in the classroom daily. Results of the study found that at the end of the intervention period, children in the intervention group had smaller increases in BMI compared to the control group. The mean increase in BMI for children in the intervention group was .1606, compared to .5210 for the control group, a statistically significant difference; however the effect size was not reported. The outcome measurements of this study differed from other school-based intervention studies in that it compared relative increases in BMI between the intervention and control participants as opposed to assessing actual changes in BMI or weight status, which may explain why there was a significant difference between the intervention and control groups. Overall, the most effective interventions for school-based obesity prevention efforts aim to affect several areas of health such as physical activity, nutrition, and knowledge.

Worksite-based prevention. Preventing obesity and obesity-related disease and lowering associated healthcare costs are important factors for employers interested in incorporating prevention efforts into the corporate environment. The first published worksite intervention involved employees of a department store in New York City over 30 years ago and since that time hundreds of interventions have been developed and implemented by many other corporations (Pelletier, 2005). Expert opinion currently suggests that comprehensive worksite health promotion and disease management interventions are more likely to result in better clinical outcomes as well as higher return

on investment for the money the company invests in health promotion and disease management efforts compared to companies that utilize less comprehensive worksite health promotion (Matson Koffman et al., 2005; Pelletier, 2001, 2005). The most common elements of a comprehensive worksite health promotion programs are as follows: health risk appraisal; individual counseling and referral information on risk factors; environmental intervention in the workplace to support a healthy lifestyle; general health messages; and health education and support groups that assist with setting personal goals for wellness. Comprehensive worksite health promotion programs include several of these components that have been discussed in several comprehensive reviews (Matson Koffman et al., 2005; Pelletier, 2001, 2005). Other factors such as providing incentives to employees to increase participation have also been found to increase effectiveness through increased participation (Matson Koffman et al., 2005).

The current emphasis of comprehensive worksite health promotion interventions is not necessarily specific to obesity but rather on more generally identifying employees who have one or more identifiable disease risk factors, using health screenings or health risk appraisals (Pelletier, 2001). The focus is on employees who are at higher risk for disease because they are more likely to incur more medical costs, absenteeism, and lost productivity (Weaver et al., 1998); therefore, reduction in risk factors among high risk employees results in a greater return on investment for the employer (Pelletier, 2001, 2005). Return on investment is an important outcome measure for worksite health promotion interventions because this measure represents evidence of tangible program effectiveness and financial return to the employer. A recent review of comprehensive worksite health promotion programs reported that companies can yield a three dollar to

six dollar return on every dollar invested over a two to five year duration when they implement comprehensive worksite health promotion programs that target cardiovascular disease risk factors (Matson Koffman et al., 2005). A long-term follow-up of medical expenditures from the Health and Wellness program for employees of Johnson & Johnson found that even four years after the program was implemented, there was a significant decrease in healthcare visits and costs compared to the five years before the worksite program was implemented (Ozminkowski, 2002).

In addition to decreases in medical expenditures, effective comprehensive worksite promotion programs must also show evidence of reductions in health-risk factors. The goal of the intervention is to decrease the number of employees in the high-risk category while increasing or maintaining the number of employees in the low-risk category. A study examining the effectiveness of LifeSteps, a comprehensive health promotion program for United Auto Workers – General Motors, found that among a sample of 12,984 employees who participated in the program, the percentage of employees in the low-risk category was significantly increased from 63.6% to 66.7%, two years following program implementation (Yen, Edington, McDonald, Hirschland, & Edington, 2001). There was also evidence that employees with a high-risk status tended to show higher rates of participation when they were offered the comprehensive programs compared to high-risk status employees who were only offered health screenings. Furthermore, evidence from the StayWell program for employees of the Daimler-Chrysler Corporation showed a dose-dependent relationship between program participation and medical care costs (Serxner, Gold, Grossmeier, & Anderson, 2003). Employees who completed three or more health risk appraisals (HRA) showed the least

medical expenditures compared to employees who completed fewer than three HRAs. Results showed that employees who completed three or more HRAs had average annual medical expenditures that were \$543 less than those of employees who did not complete an HRA. In general, comprehensive worksite health promotion has been shown to be an effective way to decrease medical costs as well as risks associated with modifiable health behaviors. However, health promotion and disease prevention in the workplace must be comprehensive and focus more on overall disease risk factors than specific risk factors such as obesity.

Community-based prevention. Evaluating the effectiveness of community-based health promotion programs is difficult because of the plethora of environmental influences that are difficult to control through rigorous methodological designs. Sound research designs need to control extraneous variables that may account for changes in the dependent variables; however, when internal validity is well controlled, the external validity can be compromised and the ability to generalize results to the general population is difficult. This is a significant challenge with community-based research in obesity prevention and health promotion. A review of 27 studies of community-based interventions aimed at the general population addressed the external and internal validity of these studies (Dzewaltowski, Estabrooks, Klesges, Bull, & Glasgow, 2004). This review found that few studies reported dimensions of external validity, such as representativeness of the sample and long-term follow-up of maintenance of health promotion programming. This lack of external validity and follow-up significantly limit the ability to judge generalizability and utility of these interventions in the general population. The review suggests that in order for results from community-based

interventions to be translated to public health practice, studies must report external validity, such as representativeness of the sample.

Much of the community-based interventions aimed at health promotion focus on improving physical activity and nutrition as opposed to focusing exclusively on changes in weight. A review of community-based interventions that focused specifically on the prevention of weight gain found that positive effects on weight gain were short and most interventions focused on groups that were already overweight (Hardeman, Griffin, Johnston, Kinmonth, & Wareham, 2000). Furthermore, most of these studies were not randomized controlled designs, limiting conclusions about interventions' effectiveness. One study that did use a controlled design, the Pound of Prevention study, evaluated a comprehensive weight gain prevention program for 219 community-dwelling adults over a 12-month period (Forster, Jeffery, Schmid, & Kramer, 1988). The intervention included monthly newsletters, a financial incentive program, and health education sessions. Results indicated that participants in the intervention group showed an average weight loss of 1.8 pounds compared to participants in the control group who did not show a significant change in weight. Although this is a small decrease in weight as a short-term outcome, one-year follow-up data indicated that significantly more participants receiving the 6-month comprehensive intervention maintained or lost weight (82%) compared to participants in the control group (56%).

Targeting large numbers of people through community-based interventions for health promotion is associated with several methodological problems. As a result, many community-based studies have focused on a particular segment of the population, such as a specific age group or ethnic group while others have focused on particular community

organizations, such as faith-based groups. Several large studies have implemented comprehensive interventions specifically for community-dwelling older adults (Bennett et al., 2005; Clark et al., 2005; Tan, Xue, Li, Carlson, & Fried, 2006; Wilcox et al., 2006). Similar to other community-based interventions, most of the interventions targeting older adults focus on improving physical activity and nutrition in order to reduce chronic disease risk factors as opposed to focusing specifically on weight. Wilcox and colleagues (2006) evaluated the effectiveness of implementing two evidence-based physical activity programs for older community-dwelling adults. Active Choices, a telephone-based coaching intervention tailored to a person's readiness to change, and Active Living for Everyday, a 20-week group program tailored to readiness-to-change, were implemented by community organizations with 608 adults, aged 50 years or older. Results of the study indicated that participants in both interventions reported significant increases in moderate-to-vigorous and total physical activity as well as decreases in BMI, depressive symptoms and stress.

Another emerging area of community-based health promotion programs are interventions implemented by and within faith-based organizations. This approach can be an effective means of targeting people who are often missed in other areas of health promotion, such as low income, older, or minority populations (Peterson, Atwood, & Yates, 2002). A number of studies with faith-based organizations have used motivational interviewing interventions to target nutrition and physical activity (Resnicow et al., 2001, 2004, 2005). Most of these studies have used telephone-based counseling, based on principles of motivational interviewing, to counsel participants on behavior change. Motivational interviewing (MI) was developed by Miller and Rollnick (1991, 2002) and

was originally developed to treat addictive behaviors. However, since that time, the principles of this client-centered approach to behavior change have been applied to several areas of health behavior change. Several studies conducted by Resnicow and colleagues (2001, 2004, 2005) used interventions based on motivational interviewing to effectively increase physical activity and fruit and vegetable intake among church groups, particularly churches with large numbers of African American members. These studies have used relatively brief interventions, mainly using counselors trained in MI theory to deliver telephone or in-person counseling to individuals. The results of these studies have indicated that compared to controls, participants who received interventions using motivational interviewing showed significantly greater increases in fruit and vegetable consumption (Resnicow et al., 2001, 2004) and physical activity (Resnicow et al., 2005).

Overall, community-based interventions can be difficult to evaluate because of multiple influences in communities and can be difficult to generalize to other populations. It is important to target specific segments of the population to gain a greater understanding of the impact of health promotion interventions on health behavior.

Health Behavior Among Young Adults

Physical activity. Several studies have shown that physical activity shows a sharp decrease during adolescence and continues to decline into adulthood (Carnethon, Gulati, & Greenland, 2005; Merrick & Kandel, 2003; Merrick, Morad, Helperin, & Kandel, 2005). Despite this general finding, few studies have closely examined the changes in physical activity from adolescence through early adulthood, especially among those transitioning from high school to university. The American College Health Association's National College Health Assessment (ACHA-NCHA) is a survey of university students'

health behaviors and perceptions from 78 post-secondary institutions across the United States. Data from Spring 2005 ACHA-NCHA survey of over 56,000 students found that only 43.6% of students reported engaging in at least 20 minutes of vigorous exercise or at least 30 minutes of moderate exercise three out of the past seven days (American College Health Association, 2006). This finding indicates that the majority of university students do not meet the recommended levels of physical activity.

Huang and colleagues (2003) collected cross-sectional data on height, weight, nutritional intake, and physical activity from 738 university students. Results indicated that, on average, students reported engaging in physical activity 2.8 days out of the last 7 days, which falls far below recommended physical activity levels. Gender differences were apparent, however, with men more likely to report exercising more days per week than women and more likely to report engaging in aerobic exercise than women. Another study gathered physical activity data from university students at the beginning of their first year and then again at the end of their second year of university (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). This study also measured stages of change for physical activity, based on the five stages of change (precontemplation, contemplation, preparation, action, and maintenance), according to the Transtheoretical Model of behavior change (Prochaska, & Velicer, 1997). Results revealed that at baseline fewer than 60% of students were engaging in exercise three to five days per week and by the end of the second year of university, the percentage of students exercising at the same level had significantly decreased to 55%. The authors of the study also assessed students' movement through the stages-of-change framework. Results revealed that there was a significant decrease in the percentage of students in the maintenance phase for

aerobic exercise, suggesting that fewer students were maintaining appropriate levels of physical activity. Similarly, a significant weight gain (average of 4.6 pounds) was noted in 59% of the students, demonstrating a relationship between physical inactivity and weight gain. A study by Butler, Black, Blue, & Gretebeck (2004) followed a sample of young women through their first year of university. Despite a significant decrease in the total number of calories (self-reported), these women also showed a significant decrease in physical activity and a significant increase in BMI. Therefore, among this sample of young women, significant decreases in physical activity were an important contributing factor to weight gain, even when caloric intake decreased.

In yet another study of first year university women ($N = 85$), it was found that few were meeting the daily recommended levels of physical activity (Malinauskas, Raedeke, Aeby, Smith, & Dallas, 2006). This was evident despite the fact that 83% reported currently engaging in dieting practices, with the majority indicating that they were using exercising as a means to lose weight. These results indicate that while physical activity may be seen by many university women as a means to lose/maintain weight, few are being sufficiently physically active to actually lose or even maintain their current weight.

Increasing physical activity in first year university women is obviously a difficult endeavor and even maintaining current exercise levels can be a challenging task among university students, particularly during the first year of university when individuals are learning to cope with the pressures of university life. A study examining the predictors for exercise relapse among university students found that those who relapsed from exercising three times per week not only showed a decrease in their positive perceptions of exercise but also had lower baseline scores on self-efficacy to maintain exercise

compared to students who maintained their exercise behavior over the course of three months. Therefore, it is important to consider interventions that enhance self-efficacy and emphasize the positive aspects of engaging in exercise in order to increase the likelihood that young adults will maintain levels of exercise even during times of increased stress.

Nutrition. Cross-sectional data from Spring 2005 ACHA-NCHA survey report that, overall, only 7.0% of university students reported eating at least 5 or more servings of fruit and vegetables daily (American College Health Association, 2006), highlighting the fact that the vast majority of university students are not eating the recommended number of servings of fruit and vegetables.

There is evidence to suggest that healthy eating declines from the beginning to the end of the first year of university. Huang and colleagues (2003) found that the majority of undergraduate university students during their first year of university reported eating fewer than five servings of fruit and vegetables per day (69.40%) and less than the recommended daily intake of fiber (67.10%). Butler and colleagues (2004) also found that over the course of the first semester of university, women reported a significant decrease in vegetable intake as well as pasta/bread intake. Similar results were also found by Racette and colleagues (2005). However, the results from this study did find some healthy changes as well; over the course of the first year of university, students ate significantly fewer servings of fried foods in a week. Furthermore, gender has also been found to be associated with dietary habits among college students. For example, a study examining food decisions among college students found that women showed higher involvement in making food decisions and were more likely than men to consider factors such as quality, label information, and healthiness compared to men (Levi, Chan &

Pence, 2006). However, no studies have found that college men and women significantly differ in their consumption of foods such as fruit and vegetables or high fat foods.

Another important factor to consider when examining eating habits among university students is the role of dormitory living and more importantly, eating in dining halls. A study conducted with first-year, university women also found that women who gained weight and lived in a dormitory tended to attribute weight gain to eating in dining halls (Hovell, Mewborn, Randall, & Fowler-Johnson, 1985). This attribution has been supported by a more recent study that found that eating in dining halls was associated with eating larger meals and eating for longer periods of time (Levitsky, Halbmaier, & Mrdjenovic, 2004). It is perhaps not surprising that eating breakfast and lunch in “all-you-can-eat” dining halls explained 20% of the total variance for a regression model examining the variation of weight gain among first-year university students (Levitsky et al., 2004). These studies suggest that eating in dining halls can contribute to poorer eating habits among university students but additional studies need to more carefully examine the association between eating in residence dining halls and eating habits among university students and how this might contribute to weight gain in the first year of university.

Weight gain. In addition to a decline in physical activity and healthy eating habits, the first year of university has often been associated with significant weight gain; however, the data has been equivocal about whether this first year weight gain, colloquially referred to as the “freshman fifteen”, is actually empirically observable. A study conducted by Hovell and colleagues (1985) followed a sample of first-year university women for three years. Data from the first year indicated that, compared to a

community sample, university women gained weight 36 times faster and were 2.6 to 5.2 times more likely to gain more than 15% of their body weight, thus lending credence to the “freshman fifteen” anecdote. However, follow-up data collected during the sample’s third year of university indicated that the average weight among university women had returned to baseline. The methodological limitations of this study make it difficult to generalize its results to other samples. First, some of the women in both the experimental and community comparison groups had their heights and weights measured by the investigators but other women in both groups simply provided self-reported heights and weights without independent verification. It has been documented that self-reported weights tend to be underestimated, particularly by women, and self-reported heights tend to be overestimated, resulting in an underestimation of BMI (Ezzati et al., 2006; Taylor et al., 2006). Second, the study was conducted before the acceptance of the BMI as the gold standard for community studies involving weight. Therefore, the main outcome measure for assessing weight status was determined by calculating the difference between each participant’s ideal weight, based on the standards by the Department of Agriculture, and the participant’s actual weight. This outcome measure has been replaced by the BMI because the BMI has been shown to be a reliable estimate of adiposity and it has been shown to be related to morbidity and mortality risk factors (Kushner & Blatner, 2005). Finally, this study included only women, so potential gender differences could not be examined from this study. Overall, the implications of the study are limited and difficult to generalize to the general population.

In a more recent study, Graham and Jones (2002) reported that their data did not support the premise of the “freshman fifteen” weight gain. However, this study’s

methodological limitations cast doubt on the certainty of any of its conclusions. The authors collected weight and body fat measurements from a sample of 49 freshman students' medical records at the beginning and end of the sample's first semester. Results indicated that 59% of the sample gained an average of 4.6 pounds. However, the authors of the study did not provide statistics on whether the average weight of the sample significantly changed over the course of the semester. Furthermore, the method in which follow-up data was gathered was such that participants were asked to visit student health to have their weight and body fat measured and only 62% of the sample provided complete data, thus raising the possibility of a potential subject selection bias. Given the potential subject selection bias and the limited data reported regarding weight, this study's results should be interpreted with caution.

Other studies have found clearer evidence to support the hypothesis that the first year of university is a critical period for weight gain for many university students. Levitsky and colleagues (2004) followed a sample of 68 first-year university students throughout the first semester. The authors of the study reported that heights and weights were measured by the investigators and rigorous methods for estimating weight of outer clothing were utilized. The results indicated that the mean weight gain was 1.9 kg (4.18 lbs), with a range of -5.9 (12.98 lbs) to 8.6 kg (18.92 lbs), and the BMI increased significantly from baseline. Multiple regression models to predict weight gain indicated that when initial weight was controlled, the consumption of "junk" food (defined in this study as high fat cookies, cakes, chips, and ice cream) was the strongest predictor of weight gain, accounting for 24% of the variance.

Anderson, Shapiro, and Lungren (2003) followed 132 first-year university students through the entire first year of university, measuring height and weight in a standardized manner at three points during the evaluation period. Repeated-measures ANOVA indicated that overall, regardless of gender, participants gained an average of 1.3 kg, a significant weight gain from September to December of the first semester. Furthermore, the percentage of students classified as overweight or obese increased significantly from 15.6% ($N = 21$) in September to 25.2% ($N = 24$) in December of the assessment period. Furthermore, a subset of the participants ($N = 46$) who provided weight status in May of the freshman year showed a statistically significant weight gain with an average of 1.7 kg gained from September to May, thus suggesting that weight gain remained stable until the end of the academic year.

It has also been proposed that even if the “freshman fifteen” is an empirically supported event, the weight gain is temporary and tends to return to baseline during subsequent years. As mentioned earlier, the findings of Hovell and colleagues (1985) indicated that this was indeed the case among a sample of women in their first three years of university. However this study only followed women and was conducted during the early 1980s, a period of time where obesity was just beginning to increase and, since that time, the prevalence of obesity among young adults has increased dramatically.

A recent study by Racette and colleagues (2005) documented weight gain, exercise and dietary behaviors for a sample of 359 men (47%) and 405 women (53%) during their first two years of university. The heights and weights were measured by investigators and participants completed stages-of-change questionnaires to assess exercise patterns and nutritional intake, and motivation to change these patterns. Results

showed that at the end of the second semester of the second year of university, participants gained an average of 1.8 kg, a statistically significant change. Furthermore, 70% of the students gained weight with an average of 4.1 kg weight increase among those who gained weight. At baseline, 70% of students reported eating fewer than five fruits and vegetables daily while 54% of students reported eating three or more servings of fried food at the beginning of the first year of university. By the end of the second year of university, there was a significant decrease in the percentage (43%) of students who reported eating three or more servings of fried food but there were no significant changes in fruit or vegetable intake. Although this study demonstrated that university students significantly gained weight during the first two years of university, there was not a significant relationship between weight gain and eating and exercise behaviors. Although the overall level of exercise did not significantly change over the first two years of university, there was a significant decline in aerobic exercise and a significant increase in stretching exercises. Furthermore, students also showed a change in stages-of-change for aerobic exercise. Results showed there was a significant decrease in the percentage of students in the maintenance phase for aerobic exercise but a significant increase in the percentage of students in action and maintenance phase for stretching. This finding may partially explain weight gain despite no significant decrease in self-reported physical activity. A limitation of this study is that it did not provide follow-up data on these students after the second year of university to examine further changes in weight, diet, and physical activity.

Overall, several studies have demonstrated that the first year of university is a critical time for weight gain as young adults make the transition from high school to

college. Therefore, this presents an ideal point of intervention to lessen the accelerated weight gain and provide young adults an opportunity to develop healthy behaviors during a period of transition.

Predictors of Health Behavior Change Among Young Adults

There are several factors that may influence health behavior changes among college students that are important to consider. Health risk behaviors such as binge drinking and tobacco use have been shown to influence physical activity (Keller, Maddock, Laforge, Velicer, & Basler, 2007; Seo, Nehl, Agley, & Ma, 2008) as well as dietary habits (Adams & Colner, 2008; Keller et al., 2007). For example, Keller and colleagues (2007) examined the relationship between binge drinking and other health behaviors such as tobacco use, fruit and vegetable consumption, and exercise among a sample of college students. The results of this study found that students who reported frequent binge drinking were also more likely to smoke tobacco and cannabis and less likely to report regular exercise or sufficient fruit and vegetable consumption. Furthermore, Seo and colleagues (2008) found that college students who reported not smoking in the past 30 days were more likely to report participation in moderate and physical activity. Perceived stress has also been found to influence health behaviors as well as weight gain among college students (Adams & Rini, 2007; Campbell, Swenson, & Jarvis, 1992). For example, Serlachuis, Hamer, and Wardle (2007) examined weight gain among college students in their first year of university and found that stress was associated with a greater risk of weight gain, even after controlling for current health behaviors (smoking, exercise, sleep, and alcohol use). These findings suggest that health risk behaviors among college students such as tobacco use, frequent alcohol use, and

perceived stress may moderate healthy dietary habits and these factors should be taken into consideration when designing health promotion programs to improve health behaviors among this population.

Obesity Prevention Among University Students

There are very few published studies that document the effectiveness of obesity prevention programs for university students. A recent report from the Task Force on Community Preventive Services could not identify any qualifying studies of obesity prevention interventions conducted with a sample of university students (Katz et al., 2005). For the purpose of this report, the Task Force considered the following criteria in order for an intervention to be included as a qualifying study: (1) enrollment of participants from a school or worksite setting; (2) the intervention included diet, physical activity or some combination of both; (3) weight-related measures as outcomes; (4) a control group; and (5) follow-up for at least 6 months from the beginning of the intervention. This highlights the need for studies to evaluate interventions aimed at preventing weight gain among university students and promoting a healthy lifestyle. Levitsky, Garay, Nausbaum, Neighbors, and Della Valle (2006) conducted one of the few studies with university students examining a weight control intervention for freshman university students. This study used the Tissue Monitoring System (TMS) to track daily weight for one week and then used an algorithm to estimate mean changes in body tissue. Using the algorithm, each individual received feedback about any calorie adjustments needed for the participant to maintain his or her weight. In the first of two experiments reported in this study, the experimental group of participants weighed themselves daily with a standard scale provided by the investigators and emailed their daily weights to the

primary investigator. At the end of the seven-day period, the investigators emailed experimental participants feedback using the TMS algorithm. All participants were then weighed again at the end of the semester. Results indicated that the experimental group did not experience a significant change in weight over the course of the semester, while the control group gained an average of 3.1 kg, a statistically significant change. The second experiment reported in this study also used the TMS monitoring system, but in addition, information on portion control was also provided to participants. Results indicated that the experimental group did not show a significant change in weight while the control group gained an average of 2.0 kg, a statistically significant change. The findings from this study suggest that intervention can result in the prevention of significant weight gain during the freshman year.

Health risk appraisals. The health risk appraisal (HRA) is an instrument used to collect health information on several risk factors such as blood pressure, tobacco use, fruit and vegetable intake, or alcohol use to calculate risk ratios for morbidity and mortality related to current health behavior (Smith, McKinlay, & Thorington, 1987). This method of health status measurement was championed by Lewis Robbins, M.D. in the 1940s (Schoenbach, 1987). The HRA has been used to provide epidemiological information on the health status of employee or student populations as well as a method of providing feedback to individuals about their health status and behaviors (Smith, McKinlay, & McKinlay, 1991; Smith et al., 1987). The majority of HRAs rely on self-report of health information and behaviors, which has been shown to be adequately accurate for the purpose of the HRA (Smith et al., 1987).

There is limited data to support the validity of any health risk appraisal measure. There is great variability among HRAs therefore making it difficult to assess validity (Schoenbach, 1987). However, a study by Smith and colleagues (1987) evaluated the predictive validity of 41 HRA instruments associated with coronary heart disease. The results of this study found that the best of the instruments explained 60% of the variability in heart disease risk. HRAs that used logistic regression to derive risk estimates had the highest correlation with risk estimates. Furthermore, HRAs that were more comprehensive and assessed a greater number of risks were more valid than HRAs that measured few health risks. Another study by Smith and colleagues (1991) examined the validity of risk scores generated from four commonly-used HRAs. Results of the study found moderate correlations (.40 to .77) between CHD mortality risk estimates and the HRAs included in the study. Overall, these studies indicate that HRAs are moderately valid measures of risk estimation; however, no studies have examined the validity of HRAs to measure changes in behavioral health risks. Several studies have shown that, when used in isolation, HRAs are not effective interventions for behavior change (Anderson & Stauffer, 1996; Schoenbach, Wagner, & Beery, 1987; Wagner, Beery, Schoenbach, & Graham, 1982). However, when HRAs are used in conjunction with comprehensive programming, the effectiveness of HRAs increases substantially (Hudson & Pope, 2006; Schoenbach et al., 1987).

Health risk appraisals with college students have been utilized as a method of health promotion to give students insight into their health behaviors. However, few studies have evaluated the effectiveness of HRAs as a method of prevention. Chan and Witherspoon (1988) evaluated the effectiveness of the HRA with feedback to modify

health behavior among first-year university students. The intervention had four groups: (1) baseline HRA with feedback with repeat HRA at the end of the freshman year; (2) baseline HRA with no feedback plus repeat HRA at the end of the year; (3) baseline HRA without feedback with no repeat HRA at the end of the year; (4) no HRA at baseline with the HRA taken once at the end of the year. The HRA was a 37-item questionnaire developed by the Centers for Disease Control and Prevention (Black & Ashton, 1985), which assessed the frequency of behaviors such as smoking, alcohol intake, number of hours of sleep, number of miles driven per year, amount of exercise, number of violent arguments or dangerous activities per year, seatbelt use, and number of times per week drugs were taken to affect mood. Nursing students were trained to give detailed feedback to the first group on the HRA results and to provide recommendations for health behavior change. In addition, students in the feedback group were also given information and referral to resources for on-campus wellness programs. Results indicated that the intervention resulted in significant differences between the feedback and control groups for tobacco use, with tobacco use in the experimental group staying the same but increasing in the control groups. This result suggests that the HRA was an effective prevention tool for tobacco use among college students but the same results were not apparent for other behaviors related to nutrition, alcohol intake, and exercise.

Health coaching. Health coaching is a burgeoning area of health promotion that aims to facilitate and promote health behavior change among individuals. Palmer, Tubbs, and Whybrow (2003) define health coaching as "...the practice of health education and health promotion within a coaching context" (p. 92). Health coaching is based upon the principles of motivational interviewing (Miller & Rollnick, 2002). By taking a client-

centered approach to working with clients, health coaching diverges from the traditional medical model in that it aims to provide information to the client without being authoritarian, forceful, or confrontational (Butterworth, Linden, McClay, & Leo, 2006; Linden, Butterworth, & Roberts, 2006). The theoretical foundation of health coaching is based on motivational interviewing's three underlying assumptions: collaboration, evocation, and autonomy (Miller & Rollnick, 1991, 2002). In this regard, health coaching is based on a collaborative relationship with a client in which the practitioner aims to evoke "change talk" (i.e. the individual's own reasons for change) while respecting the autonomy of the client to make his or her own choices about change (Butterworth et al., 2006; Miller & Rollnick, 1991, 2002). Health coaching also utilizes the Transtheoretical Model (Prochaska, 1979; Prochaska & DiClemente, 1983, 1984) to resolve ambivalence and help a client move through the stages of change to ultimately make lifestyle changes that would reduce health risk (Butterworth et al., 2006; Linden et al., 2006).

The demand for health coaching has increased to help address the increasing cost of medical care and can be used as an adjunct to medical treatments to assist patients with self-managing chronic diseases by making health behavior changes (Lipscomb, 2006). Health coaching has also been used extensively for worksite health promotion programs and community-level health promotion interventions (Clark et al., 2002; Holland et al., 2005; Tidwell et al., 2004; Yen et al., 2001). The majority of these interventions have focused on community-dwelling older adults and utilized nurse health coaches trained in brief motivational interviewing strategies. Bennett and colleagues (2005) evaluated a health coaching intervention among older adults (aged 60 and over) aimed at eliciting health behavior change related to one of five chronic diseases: diabetes, lung disease,

heart disease, neuromuscular disease, or arthritis. The health coach developed a behavioral action plan with each participant and only intervention participants were contacted for further follow-up via telephone or email for six months. Results indicated that health distress and illness intrusiveness were significantly lower among intervention participants compared to controls. However, there were no significant differences on measures of self-reported general health, level of energy, or social/role activities.

Health Matters, a health promotion intervention for the California Public Employees' Retirement Program, also utilized nurse health coaching among community-dwelling older adults with at least one chronic disease or health problem (Holland et al., 2005). In addition to health coaching, Health Matters also provided patient education, social work consultation, a fitness program and referral to community resources. Outcome measures collected after 12 months of health coaching indicated that those who participated in the Health Matters program either maintained or significantly increased aerobic and stretching exercise compared to the control group, which showed a decline in physical activity.

Very few studies have examined the use of health coaching among young adults, particularly university students. Murphy and colleagues (2001) conducted an evaluation of an alcohol reduction intervention among university students. This intervention utilized a graduate student clinician to deliver a "feedback" meeting with students who indicated a high level of alcohol use. The meeting lasted 50 minutes and was conducted using the principles of motivational interviewing. This approach was compared with an educational video intervention and assessment-only control group. Results showed that participants in the motivational interviewing group had significantly greater decreases in

drinks per week and frequency of binge-drinking, indicating that even a single feedback session about health behavior can result in significant reduction of harm.

Although most health coaching is telephone-based, there is some evidence to suggest that email may also be an effective method of eliciting positive health behavior change (Levitsky et al., 2006; Obermayer, Riley, Asif, & Jean-Mary, 2004) . A study targeting tobacco use and cessation among university students also utilized an individualized approach to help students to quit smoking using cell phone text messaging (Obermayer et al., 2004). After a web-based assessment of tobacco use, motivation to quit, and readiness-to-change, the intervention group was sent text messages to their personal cellular telephones on various topics related to tobacco cessation. Of those who participated in the intervention, 46% reported that they attempted a quit date and 34% were not smoking at six weeks. Participants also reported that they preferred and used the text messaging more frequently than the web-based program. This study suggests that email and text-message based health coaching interventions are a potential adjunct or alternative to telephone health coaching among university students.

Conclusions

The epidemic of overweight and obesity is such that comprehensive intervention is needed at multiple levels of public health. The growing prevalence of overweight has been observed among all age groups, from children to older adults; therefore prevention efforts should target all age groups. Young adults are a segment of the population that has been relatively ignored in prevention efforts and there are very few studies that evaluate health promotion interventions for young adults. University education represents an opportunity to gain academic knowledge as well as other important life

skills. Young adults who enter university may experience a major transition from living with their family of origin to living either on their own or in university residence halls. This transition has been associated with negative changes in dietary patterns and decreases in physical activity and weight gain; therefore, university students, especially first-year students, represent a population that could greatly benefit from health promotion and obesity prevention efforts in order to set the stage for further healthy lifestyle behaviors. These efforts should be based on health behavior change models such as the Transtheoretical Model (Prochaska, 1979; Prochaska & DiClemente, 1983, 1984) and Motivational Interviewing (Miller & Rollnick, 1991, 2002).

Overview of the present study

The purpose of the current study was to evaluate two interventions which sought to increase healthy lifestyle behavior such as physical activity and dietary habits and to prevent weight gain among young adults in their first year of university. The following three groups were compared on several health outcomes: (1) Health coaching group: HRA with individualized feedback and monthly health-related email messages plus health coaching; (2) Minimal intervention group: HRA with individualized feedback and monthly health-related email messages; and (3) Control Group: HRA only. The HRA assessed and provided feedback on the following health behaviors and indices: (1) physical activity; (2) nutrition; (3) body mass index (BMI) and waist circumference; (4) tobacco, alcohol, and drug use; and (5) perceived stress.

Hypotheses

Very few studies have evaluated obesity prevention interventions among young adults and few studies have evaluated the effectiveness of health coaching for university

students. The first hypothesis was that the participants in the health coaching group compared to the minimal and control groups from baseline to post-treatment would show increases in moderate and vigorous physical activity, strength training, and fruit and vegetable intake and decreases in high fat food intake as well as show less increase in waist circumference and BMI. It was also hypothesized that participants in the minimal group compared to participants in the control group from baseline to post-treatment would report higher moderate and vigorous physical activity, strength training, and fruit and vegetable intake and report lower high fat food intake, as well as show less increase in waist circumference and BMI. Finally, to explore potential prospective predictors of health outcome, a series of nine multiple regressions were conducted. It was hypothesized that perceived stress, tobacco use, and binge drinking would be negatively correlated with positive health outcomes after controlling for baseline measures of physical activity (moderate, vigorous, and strength training), nutrition (fruit, vegetable, and high fat food consumption), and body composition (waist circumference and BMI). It was also hypothesized that women would be more likely than men to show positive health outcomes for nutrition while men would be more likely to show positive health outcomes for physical activity after controlling for baseline measures of physical activity, nutrition, and body composition.

CHAPTER II

METHOD

Participants

In total, 111 first-year college students (77 women, 34 men) who were recruited from introductory psychology courses and other campus sources (student union center, student health, campus libraries, residence halls) volunteered to participate in the study. Students were eligible to participate in the study if they: (1) were willing to complete an online health risk appraisal; (2) were willing to discuss physical activity, dietary habits and other health behaviors via telephone; and (3) were willing to receive emails about health-related topics. There were 31 participants who did not complete the post-assessment analyses. Of this group of participants, one student withdrew from university, three students withdrew from the study, two students were excluded from the study because they were not in their first year of college, and 25 students did not present for the post-assessment. After signing an informed consent (Appendix A), participants were randomly assigned to participate in one of three groups: (1) health coaching group ($n = 26$; 20 women, 6 men): HRA with individualized feedback plus health-related emails plus biweekly telephone health coaching; (2) minimal intervention group ($n = 24$; 18 women, 6 men): HRA with individualized feedback plus health-related emails; and (3) control group ($n = 30$; 17 women, 13 men): HRA only.

There were a total of 80 participants (55 women, 25 men) who completed both the baseline and post-intervention assessments. However, in order to balance the distribution

of gender across groups, six men were randomly excluded from the control group, thus analyses were completed for a total of 74 participants (55 women, 19 men). The overall mean age of this sample was 18.59 years ($SD = 2.03$), while for women, the mean age was 18.36 years ($SD = 1.02$) and the mean age of the men was 19.26 years ($SD = 3.60$). Results of an independent samples *t*-test indicated there were no significant differences between the mean age of men and women in this sample.

Measures

Health Risk Appraisal. The health risk appraisal (HRA) used for the proposed study was the College Personal Behavioral Health Profile (CPBHP). Several items on the CPBHP were modified from the University of North Dakota Center for Health Promotion and Prevention Research's Personal Behavioral Health Profile (PBHP), developed for adults in the general population (UND, 2006) which assessed physical activity, nutrition, daily tobacco use, and readiness to change for tobacco, alcohol, physical activity and nutrition. Participants were asked to report how often they engaged in moderate, vigorous, and strength training exercise over the past week on a 4-point Likert incremental scale as follows: 1 = less than one time per week; 2 = one to two times per week; 3 = three to four times per week; and 4 = five or more times per week. Participants were asked to report how many servings of fruit, vegetables, and high fat foods they consumed on average each day. Responses were rated on a 4-point Likert incremental scale as follows: 1 = less than one serving; 2 = one to two servings; 3 = three to four servings; and 4 = five or more servings. For tobacco use, participants were asked to report the number of cigarettes smoked per day on a 3-point Likert incremental scale (1 = 14 or fewer per day; 2 = between 15 and 25 cigarettes per day; and 3 = more than 25

cigarettes per day). For readiness to change, participants were asked if they intend to make a change in their tobacco use, alcohol use, physical activity, and diet in the next six months (1 = yes, 0 = no) and if they answered yes, they were also asked to rate their readiness to change on 10-point Likert incremental scale (1 = not ready, 10 = trying to change).

Additionally, items developed for a university population were also included from the American College Health Association's National College Health Assessment (ACHA-NCHA) to assess substance use (tobacco, alcohol, and drug use) and weight-related behaviors and concerns. For substance use, participants were asked to indicate how many times they used tobacco, alcohol, and amphetamines in the past 30 days using an 8-point Likert incremental scale as follows: 1 = never used; 2 = used but not in past 30 days; 3 = one to two days; 4 = three to five days; 5 = six to nine days; 6 = 10 to 19 days; 7 = 20 to 29 days; 8 = all 30 days. For alcohol use, additional questions were included to assess binge drinking, which was assessed by asking participants to rate on a 10-point Likert scale how many times over the past two weeks they consumed five or more drinks in one sitting (0 = none; 1 = one time; 2 = two times; 3 = three times; 4 = four times; 5 = five times; 6 = six times; 7 = seven times; 8 = eight times; 9 = nine or more times). Additionally, participants were asked to report the number of drinks consumed on occasions when alcohol is consumed on a 9-point Likert scale (1 = one drink; 2 = two drinks; 3 = three drinks; 4 = four drinks; 5 = five drinks; 6 = six drinks; 7 = seven drinks; 8 = eight drinks; 9 = nine or more drinks). Weight related concerns were assessed using three questions: (1) How would you describe your weight (1 = very underweight; 2 = slightly underweight, 3 = just the right weight; 4 = slightly overweight, 5 = very

overweight); (2) Are you trying to do the following about your weight (1 = I am not trying to do anything about my weight; 2 = stay the same; 3 = lose weight; 4 = gain weight); and (3) Within the last year did you do any of the following (1 = exercise to lose weight, 2 = diet to lose weight, 3 = vomit or take laxatives to lose weight, 4 = take diet pills to lose weight, 5 = I did not do any of the above). Also, in order to assess perceived stress, items were adapted from Cohen, Kamarck, and Mermelstein's Perceived Stress Scale (1983). Responses, for each item ranging from 1 (*never*) to 5 (*very often*), were summed to create a total scale in which higher scores reflected greater perceived stress. The Time 1 inter-item reliability ($\alpha = .86$) for this shortened version is consistent with the longer version of the scale (i.e., $\alpha = .84-.86$; Cohen et al. 1983).

The CPBHP is an online assessment instrument containing the dependent variables that were examined in this study, but it also serves as part of the intervention. The CPBHP assesses health risk factors and readiness-to-change for the following areas: physical activity, dietary habits, tobacco use, alcohol use, perceived stress, body mass index, and waist circumference. After participants completed the online CPBHP, they received an online report that contained individualized feedback and referral information based on risk factors (all but those in the HRA only control group). This report was generated as soon as they completed the online survey and provided basic information about each of the assessed areas of health. Each report also included links to Portable Document Files (PDFs) that included detailed information about each risk factor that was identified based on the participant's reported health behaviors. For example, if a student reported that she or he ate less than five servings of fruit and vegetables, a link to a PDF document was included which provided information about the minimum

recommendations for fruit and vegetable intake as well as information about increasing fruit and vegetable intake.

Sociodemographic measures. The following demographic data was collected: age, gender, ethnicity, marital status, and year of university. This information was used to provide descriptive information about the sample to determine how it may compare to other populations.

Anthropometric measures. Weight was measured in pounds, using a standardized Tanita™ scale and height was measured in inches, using a standardized stadiometer. Waist circumference was measured in centimeters using a Myotape™ tape measure. The waist circumference was measured halfway between the lower rib margin and the iliac crest or approximately 1 inch above the navel. Prior to height, weight and waist measurements, participants were asked to remove shoes and heavy clothing such as jackets or sweaters. BMI was calculated at baseline and post-assessment by using the following standard formula: $\text{weight/height}^2 \times 703$.

Procedure

Interested participants, who met the eligibility criteria, were invited to attend an initial assessment session. Participants were enrolled over the first four weeks of the Fall 2007 and Spring 2008 semester. Students could only participate in the study for one semester. Upon arrival, participants were informed that the purpose of the study was to gather information about how health behaviors of students change in their first year of college. Participants were informed that they would be asked to return at the end of the semester to have their weight and waist circumference measured again as well as complete the HRA again and would be compensated with either extra credit or monetary

compensation. Participants were asked to read and sign the consent form outlining the purpose of the study in greater detail. Once participants signed the consent form, anthropometric measures were taken. A copy of the anthropometric measurements was given to each participant, which they were instructed to use to complete the CPBHP. Computers were available for participants to have the option of completing the online health risk appraisal at the meeting or completing the health risk appraisal on their own computer. Participants assigned to the minimal and comprehensive intervention groups received a personal behavioral health profile immediately following the completion of the HRA. This profile was available to participants by logging onto a password-protected website where they could access the profile at any point during the semester. Participants in the control group completed the HRA but did not receive any feedback or resource information on individualized risk factors.

Once participants completed the online HRA, the participants assigned to the comprehensive intervention groups were contacted via telephone to initiate bi-weekly health coaching. Health coaching began for all participants at the same time which was approximately one month after the beginning of the semester, once enrollment for the study was completed. The duration of each semester was approximately four months; therefore health coaching sessions were conducted for approximately three months. Health coaching was provided by the principal investigator, who has been trained in motivational interviewing and health behavior change techniques. The principal investigator attempted to contact participants twice per month and calls lasted 10 to 30 minutes based on the participant's needs. Health coaching sessions ranged from three to five sessions per participant with a mean of 4.24 ($SD = .60$). Although telephone contact

was the only method of contact that students utilized for health coaching sessions, email contact was used to forward information related to the health coaching calls such as resource information or links to websites pertaining to the content or goals of health coaching. Although any health behavior included in the CPBHP was discussed with the participant, health coaching goals were based on priorities set by the participant. Furthermore, counseling specifically for weight loss was not the focus of health coaching sessions; however goals were based on improving health behaviors that would assist participants with maintaining their weight such as physical activity and nutrition. Participants in the minimal and comprehensive intervention groups were sent three emails, once per month, after study enrollment was completed for the semester. The first email message was on nutrition and discussed portion sizes. The second email message was on physical activity and discussed overcoming barriers to physical activity among college students. The third email message was on alcohol use and discussed the consequences of alcohol use among college students. The content of each email message was sent as a PDF which participants could open, review, and print and/or save.

Data Analysis Strategy

In order to assess effectiveness of the health coaching and minimal interventions compared to the control group, analysis of covariance (ANCOVA) tests were performed to measure change as a function of group on the following dependent measures: moderate physical activity; vigorous physical activity; strength training; fruit intake; vegetable intake; high fat foods intake; waist circumference; and BMI. When no significant group differences were found among the three experimental groups, the health coaching and

minimal groups were combined into one group to increase power associated with the analyses and compared to the control group.

In addition, the utility of using baseline measures to prospectively predict behavioral health measures at post-assessment was examined by conducting a series of eight multiple regressions within the total sample of participants. In each regression, the dependent variable was the post-treatment dependent measure and the independent/predictor variables were all of the baseline dependent measures entered simultaneously including the following additional predictors: gender; binge drinking; stress level, and tobacco use. These four variables were included based on previous literature findings demonstrating relationships with various other health outcomes.

CHAPTER III

RESULTS

The current study evaluated two interventions, a health coaching and minimal intervention, aimed at increasing health behaviors such as physical activity and dietary habits as well as to decrease weight gain compared to a control group. The health coaching intervention utilized telephone health coaching in addition to health risk appraisals (HRA) with individualized feedback and health-related emails. The minimal intervention utilized health risk appraisals (HRA) with individualized feedback and health-related emails. Data were analyzed for 74 participants. Women ($n = 55$) comprised 74.3% of the total sample and men ($n = 19$) comprised 25.7% of the sample. The majority of participants were White (94.6%) and reported their marital status as never married (97.3%).

Descriptive Analysis of Dependent and Moderator Variables at Baseline

Table 1 presents the descriptive statistics for the categorical dependent variables at baseline by experimental group and Table 2 presents the means and standard deviations for all dependent variables by experimental group at baseline.

Table 1. Descriptive Statistics for Dependent Variables By Experimental Group at Baseline.

Dependent Variables	HC Group		Minimal Group		Control Group	
	N	%	N	%	N	%
Moderate Physical Activity						
Less than 1 time per week	3	11.50	1	4.20	0	0
1-2 times per week	7	26.90	6	25.00	5	20.80
3-4 times per week	5	19.20	6	25.00	8	33.30
5 + times per week	11	42.30	11	45.80	11	45.80
Vigorous Physical Activity						
Less than 1 time per week	4	15.40	1	4.20	1	4.20
1-2 times per week	6	23.10	7	29.20	7	29.20
3-4 times per week	8	30.80	8	33.30	13	54.20
5 + times per week	8	30.80	8	33.30	3	12.50
Strength Training						
Less than 1 time per week	9	4.60	5	20.80	6	25.00
1-2 times per week	5	19.20	8	33.30	8	33.30
3-4 times per week	10	38.50	7	29.20	8	33.30
5 + times per week	2	7.70	4	16.70	2	8.30
Fruit Intake						
Less than 1 serving	8	30.80	4	16.70	4	16.70
1-2 servings	13	50.00	11	45.80	14	58.30
3-4 servings	5	19.20	9	37.50	5	20.80
5 or more servings	0	0	0	0	1	4.20
Vegetable Intake						
Less than 1 serving	9	34.60	4	16.70	3	12.50
1-2 servings	10	38.50	13	54.20	15	62.50
3-4 servings	6	23.10	6	25.00	6	25.00
5 or more servings	1	3.80	1	4.20	0	0
High Fat Foods Intake						
Less than 1 serving	6	23.10	3	12.50	6	25.00
1-2 servings	13	50.00	17	70.80	10	41.70
3-4 servings	7	26.90	4	16.70	8	33.30
5 or more servings	0	0	0	0	0	3.30

Note: HC = health coaching

Table 2. Means and Standard Deviations for Dependent Variables by Experimental Group at Baseline.

Dependent Variables	HC Group	Minimal Group	Control Group
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
Moderate Physical Activity	2.92 (1.09)	3.13 (0.95)	3.25 (0.79)
Vigorous Physical Activity	2.77 (1.07)	2.96 (0.91)	2.75 (0.74)
Strength Training	2.19 (1.02)	2.42 (1.02)	2.25 (0.94)
Fruit Intake	1.88 (0.71)	2.21 (0.72)	2.13 (0.74)
Vegetable Intake	1.96 (0.87)	2.17 (0.76)	2.13 (0.61)
High Fat Foods Intake	2.04 (0.72)	2.04 (0.55)	2.08 (0.78)
Waist Circumference	32.08 (5.24)	30.13 (2.40)	33.92 (4.69)
BMI	23.96 (5.01)	21.84 (2.44)	26.12 (4.54)

Note: HC = health coaching

The health coaching intervention group ($M = 16.04$, $SD = 4.23$), the minimum intervention group ($M = 15.29$, $SD = 3.32$), and the control group ($M = 16.88$, $SD = 3.69$) did not differ on reports of stress at baseline [$F(2,71) = 1.06$, $p = .353$]. Cigarette smoking in the past 30 days among the overall sample at baseline (10.8%) was considerably lower than the current smoking rate for 18 to 24 year olds in the state (30.3%; Centers for Disease Control [CDC], 2007), and was also lower than the current smoking rate for college students according to the National College Health Assessment (18.9%, American College Health Association, 2007) but was very similar to the state rate for college-educated individuals (9.6%; CDC, 2007). The percentage of participants who reported consuming five or more drinks in one setting at least once over the past two weeks was virtually identical (50%) to that reported for 18 to 24 year old adults in the

state (50.3%; CDC, 2007). Table 3 presents the percentages of participants in each of the three study groups who reported cigarette smoking in the past 30 days and at least one incident of consuming five or more drinks in the past two weeks at the baseline assessment.

Table 3. Prevalence of Cigarette Smoking and Binge Drinking by Experimental Group at Baseline.

Additional Predictor Variables	HC Group	Minimal Group	Control Group
Binge Drinking (> 5 drinks)	46.2%	41.7%	62.5%
Tobacco Use	8.3%	12.5%	12.5%

Note: HC = health coaching

The majority of participants reported that they were willing to increase their physical activity (84.8%) and improve their diet over the next six months (75.9%). The mean number of health coaching sessions in the intervention group receiving health coaching was 4.24 ($SD = .60$; Range = 3 - 5). Of participants who received health coaching, 7.7% ($n = 2$) completed three sessions, 61.5% ($n = 16$) completed four sessions, and 30.8% ($n = 8$) completed five sessions of health coaching.

Effects of the Health Coaching and Minimal Interventions on Behavioral Health Changes

In order to examine group differences between the health coaching, minimal, and control groups, Analysis of Covariance (ANCOVA) tests were performed on the following measures: moderate physical activity; vigorous physical activity; strength training; fruit intake; vegetable intake; high fat food intake; waist circumference; and BMI. In all cases, the baseline measure of the variable was used as the covariate when examining group differences on the post-assessment measure of the variables.

Moderate physical activity. The results indicated that there were no significant differences for moderate physical activity at post-assessment controlling for baseline levels.

Vigorous physical activity. The results indicated that there were no significant differences for vigorous physical activity at post-assessment controlling for baseline levels.

Strength training. The results indicated that there were no significant differences for strength training at post-assessment controlling for baseline levels.

Fruit intake. The results indicated that there were no significant differences for fruit intake at post-assessment controlling for baseline levels.

Vegetable intake. The results indicated that there were no significant differences for vegetable intake at post-assessment controlling for baseline levels.

High fat food intake. The results indicated that there were no significant differences for high fat food intake at post-assessment controlling for baseline levels.

Waist circumference. The results indicated that there were no significant differences for waist circumference at post-assessment controlling for baseline levels.

BMI. The results indicated that there were no significant differences for BMI at post-assessment controlling for baseline levels.

Effects of the Combined Intervention on Behavioral Health Changes

As no significant group differences were found between the health coaching and minimal intervention groups, these two groups were then combined to form one intervention group and compared to the control group using ANCOVA with the following dependent measures: moderate physical activity; vigorous physical activity;

strength training; fruit intake; vegetable intake; high fat food intake; waist circumference; and BMI. In all cases, the baseline measure of each dependent variable was used as a covariate.

Moderate physical activity. The results indicated that there was not a significant group difference between the combined intervention group and the control group for moderate physical activity.

Vigorous physical activity. The results indicated that there was a significant group difference with the combined intervention group reporting significantly higher post-assessment vigorous physical activity than the control group [$F(1, 71) = 4.17, p < .05$; Partial $\eta^2 = .06$], adjusted for baseline levels. The baseline and adjusted post-assessment means for the intervention and control groups are presented in Table 4.

Table 4. Results of Significant ANCOVAs for Effects of Combined Intervention on Behavioral Health Changes.

Dependent Variable	Control Group		Combined Intervention	
	Baseline Mean (SD)	Adjusted Mean (SD)	Baseline Mean (SD)	Adjusted Mean (SD)
<i>Vigorous Physical Activity</i>	2.75 (0.74)	2.34 (0.15)	2.86 (0.99)	2.72 (0.11)
<i>BMI</i>	26.12 (4.54)	24.79 (0.23)	22.94 (4.09)	24.18 (0.16)

Strength training. The results indicated that there was not a significant group difference between the combined intervention group and the control group for strength training.

Fruit intake. The results indicated that there was not a significant group difference between the combined intervention group and the control group for fruit intake.

Vegetable intake. The results indicated that there was not a significant group difference between the combined intervention group and the control group for vegetable intake.

High fat food intake. The results indicated that there was not a significant group difference between the combined intervention group and the control group for high fat food intake.

Waist circumference. The results indicated that there was not a significant group difference between the combined intervention group and the control group for waist circumference.

BMI. The results indicated that there was a significant group difference with the combined intervention group reporting significantly higher post-assessment BMI than the control group [$F(1, 71) = 4.56, p < .04$; Partial $\eta^2 = .06$], adjusting for baseline levels. Table 4 shows the baseline and adjusted post-assessment means for the combined intervention and control groups.

Prospective Predictors of Behavioral Health Changes

In order to explore the utility of using various baseline measures to prospectively predict behavioral health outcomes at post-assessment, a series of multiple regressions were performed on the entire sample for each of the dependent measures (moderate physical activity; vigorous physical activity; strength training; fruit intake; vegetable intake; high fat food intake; waist circumference; and BMI). In each regression, the dependent variable was the post-assessment dependent measure and the independent variables were all of the baseline dependent measures entered simultaneously in addition to the following predictors: gender, binge drinking, stress level, and tobacco use.

Moderate physical activity. The overall regression model was significant, $F(12, 61) = 3.43, p < .001$. The multiple R was .64, R^2 was .4, and the adjusted R^2 was .29. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

Vigorous physical activity. The overall regression model was significant, $F(12, 61) = 6.02, p = .001$. The multiple R was .74, R^2 was .54, and the adjusted R^2 was .45. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

Strength training. The results of the regression predicting post-assessment strength training showed that the overall regression model was significant, $F(12, 61) = 4.01, p < .001$. The multiple R was .66, R^2 was .44, and the adjusted R^2 was .33. Although the overall regression equation was significant, none of the predictors individually demonstrated a significant effect on post-assessment strength training.

Fruit intake. The results of the regression predicting post-assessment fruit intake showed that the overall regression model was significant, $F(12, 61) = 2.64, p < .01$. The multiple R was .58, R^2 was .34, and the adjusted R^2 was .21. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

Vegetable intake. The results of the regression predicting post-assessment vegetable intake are presented in Table 7. The overall regression model was significant, $F(12, 61) = 3.97, p < .001$. The multiple R was .66, R^2 was .44, and the adjusted R^2 was .33. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

High fat food intake. The results of the regression predicting post-assessment high fat food intake showed that the overall regression model was significant, $F(12, 61) = 2.49, p < .01$. The multiple R was .57, R^2 was .33, and the adjusted R^2 was .20. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

Waist circumference. The results of the regression predicting post-assessment high fat food intake showed that the overall regression model was significant, $F(12, 61) = 37.94, p < .001$. The multiple R was .94, R^2 was .88, and the adjusted R^2 was .86. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

BMI. The results of the regression predicting post-assessment vegetable intake are presented in Table 8. The overall regression model was significant, $F(12, 61) = 98.37, p < .001$. The multiple R was .98, R^2 was .95, and the adjusted R^2 was .94. The statistically significant predictors, their beta weights and partial correlations are shown in Table 5.

Table 5. Multiple Regression Model Predicting Post-Treatment Moderate Physical Activity.

Dependent Variable	Predictor	β	Partial r
Moderate Physical Activity	Baseline Strength Training	.40*	.30
Vigorous Physical Activity	Baseline Vigorous Physical Activity	.35*	.32
	Baseline Stress Level	-.22*	-.27
	Baseline Fruit Intake	-.22*	-.26
Fruit Intake	Baseline Fruit Intake	.32*	.31
Vegetable Intake	Baseline Vegetable Intake	.53**	.51
High Fat Intake	Baseline High Fat Intake	.44**	.43
	Gender	.24*	.26
Waist Circumference	Baseline Waist Circumference	.97**	.73
Body Mass Index	Baseline Body Mass Index	.78**	.81
	Baseline Waist Circumference	.20*	.32

* $p < .05$ ** $p < .001$

CHAPTER IV

DISCUSSION

Very few studies have evaluated obesity prevention interventions among young adults such as university students and no studies have evaluated the effectiveness of health coaching among university students to increase healthy lifestyle behaviors. The current study evaluated two interventions (health coaching and minimal intervention) that aimed to increase health behaviors such as physical activity and dietary habits to decrease weight gain among young adults in their first year of university. Both intervention groups utilized health risk appraisals (HRA) with individualized feedback and periodic health-related emails but the health coaching group also included telephone health coaching. Both intervention groups were compared to a control group that completed the HRA but did not receive feedback.

Effects of the Health Coaching and Minimal Interventions on Behavioral Health Changes

Results indicated that there were no significant differences in students' reported health behaviors from baseline to post-assessment when comparing the health coaching group, minimal intervention group, and control group. These results were contrary to the hypothesis that the participants who received the HRA with individualized feedback, health-related emails, and health coaching would report significantly higher participation in physical activity (moderate, vigorous, and strength training), higher consumption of fruits and vegetables, lower consumption of high fat foods, and show less weight gain (as evidenced by lower increases in BMI and waist circumference) than participants who

received the minimal intervention group and controls. These results also did not show support for the complementary hypothesis that the minimal intervention group would show similar advantages contrasted solely with the control group. Although we did not find significant differences when we compared the health coaching, minimal and control groups, when the two intervention groups were combined and compared to the control group, analyses did show significant group differences for vigorous physical activity and BMI.

There may be several explanations for why health coaching did not result in significant improvements in health behaviors among this sample of college students. Several studies evaluating health coaching found positive results compared to minimal interventions (similar to the one used in the current study), but many of these studies were conducted in work sites with employees or with community-dwelling older adults (Holland et al., 2005; Tidwell et al., 2004; Proper, Hildebrandt, Van der Beek, Twisk, & Van Mechelen, 2003; Wilcox et al., 2006; Yen et al., 2001). These studies suggest that health coaching is an effective intervention to improve health behaviors among community-dwelling older adults and adults in the workplace; however these results may not generalize to college students. Considering the current results which did not find that the health coaching group resulted in significant health changes compared to the minimal and control groups, it suggests that health coaching may not necessarily be the best mechanism for producing health behavior change among college students whose lifestyle may differ from these previously studied populations. It was often difficult to find consistent times that students in the health coaching intervention group were available for relatively short periods of time (10 minute intervals). Although the use of cellular

telephones allow for greater flexibility in contacting students, it was difficult to maintain consistent contact with participants in the health coaching group, which may have influenced the effect of this intervention in improving health behaviors. Furthermore, health coaching contacts ranged from three to five sessions over a four month period and the average number of sessions of 4.24 was below the expected six to eight sessions (i.e., approximately two health coaching sessions per month). The average number of sessions in the current study was also less than that found in the previous health coaching studies with adults. For example, one study had 11 health coaching sessions over 12 months (Holland et al., 2005), another had 8 sessions over six months (Wilcox et al., 2006), and a third had 7 sessions over nine months (Proper et al., 2003). This suggests that perhaps the number of health coaching sessions in the current study was not sufficient to influence significant change among college students. It is also important to consider factors that affect motivation to change, particularly factors that may relate to young adults.

Perceived threat, as defined by the Health Behavior Model (HBM: Kohler, Grimley, & Reynolds, 1999; Roden, 2004; Rosenstock, 1974), is the belief that one is vulnerable to a particular health problem and as these threats increase, the motivation to make behavioral health changes also increases. This construct may explain the difficulties in engaging participants in health coaching who may not have perceived imminent threats to their health, thus were less motivated to engage in behavioral health changes. Furthermore, although criteria for participating in the study was that students must be willing to discuss their health behaviors with a health coach, participants in the current study were randomly assigned to receive health coaching, regardless of their baseline health behaviors. This factor may also have affected motivation to engage in health coaching,

particularly if the student perceived their health to be good based on the feedback from the HRA.

Effects of the Combined Intervention on Behavioral Health Changes

Covariate analysis showed that the combined intervention group reported significantly more vigorous physical activity at post-assessment than did the control group, adjusting for baseline levels. However, examination of the means revealed that both the combined intervention and the control group showed decreases in vigorous physical activity from baseline to post-assessment but the decreases seen in the control group were much greater. These results suggest that completing the health risk appraisal and receiving individualized feedback combined with periodic emails might have helped participants maintain their levels of vigorous activity, but they were not effective in helping participants increase their levels of vigorous physical activity. Although this is not what we expected, this is still an important finding in that it demonstrates that the intervention resulted in participants showing less of a decline in vigorous physical activity, compared to controls.

Results for BMI were contrary to the initial hypothesis that the intervention group would show significantly lower BMI compared to the control group from baseline to post-treatment. Unexpectedly, the current results showed that the combined intervention group had significantly greater BMI values at the post-assessment than did the control group, adjusting for baseline levels. Interestingly, examination of the means revealed that this effect was primarily the result of an unexpected and unexplained decrease in BMI values in the control group from baseline to the post-assessment. Although the results showed that BMI among the intervention group did not significantly change which

was the intent of the intervention (to prevent weight gain), it is unclear as to why BMI would decrease among controls. The nature of the study involved no contact with the control group beyond the baseline and post-assessment, therefore little is known about this group of students and what may have contributed to a significant decrease in BMI among this group¹. However, baseline BMI for the control group was higher compared to the HC and minimal intervention groups and although the ANCOVA analysis controls for baseline differences between groups, there may have been other factors that might have made students in this group more motivated to lose weight than the intervention groups such as societal pressure to be thin.

Failure to Show Improvements in Health Behaviors

Contrary to expectations, the current study did not see significant improvements in health behaviors such as physical activity or dietary habits among the intervention groups compared to controls. One potential explanation for these lack of differences between groups may be that students perceive moderate physical activity to be part of their daily living activities such as walking to classes or climbing the stairs instead of taking the elevator, therefore they may not perceive changes in that type of physical activity given that their regular daily activity stays relatively constant. Furthermore, engaging in vigorous physical activity or strength training may be perceived by college students as requiring additional time, effort, and equipment that may not be easily accessible, particularly when their schedule becomes busy with school-related activities. Although all students at the University of North Dakota are provided access to a campus wellness center which provides weight and exercise equipment as well as fitness classes

¹ Examination of the distribution of BMI values in the control group did not reveal any outliers that might have introduced a specious effect.

to engage in vigorous physical activity, accessing this facility still requires students to find the time and opportunity. These added barriers may decrease the likelihood that freshman students will maintain or even increase their vigorous physical activity or strength training, particularly as they are adjusting to the demands of academic responsibilities. Additionally, a study examining barriers to physical activity among freshman college students found that exercise equipment in one's home was independently related to strength training (Sallis, Johnson, Calfas, Caparosa, & Nichols, 1997), providing support that having equipment readily accessible for strength training will increase the likelihood that college students will engage in that particular physical activity. Given that the majority of the college students in this sample lived on campus as determined by examining the addresses provided by participants at the time of the study enrollment, this finding may be particularly relevant to the current sample. Furthermore, it may be that college students may perceive making dietary changes in college as difficult. Before young adults attend college, they may have made many personal choices as adolescents with respect to their diet; however, food choices that adolescents make have been shown to be significantly influenced by their families and school environment (Contento, Williams, Michela, & Franklin, 2006). When young adults make the transition to college, they are faced with making food choices that are independent of these influences which may result in a higher consumption of foods that are more appealing but which tend to be lower in nutritional value. Perhaps in order for fruit and vegetable intake to increase and high fat food intake to decrease among college students, a more focused approach is necessary in order to impact dietary habits such as targeted and repeated information about increasing fruit and vegetable intake as well as providing

environmental cues to help college students make healthier dietary choices. Without a more focused approach to impact dietary habits, it may be difficult for comprehensive interventions to influence significant improvements in dietary habits in the presence of more appealing, albeit less nutritional alternatives.

Predicting Health Behaviors Prospectively in the Total Sample

The utility of baseline measures for predicting behavioral health outcomes at post-assessment was examined by conducting multiple regression analyses in the total sample of participants. These analyses revealed that, with the exception of strength training and moderate physical activity, each baseline variable accounted for a significant amount of variance in its respective post-assessment variable. In addition, for four of the outcome variables, additional predictors also accounted for a statistically significant amount of variance beyond that explained by the baseline measure of the outcome variable. First, there was a significant positive relationship between the frequency of strength training at baseline and the frequency of moderate physical activity at post-assessment. There was a significant negative relationship between the frequency of perceived stress and fruit intake at baseline and the frequency of vigorous physical activity at post-assessment. There was also a significant relationship between gender and high fat food consumption with men eating more high fat foods than women at post-assessment. Finally, a greater waist circumference at baseline was associated with a greater BMI at post-assessment even after controlling for BMI at baseline.

These analyses suggests that engaging in strength training exercises is a significant predictor of engaging in moderate physical activity at post-assessment, indicating that students who are engaging in strength training exercises are more likely to

increase their moderate cardiovascular physical activities. This may reflect a positive aspect of already being involved in a structured physical activity. It is possible that individuals who are engaging in strength training may be at a fitness level that makes increases in cardiovascular exercises easier to initiate and maintain than those who are not already engaging in strength training activities. A meta-analysis of studies examining strength training and its effect on blood pressure found that engaging in regular strength training significantly decreases blood pressure, which favorably affects cardiovascular capacity and fitness level (Fargard, 2006). Another potential explanation for the current results is that perhaps those who are engaged in strength training would be more likely to increase cardiovascular activities because they are already following a regular schedule of exercise and perceive fewer barriers than an individual who is not engaged in any physical activities. Studies examining predictors of exercise among college students have found that a previous history of physical activity over the past 12 months was a significant predictor of higher stage of exercise behavior change (Silver Wallace, Buckworth, Kirby, & Sherman, 2000).

Although strength training was found to be predictor of moderate physical activity, this was not observed for vigorous physical activity. However, perceived stress and fruit consumption were significant predictors of vigorous physical activity. For perceived stress, individuals who reported higher perceived stress at baseline were more likely to decrease their vigorous physical activity at post-assessment. Perceived stress has been found to be a factor in health risk behaviors such as alcohol consumption and tobacco use among college students (Naquin & Gilbert, 1996; Park, Armeli, & Tennen, 2004). However, there is a lack of literature that has demonstrated that perceived stress

can negatively affect physical activity among college students. Therefore, the current results highlight the importance of considering the role of perceived stress in affecting college students' participation in vigorous physical activity. These results suggest that higher perceived stress may also make it difficult for students to overcome the barriers associated with the additional time and resources needed to engage in vigorous physical activity, which in turn may have decreased the effect of the health coaching and minimal intervention. In addition to the role of perceived stress, fruit consumption at baseline was also a significant predictor of vigorous physical activity with lower levels of fruit consumption predicting higher levels of vigorous physical activity at post-assessment. This is an unexpected finding and conflicts with previous studies that show that increased fruit consumption is associated with physical activity among college students (Johnson, Nichols, Sallis, Calfas, & Hovell, 1998; Seo, Nehl, Agle, & Ma, 2008).

Additionally, we also found that gender was significantly related to post-assessment high fat food intake. These results showed that men were significantly more likely to eat more high fat foods at post-assessment, even after accounting for baseline high fat foods intake. This is consistent with previous studies showing that college women tend to have healthier dietary habits than college men (Levi et al., 2006; von Bothmer & Fridlund, 2005). A potential explanation for this effect is that women tend to be more concerned about dietary habits compared to men - an effect that has been found in other studies. For example, Levi and colleagues (2006) found that college women considered factors such as the healthiness, quality, and label information of their food choices to be of significantly more importance compared to college men.

Finally, waist circumference at baseline was a significant predictor of BMI at post-assessment, even when baseline BMI was controlled. This finding suggests that a student whose waist circumference was high at baseline was more likely to have larger BMI over the duration of the semester, suggesting that a higher waist size is a predictor of weight gain - an important consideration in assessing weight gain in addition to BMI. So, even though a student's BMI may not be in the overweight range but his or her waist size is in the unhealthy range, the student may be more likely to gain weight over the duration of the semester. This is not surprising given that BMI and waist circumference are known to be highly correlated. However, this effect was not observed with waist circumference, indicating that baseline BMI was not a significant predictor of increases in post-assessment waist circumference. Perhaps among students with similar BMI values, those with larger waist sizes have a more difficult time participating in physical activity. This effect has been found in other studies. For example, Divigneaud and colleagues (2008) found that individuals with waist circumference in the healthy range were more physically active and showed improved cardiovascular fitness compared to individuals with waist circumference in the unhealthy range but within the same BMI category.

Limitations

Although the current study presents some important findings, there were also factors that limited the results of the study. First, the sample is a relatively homogenous sample with 94.6% of the sample reporting White ethnicity. Given this limitation, these results can only be generalized to a relatively homogenous group of White college students and may not be representative of racial minorities.

Another limitation of this study is that many of the student participants likely ate most of their meals in campus dining halls or in restaurants. Several studies have found an association between eating in away-from-home establishments and higher BMI (Duffey, Gordon-Larsen, Jacobs, Williams, & Popkin, 2007; Kant & Graubard, 2004; Mehta & Chang, 2008). Several participants in the health coaching group reported during telephone calls that eating in dining halls presented a barrier to making healthier choices such as eating a variety of fruits and vegetables and reducing high fat food intake. Reports from health coaching participants also indicated that some students increased fruit and vegetable intake by purchasing fruit and vegetables from grocery stores; a remedy that was less available for students lacking easily accessible transportation. Although anecdotal, these observations along with findings from the studies cited above suggest that when individuals cannot purchase and prepare their own food they have more difficulty making healthier dietary choices. Therefore, food environment and control over the preparation of food is an important consideration when designing interventions to improve healthy lifestyle behaviors, particularly dietary changes. Interventions for college student populations should focus on teaching students how to make healthier choices amongst more appealing but less healthy alternatives as well as modifying the environment to promote healthier foods such as point-of-purchase interventions, which have been shown to be effective in increasing sales of healthier foods in campus dining halls (Buscher, Martin, & Crocker, 2001).

Another limitation of this study is a self-selection bias. Students who were already engaging in relatively healthy lifestyle behaviors may have been more likely to volunteer for the study. Epidemiological BMI data from the Behavioral Risk Factor Surveillance

System (BRFSS) for North Dakota indicates that 54.9% of the population is neither overweight nor obese, 23.8% is overweight, and 21.3% is obese (CDC, 2007).

Comparisons with students who enrolled in the current study demonstrated that the study participants showed lower rates of overweight and obesity compared to the general population of North Dakota with 65.7% of the sample neither overweight or obese, 20.6% overweight, and 13.7% obese, which lends support to the hypothesis that healthier students may have been more likely to volunteer for the study. It is possible that students with a higher BMI may not have volunteered for the study because of the discomfort associated with being weighed and having waist size measured.

Finally, there is the issue of whether those who completed the study were similar to those who failed to complete the study. Independent sample t-tests examining baseline differences on the main outcome variables (physical activity, dietary habits, waist size, and BMI) between those who completed the post-assessment and those who did not found that there was a significant difference for waist circumference with participants who dropped out of the study showing significantly greater waist sizes ($M = 34.84$, $SD = 4.43$) at baseline than those completing the study ($M = 32.04$, $SD = 4.53$), $t(103) = 2.91$, $p = .004$. Although several steps were taken to ensure participants' privacy when completing the waist and weight measurements, this finding may suggest that some students may not have returned for follow-up because of discomfort with being weighed or measured. Further examination of those who failed to complete the study revealed there was a difference in the attrition rate by experimental group with 31.6% of the participants in the health coaching group not completing post-assessment measures, 33.3% of the minimal intervention not completing post-assessment measures, and 18.9%

of the control group not completing post-assessment measures. This suggests that more students in both the interventions groups (health coaching and minimal) did not return for post-assessment analyses. This difference in attrition rates may suggest that receiving feedback indicating that one is not meeting recommendations might discourage returning for a post-assessment, which logically might even be more likely if one had not made significant changes in the interim. These differences suggest there may be factors about those who failed to complete the study that may have led to different results if they had been included in the analyses.

Future Directions

Previous studies have shown that the first year of college is a time associated with significant weight gain (Holm-Denoma, Joiner, Vohs, & Heatherton, 2008; Levitsky et al., 2004; Racette et al., 2005) as young adults make the transition from adolescence to living independently as adults in a campus setting. Therefore, college education should also include learning how to lead a healthy lifestyle through regular physical activity, eating a healthy diet, and maintaining a healthy weight. The current study presents preliminary results of a randomized intervention to prevent weight gain and maintain a healthy lifestyle among college students. Very few studies have evaluated interventions to prevent weight gain among young adults therefore further studies are needed to expand and build upon this study and further understand effective ways in which young adults can maintain a healthy lifestyle throughout their college education.

Contrary to expectations, the current study did not find that either the health coaching or the minimal intervention resulted in any significant health behavior improvements. Therefore, future studies should focus on improving the current study by

addressing some of the issues the current study did not adequately address. For example, one consideration for future studies would be to examine the effect of food environment as a barrier to making dietary changes. Examining the effect of food availability for students who live on campus is an important consideration for designing obesity prevention for college students, yet very few studies have systematically studied this effect and how it might influence interventions aimed at improving dietary habits. The results from this study suggest that providing feedback and resource information through health-related emails to students about fruit and vegetable consumption and high fat food intake was not enough to significantly improve dietary habits which suggests that assessing environmental influences is an important consideration in future studies. In addition to assessing the effect of food environment, it may also be important for future studies to assess the effect of incentives. Given the difficulties in the current study with engaging students in the health coaching intervention, a potential way to address this is to evaluate the effect of providing incentives to students to improve their health. Studies conducted with adults have shown that financial incentives to improve health outcomes have resulted in positive outcomes for tobacco cessation (Volpp et al., 2006) and weight loss (Finkelstein, Linnan, Tate, & Birken, 2007); however the use of incentives to increase motivation to make behavioral health changes has not been studied among college students.

Given that the current sample was racially homogenous, composed of mainly White college students, further studies are needed to examine the effect of obesity prevention interventions among a more ethnically diverse sample. However, the results of the current study did suggest that gender does have some influence on high fat food

intake, suggesting that gender is an important consideration when evaluating and designing interventions for young adults in a university setting. The results of the current study suggest that men are more likely to increase their consumption of high fat foods compared to college women. Therefore, further research is needed to understand why men are less likely to improve their dietary habits compared to women. Also, college men may benefit from targeted interventions focusing on dietary changes, given the previous findings that college men tend to eat a less healthy diet than women (Levi et al., 2006; von Bothmer & Fridlund, 2005) and the current findings that men are also more likely to show declines in their dietary habits compared to women, even when baseline levels are controlled.

A final consideration for future studies would be to consider the influence of strength training upon cardiovascular physical activities and waist circumference upon changes in weight. Results of the prospective predictor analyses suggest these are important predictors of change in these areas. For example, when increasing moderate and vigorous physical activity, do participants experience different barriers with starting an exercise program when they are not currently engaged in any physical activities versus participants who are adding cardiovascular activities to an existing strength training schedule? Furthermore, does tailoring interventions or feedback taking these predictors (waist circumference and strength training) into account result in better outcomes compared to interventions that don't consider the influence of strength training and waist circumference? Additional research is needed to understand the impact of these factors on the effectiveness of interventions.

Conclusions

The current study failed to find that interventions aimed at promoting healthy lifestyle behaviors among college students resulted in significant improvements in health behaviors among college students in their first year of college. Further, the current study failed to demonstrate that the intervention utilizing health coaching in addition to health risk appraisals (HRA) with individualized feedback and health-related emails was more effective than a minimal intervention that utilized the HRA with individualized feedback and health-related emails. There were many influences that may have reduced the impact of the interventions, such as low motivation to make behavioral health changes or environmental and lifestyle factors that served as barriers to making changes. Therefore, when designing interventions to improve health behaviors among college students, it may be especially important to consider changes to the food environment as well as providing incentives for making changes among a population that may not feel that significant behavioral health changes are pertinent or important to them.

Although positive results were not found with the interventions evaluated, an examination of baseline predictors demonstrated prospectively that strength training, fruit intake, gender, and waist circumference predicted behavioral health outcomes at post-assessment and perceived stress had a negative effect on physical activity. These results suggest that these might be important considerations in predicting who is more likely to make behavior health changes and can be used to inform interventions for improving health behaviors.

APPENDICES

Appendix A Consent Form

Sonia Marrone (sonia.marrone@und.nodak.edu), a doctoral student in psychology, is conducting this study at the University of North Dakota with Dr. Nancy Vogeltanz-Holm (nancy_vogeltanz@und.nodak.edu) who is the Director of the Center for Health Promotion and Prevention Research at the UND Medical School and Dr. Jeff Holm (jeffrey_holm@und.nodak.edu) a professor in the UND Department of Psychology and the Senior Scientist at the Center for Health Promotion and Prevention Research at the UND Medical School

This study will evaluate an intervention aimed at increasing healthy lifestyle behaviors such as healthy eating and physical activity. After you have provided informed consent to participate in the study (by providing your signature at the end of this document), you will be randomly assigned to one of three groups: comprehensive, feedback only, and control (groups described below). First, you will be asked to attend a session where we will measure your height, weight and waist size. You will also be asked to complete a College Personal Behavioral Health Profile (CPBHP) online. The CPBHP asks you a number of questions to assess your health behaviours such as your height and weight, tobacco and alcohol use, physical activity, and your diet/nutrition. Completing the online CPBHP will take approximately 10 minutes. You will receive \$10 after completing the CPBHP. At the end of the semester, you will be contacted to attend another session where your height, weight, and waist size will be measured you will again complete the online CPBHP. After completing the second CPBHP you will receive another \$20.

If you are randomly assigned to either the comprehensive or the feedback only groups you will receive a report that provides feedback about your reported health behaviours as well as recommendations and strategies for achieving and/or maintaining a healthy lifestyle. You will also receive monthly emails containing strategies and recommendations for maintaining healthy lifestyle behaviors.

For those assigned to the comprehensive group, you will also receive phone calls from a health coach twice per month at your convenience. Each call will last approximately 10 to 15 minutes. The number of total health coaching calls you receive will vary between 8 and 12 over the course of this study. The nature of these calls will focus on providing you with support and information about how to improve healthy lifestyle behaviours that you want to change or improve.

Although there are no psychological or physical harm associated with the study, some statements may be of a particularly sensitive nature to some participants. We will be asking questions about your weight, diet/nutrition, and physical activity. If you begin to feel uncomfortable or upset, you are free to stop participating at any time with no penalty. If for any reason you experience emotional discomfort or upset related to this study, please contact Sonia Marrone, Dr. Nancy Vogeltanz-Holm or Dr. Jeffrey Holm immediately. You can also contact the Psychological Services Center, 210 Montgomery

Hall, 777-3691 or University Counseling Center, 2nd Floor McCannel Hall, 777-4189, both of which offer free services to UND students.

We appreciate your taking the time to participate and to learn more about how psychological research is done. No information that might identify you will be given to anyone outside the research team. We will provide you with a copy of this consent form. However, this consent form cannot be matched with your responses on the CPBHP and will be kept separate from the CPBHP in a locked laboratory for a minimum of three years, upon which the consent form and response sheets will be shredded. Only the investigator, (Sonia Marrone), Dr. Nancy Vogeltanz-Holm, Dr. Jeff Holm and people who audit IRB procedures will have access to the data. Although all data will be kept strictly confidential, there are limitations to confidentiality. If you disclose during the course of the study that you intend to harm yourself or others, I must give this information to the proper authorities.

The findings from this study will be used to write a dissertation thesis. The study will add to psychologist's understanding of how to increase healthy lifestyle behaviors and decrease weight gain among university students. Results from this study will also be presented at conferences and in professional journals. The results of this study will be made available to participants by contacting Sonia Marrone, principal investigator, sonia.marrone@und.nodak.edu or at 701-777-0295.

If you have questions about the research, please call Sonia Marrone at 701-777-9885 or Dr. Nancy Vogeltanz-Holm or Dr. Jeff Holm at 701-777-4046. If you have questions regarding your rights as a research subject, or if you have any concerns or complaints about the research, you may contact the University of North Dakota Institutional Review Board at (701) 777-4279. Please call this number if you cannot reach research staff, or you wish to talk with someone else.

By choosing to sign below, I am indicating that I have read this consent form and freely choose to participate.

Participant

Date

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