ABSTRACT

TO SUPERSIZE OR NOT TO SUPERSIZE: A TRANSTHEORETICAL MODEL EXPLORATION OF MULTIPLE HEALTH BEHAVIOR CHANGE

Lauren M. Rosing

Some researchers suggest that multiple health behavior change (MHBC) interventions may be more beneficial than single health behavior change interventions in reducing the mortality rates related to chronic conditions. The present investigation sought to determine if four health behaviors (i.e., exercise, fruit and vegetable intake, high fat food avoidance, and stress management) that are risk factors for chronic conditions were positively related to each other. The researcher explored individuals’ movement through the Transtheoretical Model’s stages of change. The sample consisted of 321 first-year college students from a mid-sized, Midwestern university. Most first-year students did not meet guidelines for all four of these health behaviors. Also, the majority of first-year students’ behaviors remained static over time. MHBC interventions that target exercise, fruit and vegetable intake, high fat food avoidance, and stress management are warranted for first-year college students, and they could reduce people’s risk of developing chronic conditions.
TO SUPERSIZE OR NOT TO SUPERSIZE: A TRANSTHEORETICAL MODEL
EXPLORATION OF MULTIPLE HEALTH BEHAVIOR CHANGE

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Chapter One
To Supersize or Not to Supersize: A Transtheoretical Model
Exploration of Multiple Health Behavior Change

In order to improve people’s health, professionals in the field of health promotion aim to prevent morbidity and mortality within the human population (Zarcadoolas, Pleasant, & Greer, 2006). Experts in health promotion utilize epidemiological research to create programs that focus on helping people reduce their morbidity and mortality risk behaviors (Green & Kreuter, 2005). Current epidemiological research reported by the Centers for Disease Control and Prevention (CDC) list heart disease, cancer, stroke, and diabetes among the ten leading causes of death in the United States for males and females (Heron et al., 2009). Research suggests that these causes are exacerbated by multiple health risk behaviors including improper diet, inadequate amounts of physical activity, and unhealthy amounts of stress (e.g. Haskell et al., 2007; Park, Edmondson, Fenster, & Blank, 2008; Prochaska, 2008; Prochaska, Spring, & Nigg, 2008; Prochaska, Velicer, Nigg, & Prochaska, 2008; USDA & USDHHS, 2005). As a result, some health researchers suggest that multiple health behavior change interventions may be more beneficial than single health behavior change interventions in reducing the mortality rates for the four chronic conditions as well as for reducing health care costs (Clark, Nigg, Greene, Riebe, & Saunders, 2002; Clark et al., 2005; Prochaska, 2008; Prochaska, Spring, et al., 2008; Prochaska, Velicer, et al., 2008). For the purposes of this study, health behaviors are defined as actions, either positive or negative, that affect one’s health, and multiple health behavior change (MHBC) refers to an individual’s attempt to change two or more health behaviors simultaneously (Prochaska, Spring, et al., 2008).

There are two hypotheses that address the potential positive aspects of MHBC. The first view is known as the enhancement hypothesis, and this refers to the belief that a MHBC intervention would result in greater improvements in the target health behaviors compared to improvements that would result from single health behavior change intervention for these behaviors due to an interaction effect (Clark et al., 2002; Clark et al., 2005). The second view is known as the additivity hypothesis, and this refers to the idea that MHBC and single health behavior change lead to similar improvements in the target behavior(s), but MHBC is more beneficial because it provides a “‘two for one’ package” (Clark et al., 2002, p. 553). However,
there is also a theory related to MHBC known as the overburdening hypothesis, which is presented by professionals in the field because they are concerned that MHBC interventions may be overwhelming for individuals (Clark et al., 2002; Clark et al., 2005). The overburdening hypothesis suggests that people will experience greater improvements in their behaviors when they try to change one behavior at a time compared to if they attempt to change more than one behaviors simultaneously (Allegrante, Peterson, Boutin-Foster, Ogedegbe, & Charlson, 2008; Bock, Marcus, Rossi, & Redding, 1998; Clark et al., 2002; Clark et al., 2005; Prochaska, Spring, et al., 2008). This hypothesis suggests that MHBC may be daunting for some or all individuals due to the increased demands placed on people when they focus their attention on changing two or more behaviors instead of one behavior at a time (Allegrante et al., 2008; Bock et al., 1998; Prochaska, Spring, et al., 2008). Moreover, researchers note that the added complexity of changing two or more behaviors may lead to lower adherence rates compared to single health behavior change interventions (Allegrante et al., 2008; Bock et al., 1998; Prochaska, Spring, et al., 2008).

The current study aims to determine if people make multiple positive and negative health behavior changes simultaneously without the presence of a clinical intervention since positive and negative health behaviors co-occur in many people (Park et al., 2008; Patterson, Haines, & Popkin, 1994). In line with those who support the additivity and enhancement hypotheses, the researcher believes that the potential of MHBC needs to be explored because addressing multiple risk behaviors may have greater potential for reducing rates of heart disease, cancer, stroke, and diabetes in the United States (Prochaska, 2008; Prochaska, Spring, et al., 2008; Prochaska, Velicer, et al., 2008). Specifically, the researcher explores the potential for MHBC involving four health behaviors (i.e., exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) because engagement in these behaviors is related to reduced risk of developing or exacerbating chronic conditions that commonly lead to early death in the United States (Haskell et al., 2007; Park, et al., 2008; Prochaska, 2008; Prochaska, Spring, et al., 2008; Prochaska, Velicer, et al., 2008; USDA & USDHHS, 2005). In the following section, MHBC research that involves at least two of these four behaviors will be reviewed, and the ways in which the current study will expand on this research will be noted throughout.
Review of Multiple Health Behavior Change Research

The body of research on MHBC is relatively new, and one of the major focuses is on changing people’s exercise and diet behaviors simultaneously (e.g. Riebe et al., 2003; Riebe, et al., 2005; Wee, Davis, & Phillips, 2005; Clark et al., 2002; Clark et al., 2005; Vandelanotte, Reeves, Brug, & De Bourdeaudhuij, 2008; Prochaska & Sallis, 2004). Healthy weight management and weight loss interventions in adults are two focuses of MHBC research involving both diet and exercise behaviors (Wee et al., 2005; Riebe et al., 2003; Riebe et al., 2005). One study compared adults’ Transtheoretical Model (TTM) stage of change for losing weight with their stage of change to improve diet and their stage of change for engagement in regular exercise to determine if people who were at advanced stages of readiness to lose weight were also ready to engage in behaviors that would help them achieve their weight loss goal (Wee et al., 2005). Wee et al. (2005) found that 38% of those who were in the preparation, action, or maintenance stage for weight loss were also in one of these three stages for exercise and diet. Among overweight and obese adults in their sample, 72% were in the preparation, action, and maintenance stages for weight loss, and 47% of the 72% were also in one of these stages for exercise and diet (Wee et al., 2005). Moreover, Wee et al. (2005) reported that some participants were ready to improve diet and exercise even though they were not ready to lose weight, which suggests that people do desire to change these two behaviors simultaneously. Riebe et al. (2003) and Riebe et al. (2005) presented research results from a study involving healthy weight management that provide support for the MHBC enhancement and additivity hypotheses.

Riebe et al. (2003) and Riebe et al. (2005) reported on a longitudinal study that examined the results of a TTM based healthy weight management MHBC intervention for overweight and obese adults. The intervention included instruction on increasing exercise, reducing fat intake, and increasing fruit and vegetable intake, and the goal was to aid the participants in losing weight by teaching them to engage in a healthier lifestyle (Riebe et al., 2003; Riebe et al., 2005). Riebe et al. (2005) found that those in the action or maintenance phase of the TTM, had increased from 35% to 88% for avoiding dietary fat consumption and 33% to 53% for regular exercise at the end of the six-month clinical program. In addition, Riebe et al. (2003) found significant results at three and six months after the beginning of the clinic-based intervention, which indicated that participants had increased their cardiorespiratory fitness and reduced their
dietary fat intake compared to their baseline reports. The amount of fruits and vegetables the participants reported eating remained static throughout the six-month intervention, but the researchers note that this could be because the majority of participants were already meeting intake recommendations at baseline (Riebe et al., 2003). Riebe et al. (2005) noted that this MHBC intervention for healthy weight management was successful because individuals were able to maintain improvements in weight, BMI, and percent body fat two years after the beginning of the program (Riebe et al., 2005). This research suggests that individuals are not only ready to simultaneously improve their exercise and diet behaviors (Wee et al., 2005), but that they are actually able to make and maintain improvements in these behaviors over time (Riebe et al., 2003; Riebe et al., 2005).

In combination, the findings in these three studies (Riebe et al., 2003; Riebe et al., 2005; Wee et al., 2005) support some of the hypotheses of the current study because they suggest that people who are at advanced TTM stages in terms of readiness to improve their diet are also at advanced TTM stages in terms of readiness to change their exercise behavior (Riebe et al., 2003; Riebe et al., 2005; Wee et al., 2005). Moreover, the research suggests that individuals are able to simultaneously improve their exercise and diet behaviors after participating in a MHBC intervention (Riebe et al., 2003; Riebe et al., 2005). In general, these studies (Riebe et al., 2003; Riebe et al., 2005; Wee et al., 2005) lend more preliminary support for the MHBC enhancement and additivity hypotheses than they do for the overburdening hypothesis. The current study seeks to increase the generalizability of these studies (Riebe et al., 2003; Riebe et al., 2005; Wee et al., 2005) by determining if people ready to change their exercise behavior are also ready to change their diet behavior without considering healthy weight management or weight loss. It is important to explore these two variables without discussion of weight management because it is possible that people’s desire to lose weight affects their desire to change both of these behaviors simultaneously. In order to expand on these studies, the present research examines patterns in first year students’ TTM stage of change distributions for four health behaviors (exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) to ensure that a positive relationship in regard to people’s readiness to change these behaviors exists when examined outside of the context of healthy weight management or weight loss.
There are also MHBC research studies that aim to simultaneously improve the diet and exercise behaviors of older adults (60 years old and over) because they are at greater risk for developing chronic conditions due to the poor practice of these two health behaviors (e.g. Clark et al., 2002; Clark et al., 2005). The study of exercise and nutrition in older Rhode Islanders (SENIOR) is a study being conducted to determine if MHBC interventions are more beneficial than single health behavior change interventions in older adults (Clark et al., 2002; Clark et al., 2005). The SENIOR study consists of three treatment groups (exercise and nutrition combination, exercise only, nutrition only) and one control group (Clark et al., 2002; Clark et al., 2005). Clark et al. (2005) conducted preliminary chi-square analyses on the SENIOR study, which compared the participants’ stage of change for regular exercise with their stage of change for fruit and vegetable consumption. The analyses suggested that those in the action or maintenance stage of change for exercise behavior were more likely to be in the action or maintenance stage of change for fruit and vegetable consumption (Clark et al., 2005). These results provide some support for the MHBC enhancement and additivity hypotheses (Clark et al., 2005). The current researcher expands on the analyses of Clark et al. (2005) by exploring the relationship among the stage of change distributions for four health behaviors (exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) in adults. These analyses are also going to be taken one step further by exploring if people’s progression through the stages of change for each of these behaviors is related to their progression through the stages of change for the other three behaviors.

The investigators of two studies (Prochaska & Sallis, 2004; Vandelanotte et al., 2008) that are similar to the experimental design of the SENIOR study (Clark et al., 2002; Clark et al., 2005) report that simultaneous MHBC is just as successful as sequential MHBC and single health behavior change. Specifically, Prochaska and Sallis (2004) conducted a study in adolescents (M = 12.1 years old, SD = 0.9 years) to assess the effectiveness of a MHBC intervention that targeted physical activity and nutrition behaviors compared to a single health behavior change intervention that targeted physical activity behavior. Boys in both interventions increased their physical activity levels significantly at follow-up compared to the control group, and there was not a significant difference found between the single health behavior change and the MHBC groups (Prochaska & Sallis, 2004). Physical activity participation decreased in girls
for all three groups (Prochaska & Sallis, 2004). Boys’ fruit and vegetable consumption decreased in the MHBC intervention group, but it unexpectedly increased in the single health behavior change group and the control group (Prochaska & Sallis, 2004). Girls’ fruit and vegetable consumption increased in both of the intervention groups, and it decreased in the control group (Prochaska & Sallis, 2004). While the results of Prochaska and Sallis (2004) are inconsistent, they provide some evidence that an intervention focusing solely on improving physical activity can lead to improvements in diet. Vandelanotte et al. (2008) conducted a similar study with adults to determine if a sequential or a simultaneous MHBC intervention is more effective than the other. Two groups changed two behaviors sequentially with one focusing on exercise then fat intake and the other focusing on fat intake then exercise (Vandelanotte et al., 2008). The third intervention group focused on reducing fat intake and increasing physical activity simultaneously (Vandelanotte et al., 2008). Vandelanotte et al. (2008) found no significant differences between interventions based on the participants’ ability to successfully change their behavior, and 33.5% of all participants improved both behaviors successfully. The findings of these two studies are important because the results of Prochaska and Sallis (2004) suggest that MHBC interventions may not provide increased benefit or detriment to the success of behavior change interventions, and Vandelanotte et al. (2008) provide evidence that simultaneous MHBC interventions are as effective as sequential MHBC (Vandelanotte et al., 2008). Prochaska and Sallis (2004) note that further research is needed to determine the potential effectiveness of MHBC interventions because their results are somewhat inconclusive. The current study aims to determine the potential effectiveness of MHBC related to exercise, diet, and stress management in first-year college students because they have more autonomous control over their own health behaviors compared to children who are influenced by their parents.

There is also a body of research that includes an additional target behavior(s) in MHBC interventions that seek to modify exercise and diet behaviors (e.g., Bock et al., 1998; Emmons, Marcus, Linnan, Rossi, & Abrams, 1994; Johnson, Nichols, Sallis, Calfas, & Hovell, 1998; Fitzgibbon, Stolley, Schiffer, Sanchez-Johnsen, Wells, & Dyer, 2005; Rosenberg, Norman, Sallis, Calfas, & Patrick, 2007; Sanchez et al., 2007; Sanchez et al., 2008; Stolley, Sharp, Wells, Simon, & Schiffer, 2006; Allegrante et al., 2008; Sher, Bellg, Braun, Domas, Rosenson, &
Canar, 2002). For example, two studies explore the relationship among diet, physical activity, and sedentary behavior (Sanchez et al., 2007; Sanchez et al., 2008). Sanchez et al. (2007) conducted a study to determine how four health behaviors (physical activity, fruit and vegetable consumption, dietary fat intake, and watching television) co-occur in adolescents between 11 and 15 years old. Then, Sanchez et al. (2008) conducted a similar study with overweight women between 18 and 55 years old. However, Sanchez et al. (2008) defined sedentary behavior as being inactive for 8 or more hours per day rather than time spent watching television. Sanchez et al. (2007) found that only 1.9% of adolescents in their sample engaged in all four positive forms of the target health behaviors, and Sanchez et al. (2008) found that only 2.3% of the women in their sample engaged in all four positive health behaviors. In addition, the majority of the adolescent participants (84.2%) were engaging in two or more health risk behaviors, and 12.5% of the sample was at risk for all four behaviors (Sanchez et al., 2007). Sanchez et al. (2008) found that 32.9% of their sample was engaging in all four health risk behaviors, 32.6% of their sample was engaging in three health risk behaviors, and 24.3% of their sample was engaging in two health risk behaviors. In the adolescent sample, the most common combination of three health risk behaviors included physical activity, dietary fat intake, and fruit and vegetable consumption (Sanchez et al., 2007). This was the most common cluster of health risk behaviors in girls with 25.3% of the sample not meeting the recommended guidelines, and it was the second most frequent combination in boys (Sanchez et al., 2007). Finally, Sanchez et al. (2008) found that 50.7% of their sample of women was at risk for physical activity, dietary fat intake, and fruit and vegetable consumption, which suggests that these three behaviors often co-occur in adults as well. These results suggest that adolescents and adult overweight women typically engage in more than one health risk behavior simultaneously, and that there is frequently a positive relationship among their physical activity, fruit and vegetable consumption, and dietary fat intake health risk behaviors. The current researcher expands on this research by determining if a similar relationship among physical activity, fruit and vegetable consumption, and dietary fat intake exists in young adults who are not necessarily overweight. Moreover, she will utilize stress management as a fourth variable rather than sedentary behavior because stress management along with the three previously mentioned behaviors may affect people’s development of chronic conditions later in life.
There are also two studies that examine the relationship among physical activity, diet, and smoking (Bock et al., 1998; Emmons et al., 1994). Bock et al. (1998) explored the relationship between readiness to adopt moderate physical activity and readiness to stop smoking as well as readiness to adopt moderate physical activity and readiness to change dietary behavior in sedentary adults. A similar study was conducted by Emmons et al. (1994), which compared adults readiness to increase physical activity, reduce fat intake, and stop smoking based on their TTM stage of change. Bock et al. (2008) found that adults’ who wanted to reduce dietary fat consumption were more likely to be ready to become physically active, and participants who were in the precontemplation stage for physical activity (i.e. not thinking about becoming active) were also less motivated to reduce the amount of high fat food in their diet. Two results from Emmons et al. (1994) also provide evidence that there is a relationship between engagement in physical activity and avoidance of high fat foods. First, in this study, almost 50% of the participants were in the action or maintenance stages for exercise, and over 60% of the participants’ were in the action or maintenance stages for fat intake reduction (Emmons et al., 1994). Additionally, Emmons et al. (1994) found that readiness to change dietary fat intake was positively related to the time participants spent exercising each week, and those with lower dietary fat consumption were more likely to be physically active and not smoke. Bock et al. (1998) did not find a relationship between readiness to become physically active and readiness to quit smoking in this study, but smokers were less likely to avoid high fat food and ate fewer fruits and vegetables compared to nonsmokers. However, those individuals who were in the contemplation and preparation stages for physical activity ate more fruits and vegetables compared to those in the precontemplation stage (Bock et al., 1998). Moreover, those who ate more fruits and vegetables reported that they regularly avoided eating high fat foods (Bock et al., 1998). These results are important because they suggest that the two diet behaviors (fruit and vegetable intake and high fat food consumption) focused on in the current study are related to each other and to exercise (Bock et al., 1998; Emmons et al., 1994). The fact that participants with one risk factor were more likely to have at least one other risk factor provides further evidence for the need to create programs that include information about multiple behaviors that are a part of a healthy lifestyle (Emmons et al., 1994). While the results of these studies (Bock et al., 1998; Emmons et al., 1994) suggest that people are ready to change their diet and exercise...
behaviors simultaneously, Bock et al. (1998) note that there is still concern that MHBC interventions may be overwhelming for individuals. The current study attempts to provide support for the benefits of MHBC interventions by extending the research of Bock et al. (1998) and Emmons et al. (1994) through exploration of the patterns among four health behaviors (i.e., exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) of first-year college students.

A reduction in breast cancer risk factors is another focus of MHBC studies involving three health behaviors (Fitzgibbon et al., 2005; Stolley et al., 2006). Specifically, two MHBC studies targeted exercise, diet, and breast health behaviors in African American women (Fitzgibbon et al., 2005; Stolley et al., 2006). Fitzgibbon et al. (2005) conducted a pilot study with two cohorts of African American women to examine the effects of an intervention that addressed the three health behaviors. Cohort 1 spent equal time on breast health and weight loss strategies, while cohort 2 focused on weight loss most of the time (80%) and breast health 20% of the time per recommendation by cohort 1 (Fitzgibbon et al., 2005). Stolley et al. (2006) explored changes in the health behaviors of African American breast-cancer survivors in a mixed methods pilot study, which resulted in findings similar to Fitzgibbon et al. (2005). The first focus group discussed diet and exercise behaviors, and the second focus group discussed health behaviors and breast cancer (Stolley et al., 2006). In cohort 1, there was not a significant difference between weight changes or BMI changes in the intervention and control group, but the intervention group significantly reduced their weight and BMI compared to the control group in cohort 2 (Fitzgibbon et al., 2005). In cohort 1, there was no difference between physical activity behavior and dietary fat intake between the intervention and control groups, and in cohort 2, the intervention group did not differ significantly in their intake of dietary fat compared to the control group (Fitzgibbon et al., 2005). In contrast to most of these results, Stolley et al. (2006) noted that most of the participants changed some behaviors after their diagnosis, and common changes were increasing fruit and vegetable intake, decreasing fat consumption, and increased exercise in women with higher incomes or education levels. The participants also reported that negative emotions were related to poor diet choices (Stolley et al., 2006), which suggests that there may be a relationship between stress management and positive dietary behaviors. In addition, it suggests that information on stress management may provide a missing link that
would lead to greater success in MHBC interventions that target diet and exercise. Moreover, the fact that women reported that they were motivated to change their behaviors to prevent recurrence of cancer and/or to reduce the risk of other chronic conditions (e.g., diabetes, hypertension, and high cholesterol; Stolley et al., 2006) could provide another reason for the seemingly contradictory results in these two studies (Fitzgibbon et al., 2005; Stolley et al., 2006). The participants sampled by Fitzgibbon et al. (2005) were not cancer survivors, so it is possible that the lived experience of breast cancer survivors is what leads to multiple positive changes in their health behaviors (Stolley et al., 2006). However, the results of these two studies (Fitzgibbon et al., 2005; Stolley et al., 2006) were not completely inconsistent. In cohort 2, those in the intervention group worked out more frequently, for a longer duration, and at a higher intensity compared to the control group (Fitzgibbon et al., 2005), which supports the finding of Stolley et al. (2006) who found that breast cancer survivors did tend to increase exercise after diagnosis and treatment. Still, the current researcher believes it is important to explore the potential for a certain lived experience to be causing the relationship among diet and exercise behaviors because MHBC research typically includes people with a chronic condition (Stolley et al., 2006; Sher et al., 2002; Allegrante et al., 2008; Park et al., 2008). The current researcher aims to provide quantifiable evidence for a relationship among diet and exercise behaviors in young adults who are unlikely to have already developed heart disease, cancer, diabetes, or stroke.

Some studies also suggest that a positive relationship exists among diet, exercise, and stress management behaviors in people with a chronic health condition (Hanson & Pichert, 1986; Park et al., 2008; Fahrenwald & Walker, 2003; Riley, Lewis, Lewis, & Fava, 2008; Daubenmier et al., 2007; Govil, Weidner, Merritt-Worden, & Ornish, 2009; Koertge et al., 2003; Pischke, Scherwitz, Weidner, & Ornish, 2008; Pischke et al., 2006). Specifically, Park et al. (2008) conducted research to examine positive and negative health behavior changes made by 250 cancer survivors. In this study, participants were asked how their experience with cancer had changed their diet, exercise, stress management, and sleep behaviors (Park et al., 2008). The results indicated that positive and negative health behavior changes clustered together (Park et al., 2008). In other words, Park et al. (2008) found that cancer survivors’ changed certain health behaviors (exercise, diet, sleep, and stress management) in the same direction over time. Diet
was the most frequent behavior to be positively changed by the cancer survivors, and sleep behaviors most frequently changed in the negative direction (Park et al., 2008). Hanson and Pichert (1986) provide support for a relationship among three of these behaviors (exercise, diet, and stress management) in diabetic adolescents as well. Specifically, they found that cumulative stress and positive cumulative stress were related to increased amounts of exercise in girls, and negative cumulative stress in boys was related to decreased amounts of exercise (Hanson & Pichert, 1986). Second, they established that cumulative negative stress and number of negative stressors perceived by the adolescents was related to lower calorie consumption than their recommended levels (Hanson & Pichert, 1986). These results suggest that that negative stressors may be related to negative dietary behaviors, while positive stressors may be beneficial for girls’ level of engagement in physical activity (Hanson & Pichert, 1986). Fahrenwald and Walker (2003) found that women commonly reported that stress management was one of the benefits of engaging in physical activity, which suggests that a positive relationship exists between exercise and stress management behaviors in adults as well. In addition, women infected with HIV reported that they were motivated to engage in healthy behaviors (e.g. physical activity, proper nutrition, and water therapy) because they knew that stress negatively impacted their health (Riley et al., 2008), which also suggests that stress management may be related to engagement in positive exercise and diet behaviors as predicted by the current researcher. Finally, MHBC interventions that simultaneously target exercise, diet, and stress management behaviors have successfully improved coronary heart disease patients’ health behaviors and reduce their cardiovascular risk factors (Daubenmier et al., 2007; Govil et al., 2009; Koertge et al., 2003; Pischke et al., 2008; Pischke et al., 2006).

For example, two studies utilized the Multisite Cardiac Lifestyle Program (MCLIP) to improve heart disease patients’ exercise, diet, and stress management behaviors (Daubenmier et al., 2007; Govil et al., 2009). MCLIP required participants to attend sessions with one hour of exercise, one hour of stress management, one hour of group support, and cooking demonstrations two times per week for three months (Daubenmier et al., 2007; Govil et al., 2009). In addition, participants were encouraged to eat less than ten percent of their calories from fat, and it was recommended that they exercise for three hours per week. In both studies, participants were able to increase exercise, increase stress management, and reduce their dietary fat intake as a result of
their participation in MCLIP (Daubenmier et al., 2007; Govil et al., 2009). Moreover, the results of Daubenmier et al. (2007) suggested that changes in each of the target behaviors reduced coronary risk factors individually, additively, and interactively. Specifically, an interaction between increased exercise and decreased dietary fat intake revealed that those who improved the most on these two behaviors were also the most likely to have reductions in their perceived stress (Daubenmier et al., 2007). Govil et al. (2009) also noted that participants’ improvements in exercise, diet, and stress management led to reductions in their cardiovascular risk factors. Finally, Govil et al. (2009) suggested that participants from low socioeconomic backgrounds experienced similar improvements compared to those of higher socioeconomic status after participation in MCLIP.

The Multicenter Lifestyle Demonstration Project (MLDP) is a MHBC intervention that targets exercise, diet, and stress management behaviors in patients with coronary heart disease similar to the MCLIP. Specifically, the MLDP began with lectures and demonstrations that lasted twelve hours total over the course of a few days (Koertge et al., 2003; Pischke et al., 2006). After these sessions, the participants were required to attend three one-hour sessions per week, and one of the sessions was dedicated to engagement in aerobic activity (Koertge et al., 2003; Pischke et al., 2006). Finally, participants in the MLDP were encouraged to exercise three hours per week, manage stress for one hour per day, and eat only ten percent of their total calorie intake from fat (Koertge et al., 2003; Pischke et al., 2006). Koertge et al. (2003) reported that participants saw positive reductions in a variety of health indicators (e.g. blood pressure, cholesterol, resting heart rate, and weight) and an increase in exercise capacity three months after the intervention, and these changes were maintained twelve months after the baseline measurements. Pischke et al. (2006) also noted that participants significantly reduced their body fat and weight, lowered their heart rate and cholesterol, and increased their energy expenditure three months and one year after the beginning of the intervention. In addition, participants met the guideline for dietary fat intake at three and twelve months (Koertge et al., 2003), and all participants met the MLDP guidelines for diet (Pischke et al., 2006). Finally, Pischke et al. (2006) noted that participants with diabetes made similar improvements to those without diabetes, and all participants improved their exercise, diet, and stress management behaviors.
The results of the previously reviewed studies (Daubenmier et al., 2007; Govil et al., 2009; Koertge et al., 2003; Pischke et al., 2006) suggest that secondary prevention MHBC interventions that target exercise, dietary fat intake, and stress management can produce significant improvements in participants’ behaviors and reductions in their coronary risk factors. The present researcher wishes to explore the potential for similar MHBC interventions to be successful in young adults as primary prevention for chronic conditions (e.g. heart disease, cancer, stroke, and diabetes). This research is important because unhealthy exercise, diet, and stress management behaviors seem to begin in young adulthood (Bray & Born, 2004; Gyurcsik Spink, Bray, Chad, & Kwan, 2006; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008; Hudd et al., 2000; Serlachius, Hamer, & Wardle, 2007). Specifically, this study will determine the most common patterns in young adults’ exercise, fruit and vegetable consumption, high fat food avoidance, and stress management behaviors, and it will determine if young adults change these four behaviors in the same direction over time.

The Exercise, Diet, and Stress Management Behaviors of First-Year College Students

As mentioned in the previous section, the present researcher believes MHBC interventions similar to MCLIP and MLDP that target exercise, diet, and stress management may be beneficial for improving young adults health behaviors. Moreover, she believes that first-year college students are a subset of the young adult population that could benefit from MHBC interventions based on previous research about how the transition to college negatively affects health behaviors (e.g., Bray & Born, 2004; Gyurcsik et al., 2006; Racette et al., 2005; Racette et al., 2008; Hudd et al., 2000; Serlachius et al., 2007). Specifically, Bray & Born (2004) report a significant decline in first-year students’ average frequency of vigorous physical activity from their last two months of high school to their first two months of college (Bray & Born, 2004). Furthermore, the majority (66.2%) of participants were considered active based on guidelines for physical activity during their last eight weeks of high school, but only 44.1% of students were considered active during their first eight weeks of college (Bray & Born, 2004). The results of Gyurcsik et al. (2006) suggest that many first-year students may not be engaging in recommended amounts of physical activity due to the fact that they reported a significantly greater amount of barriers compared to high school students. Some of the common barriers
listed by the first-year college students were being invited to go out with friends, being busy with homework, having a job, and not being able to be active due to cold weather. The studies conducted by Bray and Born (2004) and Gyurcsik et al. (2006) suggest that the transition to college can have negative effects on college students’ level of physical activity. The current researcher would like to expand on the results of these studies (Bray & Born, 2004; Gyurcsik et al., 2006) by determining if the health behaviors of first-year college students were impacted during their first semester of college.

The results of Racette et al. (2005) and Racette et al. (2008) suggested that first-year college students’ may not be engaging in healthy diet behaviors or enough physical activity. Specifically, Racette et al. (2008) noted that 71% of college students were not meeting the recommendation to eat 5 or more servings of fruits and vegetables daily at the beginning of freshman year and the end of their senior year. Additionally, Racette et al. (2005) found a negative relationship between fruit and vegetable consumption and intake of fried food as well as high-fat fast food in first-year students. Also, Racette et al. (2005) reported that there was no marked change in fruit and vegetable consumption or high-fat fast food intake at the end of students’ second year of college, and there was a decrease in aerobic physical activity participation. Finally, Racette et al. (2008) found that 29% of students did not engage in regular exercise at the beginning of their freshman year, and that 25% of students were still not engaging in regular exercise at the end of their senior year. In combination, the results of Racette et al. (2005) and Racette et al. (2008) implied that first-year students were engaging in unhealthy exercise and diet behaviors, and that their behaviors remained fairly static or deteriorate over time.

According to studies conducted by Hudd et al. (2000) and Serlachius et al. (2007), stress levels may affect college students’ engagement in healthy exercise and diet behaviors. Hudd et al. (2000) noted that college students with higher stress levels reported eating junk food and drinking soda in the last 24 hours more frequently than students with lower stress levels. Additionally, students who reported being stressed were less likely to eat fruits and vegetables (Hudd et al., 2000). Moreover, Serlachius et al. (2007) reported that students who lost or gained a significant amount of weight over the course of their first year in college also reported a higher frequency and severity in their stress symptoms, and that the majority of students gained weight
during this time. In other words, students with high levels of stress were making unhealthy food choices more frequently than less stressed participants. Finally, Serlachius et al. (2007) found that first-year students reported exercising less compared to before they came to college, and the results of Hudd et al. (2000) suggest that non-stressed students are more likely to exercise regularly compared to students who are experiencing stress. These results are in line with the hypotheses of the current study because they suggest that college students who are not managing their stress are more likely to engage in unhealthy diet and exercise behaviors. The present researcher would like to expand on this research by exploring the relationship and changes in the relationship among first-year students’ exercise, fruit and vegetable consumption, high fat food avoidance, and stress management behaviors during the college transition. This research will be integral in determining if MHBC interventions would be beneficial for improving first-year college students health behaviors. If MHBC interventions are warranted, then they could be implemented to help reduce college students’ risk of developing heart disease, cancer, stroke, and diabetes later in life.

The Transtheoretical Model and Multiple Health Behavior Change

The transtheoretical model (TTM) is a theory about behavior change, which is often used by health professionals as the basis for interventions that aid people in the modification of problem health behaviors or the acquisition of positive health behaviors (Prochaska, DiClemente, & Norcross, 1992; Prochaska et al., 1994; Prochaska et al., 2005; Riebe et al., 2003; Riebe et al., 2005). The TTM focuses on the individuals’ intentions to change their health behaviors over time, and the process they go through to change their behaviors (Prochaska et al., 1992; Prochaska et al., 1994). The process that individuals go through in order to change their behavior is marked by five phases (precontemplation, contemplation, preparation, action, and maintenance) also known as the stages of change (Prochaska et al., 1992). These five stages of change for health behaviors are the main construct of the TTM, and all other constructs related to the TTM are organized around the stages of change (Prochaska et al., 1992). According to the TTM, individuals can maintain, progress, or regress through the stages of change for a health behavior over time (Armitage, Sheeran, Conner, & Arden, 2004).

People’s maintenance of stage or movement through the stages of change are based on their level of awareness about their need to change a negative behavior and/or their current
ability to engage in a positive health behavior (Prochaska et al., 1992; Prochaska et al., 1994). Individuals in the precontemplation stage for a given health behavior are not thinking about changing that behavior in the near future, which is designated as within the next six months by the TTM. People in the contemplation stage for a given behavior are aware of the need to change this behavior, and they intend to do so in the near future, which is again denoted as within the next six months. The preparation stage for a given behavior is marked by people’s desire to change this behavior in the immediate future, which means within the next 30 days according to the TTM. Individuals in the action stage have actually made changes regarding a given behavior within the last six months, and they are working towards maintenance of this positive behavior. Finally, people reach the maintenance stage when they have engaged in a given health behavior for more than six months, and people in this stage of change work to prevent relapse to an earlier stage (Prochaska et al., 1992; Prochaska et al., 1994).

The goal of this study is to determine if first-year students progress through the TTM stages of change for four health behaviors (exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) in the same direction over time. This method for exploring the potential of MHBC interventions to benefit rather than overwhelm participants was chosen based on other researchers’ insights about the potential advantages of utilizing TTM stage based interventions for each behavior within a MHBC intervention (Bock et al., 1998; Prochaska, Spring, et al., 2008; Clark et al., 2002; Clark et al., 2005). Specifically, Bock et al. (1998) suggest that models that account for people’s readiness to change (e.g. the TTM) may be instrumental in MHBC interventions because people would receive information based on their motivation to change each behavior. In other words, the model’s ability to tailor information for each behavior would be beneficial because it does not assume that people have equal motivation to change all of their behaviors during the intervention (Bock et al., 1998). Moreover, Prochaska, Spring, et al. (2008) propose that MHBC interventions that are tailored to people’s TTM stage of change may result in increased adherence and change by individuals. Therefore, the design of the current study is particularly appropriate for determining if MHBC interventions are overwhelming for participants because the results may also lend support for claims made by these other researchers (Bock et al., 1998; Prochaska, Spring, et al., 2008) about MHBC.
Operational Definitions of Exercise and Diet Behaviors

Exercise is any form of physical activity that people plan to engage in during their spare time in order to improve or maintain health (CDC, 2008). The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) recommend that all adults between 18-65 years of age engage in weekly aerobic activity and muscle-strengthening activity to maintain a healthy lifestyle (Haskell et al., 2007). Specifically, the ACSM and the AHA suggest that adults need “moderate intensity aerobic physical activity for a minimum of 30 minutes on five days each week or vigorous-intensity aerobic activity for a minimum of 20 minutes on three days each week,” which can be accumulated in no smaller than 10-minute intervals throughout the day (Haskell et al., 2007 p. 1425). The United States Department of Agriculture (USDA) and the United States Department of Health and Human Services (USDHHS; USDA & USDHHS, 2005) recommends that adults engage in a minimum of 30 minutes of moderate-intensity activity on most days of the week to reduce their risk of developing chronic conditions. The ACSM and the AHA define moderate-intensity activity as any movement that leads to marked elevation of an individual’s heart rate, while activity of vigorous-intensity refers to any form of movement that results in “rapid breathing and substantial increase in heart rate” (Haskell et al., 2007 p. 1426). Based on current recommendations (Haskell et al., 2007; USDA & USDHHS, 2005) and previous health behavior research, regular exercise is defined in this study as “any planned physical activity (e.g. brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed three or more times per week for 20 or more minutes per session at a level that increases your breathing rate and causes you to break a sweat” (Marcus, Selby, Niaura, & Rossi, 1992).

In order to eat a healthy and well-balanced diet, the USDA and USDHHS (2005) recommend people consume whole grains, fruits, vegetables, and milk or milk products daily, and they also suggest that people avoid consumption of saturated fats and oils. The consumption of fruits and vegetables is one way a healthy diet is measured in this study because eating from these two food groups can help reduce the risk of cardiovascular diseases, type 2 diabetes, and certain types of cancer (USDA & USDHHS, 2005). Moreover, research about health behavior change related to people’s diet uses consumption of fruit and vegetables as a measure of an
improved or maintained healthy diet (Clark et al., 2002; Clark et al., 2005; Laforge, Greene, & Prochaska, 1994). The USDA and the USDHHS (2005) recommend that people eat 2 cups of fruits and 2.5 cups of vegetables a day based on a 2,000 calorie diet, with greater or lesser amounts depending on the person’s daily calorie intake. The USDA (2008a; 2008b) guidelines also suggest that women and men between the ages of 19-30 years old eat 2 cups of fruits and 2.5 to 3 cups of vegetables every day. In accordance with these guidelines (USDA, 2008a; USDA, 2008b; USDA & USDHHS, 2005), the current study will define healthy intake of fruits and vegetables as eating five or more servings daily. This study will also measure a healthy diet by an avoidance of high fat foods because the USDA and the USDHHS (2005) recommend that people “limit intake of fats and oils high in saturated and/or trans fatty acids, and choose products low in such fats and oils,” (p. 30). Moreover, a diet high in saturated fats and/or trans fats can lead to heart disease and high levels of low-density lipoprotein cholesterol (USDA & USDHHS, 2005), and research on health behavior change related to diet often utilizes avoidance of high fat foods as a measure of a healthy diet (Armitage et al., 2004; Greene & Rossi, 1998; Prochaska et al., 2005; Riebe et al., 2003). Therefore, this study included fruit and vegetable consumption and avoidance of high fat foods because these behaviors can reduce one’s risk of developing chronic conditions.

**Hypotheses**

The current study will explore three different hypotheses related to MHBC research for exercise, high fat food avoidance, fruit and vegetable consumption, and stress management behaviors based on quantitative data from a larger health behavior study.

**Hypothesis 1: Most first-year college students will not engage in all of the four health behaviors.**

The researcher predicts that most first-year college students will not be in an action stage for all of the target health behaviors (exercise, high fat food avoidance, fruit and vegetable consumption, and stress management) at Time 1 or Time 2.

**Hypothesis 2: Patterns will exist in first-year college students’ engagement in the four health behaviors at Time 1 and Time 2.**

Most first-year college students will be in pre-action stages for at least two of the four health behaviors at Time 1 and Time 2. First-year students who are in pre-action stages for
certain health behaviors will be more likely to be in pre-action stages for other health behaviors. First-year students who are in pre-action stages for certain health behaviors will be more likely to be in pre-action stages for other health behaviors.

**Hypothesis 3: Patterns will exist in first-year college students’ movement through the stages of change for the four health behaviors from Time 1 to Time 2.**

Most first-year students will remain static in their stage of change for all four behaviors from Time 1 to Time 2. In addition, first-year students who move to a different stage of change for one behavior will move to a different stage of change for at least one other behavior, and a positive relationship will exist among first-year students changes in stage for these behaviors. In other words, participants who progress to later stages of change for one health behavior will progress to later stages of change for one or more other health behaviors, and participants who regress to later stages of change for one health behavior will regress to later stages of change for one or more health behaviors.

**Method**

**Participants**

The present study was based on data from 321 first-year college student participants. At the time of assessment, the participants were between 17 – 23 years old ($M = 18.06, SD = 0.44$). The sample consisted of 94 males (29.3%) and 227 females (70.7%). In addition, the sample included 1 native Hawaiian or other Pacific Islander (0.3%), 3 American Indian or Alaska Native (0.9%), 4 Black, African-American, or Haitian (1.2%), 9 Hispanic or Latino (Latina; 2.8%), 17 Asian or Asian American (5.3%), and 292 White (Caucasian; 91.0%). Finally, the majority of the sample (92.4%) reported that they were not married when they participated in the study.

**Procedure**

The current study was a part of a larger longitudinal study that assessed over twenty different health behaviors. The study consisted of two time points that occurred approximately fifteen weeks apart. The first data collection session occurred on the first day of the fall semester (Time 1), and the second data collection session was held the week before finals of the same semester (Time 2). Participants signed up for the longitudinal study via experimetrix.com, which is an online recruitment tool for research study participants. The participants chose the experiment from a list of several research studies on the experimetrix.com website. The data
collection sessions for Time 1 and Time 2 were held in a large lecture hall (with more than 400 seats) in an academic building on a mid-sized, Midwestern university campus.

At the beginning of both sessions, participants were greeted and read an explanation of the study by a research assistant. Next, the students were asked to read and complete an informed consent form. The participants were each given a questionnaire to complete once they gave consent to partake in the study. Seven versions of the survey were available, and the primary instruments were ordered using a Latin square design. It took participants approximately 30 to 60 minutes to complete the questionnaire. After returning their completed surveys to the research assistant, participants were verbally debriefed and given a printed debrief sheet for their future reference. Participants received one research experience credit for their introduction to psychology class per time point as compensation for taking part in each of the two sessions. The primary investigator’s institutional review board approved this procedure in advance.

Measures

The measures for the present study consisted of demographic questions concerning one’s age, gender, racial and ethnic background, and relationship status to form a basis for comparison within the subject sample, and to determine the generalizability of this study’s results. In addition, four staging algorithms were utilized at both time points to examine and compare first-year students’ intentions to engage in the four target behaviors. The staging algorithms for exercise, fruit and vegetable consumption, high fat food avoidance, and stress management were chosen to determine participants’ stage of change for each behavior at both time points because of the prevalence of their use within the field of health promotion (e.g., Armitage et al., 2004; Clark et al., 2005; Riebe et al., 2003).

Exercise Stage of Change (Marcus et al., 1992). The participants’ stage of change for exercise was determined for both time points by their responses to a measure created by Marcus et al. (1992). In accordance with the measure, regular exercise was operationally defined in the survey as “any planned physical activity (e.g. brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed three or more times per week for 20 or more minutes per session at a level that increases your breathing rate and causes you to break a sweat.” Then, participants were asked,
“Do you exercise regularly according to the definition above?” Response options to this question were as follows: (1) “Yes, I have been for more than 6 months,” (2) “Yes, I have been, but for less than 6 months,) (3) “No, but I intend to in the next 30 days,” (4) “No, but I intend to in the next 6 months,” (5) “No, and I do not intend to in the next 6 months.” The answer choices corresponded with the following stages of change: (1) = maintenance, (2) = action, (3) = preparation, (4) = contemplation, (5) = precontemplation. This measure was chosen to determine each participant’s stage of change for exercise at both time points because of the prevalence of its use within the field of health promotion (e.g., Clark et al., 2002; Driskell, Dyment, Mauriello, Castle, & Sherman, 2008; Marcus et al., 1992; Riebe et al., 2003; Prochaska et al., 1994).

**Fruit and Vegetable Consumption Stage of Change** (Laforge et al., 1994). The participants’ stage of change for fruit and vegetable consumption was determined at both time points by a three-part measure utilized by Laforge et al. (1994). First, the measure posed the question, “How many servings of fruits and vegetables do you usually eat each day? Response options for this question were as follows: “zero,” “one to two,” “three to four,” “five,” and “six or more.” Next participants were asked, “Have you been eating 5 or more servings of fruits and vegetables a day for more than six months?” Response options to this question were as follows: (1) “less than 6 months” or (2) “more than 6 months.” Finally, participants were asked, “Do you intend to start eating 5 or more servings of fruits and vegetables a day in the next six months?” Response options to this question were as follows: (3) “No, and I do not intend to in the next 6 months,” (4) “Yes, I intend to in the next 6 months,” (5) “Yes, I intend to in the next 30 days.” The answer choices to the second two questions of the measure correspond with the following stages of change: (1) = action, (2) = maintenance, (3) = precontemplation, (4) = contemplation, (5) = preparation. This measure determined each participant’s stage of change for fruit and vegetable consumption at both time points because of the prevalence of its use by people in the field of health promotion (e.g., Clark et al., 2002; Clark et al., 2005; Driskell et al., 2008; Prochaska et al., 2005; Riebe et al., 2005; Laforge et al., 1994).

**High Fat Food Avoidance Stage of Change** (Greene & Rossi, 1998). The participants’ stage of change for high fat food avoidance was determined at both time points by their responses to a measure created by Greene and Rossi (1998). The measure posed the question, “Do you consistently avoid eating high-fat foods?” Response options to this question were as
follows: “(1) No, and I do not intend to in the next 6 months,” “(2) No, but I intend to in the next 6 months, “(3) No, but I intend to in the next 30 days,” “(4) Yes, and I have been, but for less than 6 months,” “(5) Yes, and I have been for more than 6 months.” The answer choices correspond with the following stages of change: (1) = precontemplation, (2) = contemplation, (3) = preparation, (4) = action, (5) = maintenance. This measure was chosen to determine each participant’s stage of change for high fat food avoidance at both time points because of the prevalence of its use within the health promotion field (e.g., Armitage et al., 2004; Greene & Rossi, 1998; Prochaska et al., 2005; Riebe et al., 2003).

**Stress Management Stage of Change** (Velicer, Prochaska, Fava, Norman, & Redding, 1998). The participants’ stage of change for stress management was determined at both time points with a measure created by Velicer et al. (1998). The measure posed the question, “Do you regularly manage your stress?” Response options to this question were as follows: (1) “No, and I do not intend to in the next 6 months,” (2) “No, but I intend to in the next 6 months, (3) “No, but I intend to in the next 30 days,” (4) “Yes, and I have been, but for less than 6 months,” (5) “Yes, and I have been for more than 6 months.” The answer choices correspond with the following stages of change: (1) = precontemplation, (2) = contemplation, (3) = preparation, (4) = action, (5) = maintenance. This measure determined each participant’s stage of change for stress management at both time points because of its previous use by people in the field of health promotion (e.g., Evers, Prochaska, Johnson, Mauriello, Padula, Prochaska, 2006; Velicer et al., 1998).

**Proposed Analysis**

The purpose of the current study is to determine the relationships among first-year students’ readiness to change four health behaviors based on their TTM stage of change at two time points. In addition, the researcher will present statistical analyses to determine if first-year students’ exercise, fruit and vegetable consumption, high fat food avoidance, and stress management behaviors change in the same direction over time. The researcher believes that the results of these analyses will provide evidence that first-year students’ are in a similar state of readiness to change these behaviors, which will provide support for the MHBC additivity hypothesis (Clark et al., 2002; Clark et al., 2005). Moreover, she thinks that the results will support the development of multiple health behavior change interventions that target these four
health behaviors in first-year college students in order to reduce their risk of developing chronic conditions later in life. The three hypotheses of the present study and how they will be analyzed are described in more detail in the following paragraphs.

**Hypothesis 1: Most first-year college students will not engage in each of the four health behaviors.**

For hypothesis one, the variables are exercise stage of change (Marcus et al., 1992), fruit and vegetable consumption stage of change (Laforge et al., 1998), high fat food avoidance stage of change (Greene & Rossi, 1998), and stress management stage of change (Velicer et al., 1998). In order to establish the percent of participants in each stage of change for the four target health behaviors, frequency statistics were conducted at Time 1 and Time 2. In addition, frequency statistics were conducted at Time 1 and Time 2 to determine the percent of participants in pre-action stages versus action stages. The results from these frequency statistics will determine the percentages of first-year students engaging in (i.e., in an action stage for) each behavior (i.e., exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) at both time points.

**Hypothesis 2: Patterns will exist in first-year college students’ engagement in the four health behaviors at Time 1 and Time 2.**

For hypothesis two, the variables are exercise stage of change (Marcus et al., 1992), fruit and vegetable consumption stage of change (Laforge et al., 1998), high fat food avoidance stage of change (Greene & Rossi, 1998), and stress management stage of change (Velicer et al., 1998). Independent chi-square tests will be conducted because the variables are categorical. Specifically, two independent chi-square analyses will be conducted to determine which behaviors first-year students are and are not engaging in simultaneously at Time 1 and Time 2. These analyses will determine the percentage of first-year students engaging or not engaging in combinations of the four health behaviors concurrently and if engagement in certain combinations of these four health behaviors is more common than others. For example, one pattern may be for students to be meeting guidelines for exercise and stress management, but they are not eating enough fruits and vegetables or avoiding foods high in fat.

**Hypothesis 3: Patterns will exist in first-year college students’ movement through the stages of change for the four health behaviors from Time 1 to Time 2.**
For hypothesis three, the variables are exercise stage of change (Marcus et al., 1992), fruit and vegetable consumption stage of change (Laforge et al., 1998), high fat food avoidance stage of change (Greene & Rossi, 1998), and stress management stage of change (Velicer et al., 1998). An independent chi-square test will be conducted because the variables are categorical. This independent chi-square analysis will be conducted to determine if certain behaviors are more likely to change simultaneously over time in positive and/or inverse relationships. The results of this test will determine the percentage of first-year students who engaged in the same combination of behavior changes from Time 1 to Time 2. For example, some students may have progressed to a later stage of change for fruit and vegetable consumption and exercise, while their high fat food avoidance and stress management behaviors remained static over time.
References


Chapter Two  
To Supersize or Not to Supersize: A Transtheoretical Model  
Exploration of Multiple Health Behavior Change  

In order to improve people’s health, professionals in the field of health promotion aim to prevent morbidity and mortality within the human population (Zarcadoolas, Pleasant, & Greer, 2006), and they utilize epidemiological research to create programs that focus on helping people reduce their health risk behaviors (Green & Kreuter, 2005). Centers for Disease Control and Prevention listed heart disease, cancer, stroke, and diabetes among the ten leading causes of death in the United States for males and females (Heron et al., 2009). Research suggests that these causes are exacerbated by multiple health risk behaviors including improper diet, inadequate physical activity, and unhealthy amounts of stress (Govil, Weidner, Merritt-Worden, & Ornish, 2009; Koertge et al., 2003). As a result, some health researchers suggest that multiple health behavior change interventions may be more beneficial than single health behavior change interventions in reducing the mortality rates for the four diseases previously mentioned as well as for reducing health care costs (Clark et al., 2005; Prochaska, 2008; Prochaska, Spring, & Nigg, 2008). In the current study, multiple health behavior change (MHBC) is defined as an individual’s attempt to change two or more health behaviors simultaneously (Prochaska et al., 2008). The current study explored changes in four health behaviors (exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) of first-year college students’ based on their movement through the Transtheoretical Model’s stages of change over the course of their first semester of college.

The Transtheoretical Model and Multiple Health Behavior Change  

The Transtheoretical Model (TTM) is a theory about behavior change, which is often used by health professionals as the basis for interventions that aid people in the modification of problem health behaviors or the acquisition of positive health behaviors (Prochaska, DiClemente, & Norcross, 1992; Prochaska et al., 1994; Prochaska et al., 2005; Riebe et al., 2003; Riebe et al., 2005). The TTM focuses on the individuals’ intentions to change their health behaviors over time, and the process they go through to change their behaviors (Prochaska et al., 1992; Prochaska et al., 1994). The process that individuals go through in order to change their behaviors is marked by five phases (precontemplation, contemplation, preparation, action, and
maintenance) also known as the stages of change (Prochaska et al., 1992). These five stages of change for health behaviors are the main construct of the TTM, and all other constructs related to the TTM are organized around the stages of change (Prochaska et al., 1992). According to the TTM, individuals can maintain, progress, or regress through the stages of change for a health behavior over time (Armitage, Sheeran, Conner, & Arden, 2004).

People’s maintenance of stage or movement through the stages of change are based on their level of awareness about their need to change a negative behavior and/or their current ability to engage in a positive health behavior (Prochaska et al., 1992; Prochaska et al., 1994). Individuals in the precontemplation stage for a given health behavior are not thinking about changing that behavior in the near future, which is designated as within the next six months by the TTM. People in the contemplation stage for a given behavior are aware of the need to change this behavior, and they intend to do so in the near future, which is again denoted as within the next six months. The preparation stage for a given behavior is marked by people’s desire to change this behavior in the immediate future, which means within the next 30 days according to the TTM. Individuals in the action stage have actually made changes regarding a given behavior within the last six months, and they are working towards maintenance of this positive behavior. Finally, people reach the maintenance stage when they have engaged in a given health behavior for more than six months, and people in this stage of change work to prevent relapse to an earlier stage (Prochaska et al., 1992; Prochaska et al., 1994).

The present study aims to determine if first-year students’ movement through the TTM stages of change for four health behaviors (exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) occurs in the same direction over time. This method for exploring the potential of MHBC interventions was chosen based on other researchers’ insights about the advantages of utilizing TTM stage based interventions for each behavior within a MHBC intervention (Bock, Marcus, Rossi, & Redding, 1998; Prochaska et al., 2008; Clark, Nigg, Greene, Riebe, & Saunders, 2002; Clark et al., 2005). Specifically, Bock et al. (1998) suggested that the model’s ability to tailor information for each behavior is beneficial because it does not assume that people have equal motivation to change all of their behaviors during the intervention. Finally, Prochaska et al. (2008) propose that MHBC interventions that tailor to people’s TTM stage of change may result in increased adherence and change by individuals.
Review of Multiple Health Behavior Change Research

Current research suggests that people who engage in one positive or negative health behavior are more likely to engage in other positive and negative behaviors respectively. For example, Wee, Davis, and Phillips (2005) found that participants who were in the preparation, action, or maintenance stages of change for exercise were more likely to be in one of these later stages for diet. In addition, one study found that seniors (60 years and older) in the action or maintenance stage of change for exercise behavior were more likely to be in the action or maintenance stage of change for fruit and vegetable consumption (Clark et al., 2005), and another study found that manufactory workers with lower dietary fat consumption were more likely to be physically active (Emmons, Marcus, Linnan, Rossi, & Abrams, 1994). Similar to these results, Bock et al. (2008) found that individuals who were in the contemplation and preparation stages for physical activity ate more fruits and vegetables compared to those in the precontemplation stage, and participants who were in the precontemplation stage for physical activity were also less motivated to reduce the amount of high fat food in their diet. Moreover, research suggests that adolescents and adult overweight women typically engage in more than one health risk behavior simultaneously, and that there is frequently a positive relationship among their physical activity, fruit and vegetable consumption, and dietary fat intake health risk behaviors (Sanchez et al., 2007; Sanchez et al., 2008). Finally, Park, Edmondson, Fenster, & Blank (2008) found that cancer survivors’ were more likely to change four health behaviors (exercise, diet, sleep, and stress management) in the same direction over time.

Research also suggests that MHBC interventions are successful at improving exercise, fruit and vegetable consumption, high fat food avoidance, and stress management health behaviors. One study found that the number of overweight and obese adults in the action or maintenance stages significantly increased six months after a weight management intervention (Riebe et al., 2005), and another study based on the same sample found that increases in exercise and reductions in dietary fat intake were maintained at three and six months after the intervention (Riebe et al., 2003). Moreover, two studies report that the Multisite Cardiac Lifestyle Program (MCLIP) was able to improve heart disease patients’ exercise, diet, and stress management behaviors (Daubenmier et al., 2007; Govil et al., 2009), and the results of Daubenmier et al. (2007) suggested that changes in each of the target behaviors reduced coronary risk factors.
individually, additively, and interactively. Additionally, two studies suggested that the Mul
ticenter Lifestyle Demonstration Project (MLDP) was able to help coronary heart patients
improve their exercise, diet, and stress management behaviors (Pischke et al., 2006), and there
were positive reductions in their health indicators (e.g. blood pressure, cholesterol, resting heart
rate, and weight) at three and twelve months after the baseline measurements (Koertge et al.,
2003). Finally, Vandelanotte, Reeves, Brug, & De Bourdeaudhuij (2008) found no significant
differences between simultaneous or sequential MHBC interventions for people without medical
conditions that targeted exercise and fat intake, and 33.5% of all participants improved both
behaviors successfully.

**The Exercise, Diet, and Stress Management Behaviors of First-Year College Students**

First-year college students are a subset of the young adult population that could benefit
from MHBC interventions because previous research suggests that many college students’ are
engaging in unhealthy exercise and diet behaviors (Racette, Deusinger, Strube, Highstein, &
Deusinger, 2008). Bray and Born (2004) reported a significant decline in the first-year students’
average frequency of vigorous physical activity from their last two months of high school to their
first two months of college, and that fewer students were considered active based on guidelines
for physical activity after starting college. In addition, over 29% of students did not engage in
regular exercise at the beginning of their freshman year, and 25% of students were still not
engaging in regular exercise at the end of their senior year (Racette et al., 2008). Gyurcsik,
Spink, Bray, Chad, & Kwan, (2006) suggest that many first-year students may not be engaging
in recommended amounts of physical activity due to the fact that they report a significantly
greater amount of barriers compared to high school students. Racette et al. (2008) also noted that
71% of college students were not eating enough fruits and vegetables daily at the beginning of
freshman year and the end of their senior year. Additionally, one study found an inverse
relationship between fruit and vegetable consumption and intake of fried food as well as high-fat
fast food in first-year students, and there was no change in these behaviors at the end of their
second year of college (Racette Deusinger, Strube, Highstein, & Deusinger, 2005). Overall,
these results imply that first-year students are engaging in unhealthy exercise and diet behaviors,
and that their behaviors remain fairly static or deteriorate over time.
According to two studies, stress levels may affect college students’ engagement in healthy exercise and diet behaviors (Hudd et al., 2000; Serlachius, Hamer, & Wardle, 2007). The one study found that college students with higher stress levels reported eating junk food more frequently in the last 24 hours, and students who reported being stressed were less likely to eat fruits and vegetables (Hudd et al., 2000). Moreover, Serlachius et al. (2007) found that first-year students reported exercising less compared to before they came to college, and the results of Hudd et al. (2000) suggest that non-stressed students are more likely to exercise regularly compared to students who are experiencing stress. Finally, Serlachius et al. (2007) reported that students who lost or gained a significant amount of weight over the course of their first year in college also reported a higher frequency and severity in their stress symptoms, and that the majority of students gained weight during this time. This weight gain may be the result of unhealthy exercise and/or diet behaviors (Serlachius et al., 2007). These results are in line with the hypotheses of the current study because they suggest that college students who are not managing their stress are more likely to engage in unhealthy diet and exercise behaviors.

The present researcher would like to expand on this research by exploring the relationship and changes in the relationship among first-year students’ exercise, fruit and vegetable consumption, high fat food avoidance, and stress management behaviors during their first semester of college. This research will be integral in determining if MHBC interventions would be beneficial for improving first-year college students health behaviors. If MHBC interventions are warranted, then they could be implemented to help reduce college students’ risk of developing heart disease, cancer, stroke, and diabetes later in life.

**Hypotheses**

The current study will explore three different hypotheses related to MHBC research for exercise, fruit and vegetable consumption, high fat food avoidance, and stress management behaviors based on quantitative data from a larger health behavior study.

**Hypothesis 1: Most first-year college students will not engage in all of the four health behaviors.**

The researcher predicts that most first-year college students will not be in an action stage for all of the target health behaviors (i.e., exercise, high fat food avoidance, fruit and vegetable consumption, and stress management) at Time 1 or Time 2.
Hypothesis 2: Patterns will exist in first-year college students’ engagement in the four health behaviors at Time 1 and Time 2.

Most first-year college students will be in pre-action stages for at least two of the four health behaviors at Time 1 and Time 2. First-year students who are in pre-action stages for certain health behaviors will be more likely to be in pre-action stages for other health behaviors. First-year students who are in pre-action stages for certain health behaviors will be more likely to be in pre-action stages for other health behaviors.

Hypothesis 3: Patterns will exist in first-year college students’ movement through the stages of change for the four health behaviors from Time 1 to Time 2.

Most first-year students will remain static in their stage of change for all four behaviors from Time 1 to Time 2. In addition, first-year students who move to a different stage of change for one behavior will move to a different stage of change for at least one other behavior, and a positive relationship will exist among first-year students changes in stage for these behaviors. In other words, participants who progress to later stages of change for one health behavior will progress to later stages of change for one or more of the other health behaviors, and participants who regress to later stages of change for one health behavior will regress to later stages of change for one or more of the other health behaviors.

Method

Participants

The present study was based on data from 321 first-year college student participants. At the time of assessment, the participants were between 17 – 23 years old ($M = 18.06$, $SD = 0.44$), and 87.5% of the sample was 18 years old. The sample consisted of 94 males (29.3%) and 227 females (70.7%). In addition, it included 1 native Hawaiian or other Pacific Islander (0.3%), 3 American Indian or Alaska Natives (0.9%), 4 Black, African-American, or Haitians (1.2%), 9 Hispanic or Latinos (Latina; 2.8%), 17 Asian or Asian Americans (5.3%), and 292 White Caucasians (91.0%). The majority of the sample (92.4%) reported that they were not married when they participated in the study. Over 78% of this sample ($n = 253$) was retained across the two time points.
Procedure

The current study was a part of a larger longitudinal study that assessed over twenty different health behaviors. The study consisted of two time points that occurred approximately fifteen weeks apart. The first data collection session occurred on the first day of the fall semester (Time 1), and the second data collection session was held the week before finals of the same semester (Time 2). Participants signed up for the longitudinal study via experimetrix.com, which is an online recruitment tool for research study participants. The participants chose the experiment from a list of several research studies on the experimetrix.com website. The data collection sessions for Time 1 and Time 2 were held in a large lecture hall (with more than 400 seats) in an academic building on a mid-sized, Midwestern university campus.

At the beginning of both sessions, participants were greeted and read an explanation of the study by a research assistant. Next, the students were asked to read and complete an informed consent form. The participants were each given a questionnaire to complete once they gave consent to partake in the study. Seven versions of the survey were available, and the primary instruments were ordered using a Latin square design. It took participants approximately 30 to 60 minutes to complete the questionnaire. After returning their completed surveys to the research assistant, participants were verbally debriefed and given a printed debrief sheet for their future reference. Participants received one research experience credit for their introduction to psychology class per time point as compensation for taking part in each of the two sessions. The primary investigator’s institutional review board approved this procedure in advance.

Measures

The measures for the present study consisted of demographic questions about one’s age, gender, racial and ethnic background, and relationship status to form a basis for comparison within the subject sample, and to determine the generalizability of this study’s results. In addition, four staging algorithms were utilized at both time points to examine and compare first-year students’ intentions to engage in the four target behaviors. The staging algorithms for exercise, fruit and vegetable consumption, high fat food avoidance, and stress management were chosen to determine participants’ stage of change for each behavior at both time points because
of the prevalence of their use within the field of health promotion (e.g., Armitage et al., 2004; Clark et al., 2005; Riebe et al., 2003).

**Exercise Stage of Change** (Marcus, Selby, Niaura, & Rossi, 1992). The participants’ stage of change for exercise was determined for both time points by their responses to an item created by Marcus et al. (1992). In accordance with the item, regular exercise was operationally defined in the survey as “any planned physical activity (e.g. brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed three or more times per week for 20 or more minutes per session at a level that increases your breathing rate and causes you to break a sweat.” Then, participants were asked, “Do you exercise regularly according to the definition above?” The definition utilized in this study is similar to the American College of Sports Medicine (ACSM) and the American Heart Association’s (AHA) current definition for vigorous physical activity (Haskell et al., 2007). The five response options to this item corresponded to each of the TTM stages of change (See Appendix D).

**Fruit and Vegetable Consumption Stage of Change** (Laforge, Greene, & Prochaska, 1994). The participants’ stage of change for fruit and vegetable consumption was determined at both time points by three questions utilized by Laforge et al. (1994). First participants were asked, “How many servings of fruits and vegetables do you usually eat each day?” Response options for this question were as follows: “zero,” “one to two,” “three to four,” “five,” and “six or more.” This study defined healthy fruit and vegetable consumption as eating five or more servings per day (USDA & USDHHS, 2005). Next participants were asked, “Have you been eating 5 or more servings of fruits and vegetables a day for more than six months?” Finally, participants were asked, “Do you intend to start eating 5 or more servings of fruits and vegetables a day in the next six months?” The responses to the second and third questions paralleled the five TTM stages of change (See Appendix D).

**High Fat Food Avoidance Stage of Change** (Greene & Rossi, 1998). The participants’ stage of change for high fat food avoidance was determined at both time points by their responses to an item created by Greene and Rossi (1998). The measure posed the question, “Do you consistently avoid eating high-fat foods?” This wording was chosen because the USDA and the USDHHS (2005) guidelines for a healthy diet recommend that people “limit intake of fats
and oils high in saturated and/or trans fatty acids, and choose products low in such fats and oils.” (p. 30). The five response options to this item corresponded to each of the TTM stages of change (See Appendix D).

**Stress Management Stage of Change** (Velicer, Prochaska, Fava, Norman, & Redding, 1998). The participants’ stage of change for stress management was determined at both time points with an item utilized by Velicer et al. (1998). The measure posed the question, “Do you regularly manage your stress?” The five response options to this item paralleled each of the TTM stages of change (See Appendix D).

**Results**

Initial tests to examine the differences between completers and non-completers of the survey at both time points exhibited no significant differences between groups on the demographic variables or the key constructs of the study. In order to compare the percent of participants in each stage of change for the four target health behaviors, frequency statistics were conducted at Time 1 and Time 2. The results of these analyses can be viewed in Table 1. In addition, frequency statistics were conducted at Time 1 and Time 2 to compare the percent of participants in pre-action stages versus action stages, and these results can be seen in Table 2.

Two independent chi-square analyses were conducted to determine common patterns in first-year students’ engagement in four health behaviors at Time 1 and Time 2. The chi-square was significant for participants who were in pre-action for high fat food avoidance at Time 1, \( \chi^2(n = 176, 1) = 4.02, p = .05 \). For participants who were in action for high fat food avoidance at Time 1, the chi-square was non-significant, \( \chi^2(n = 142, 1) = 0.02, p = .90 \). The chi-square was significant for participants who were in pre-action for high fat food avoidance at Time 2, \( \chi^2(n = 124, 1) = 6.81, p = .01 \). For participants who were in action for high fat food avoidance at Time 2, the chi-square was non-significant, \( \chi^2(n = 130, 1) = 0.39, p = .53 \). The percent of first-year students who engage in each of the patterns of these four health behaviors can be viewed in Table 3 and Table 4 respectively.

A third independent chi-square analysis was conducted to determine the percent of students who engaged in the same behavior change patterns from Time 1 to Time 2. The chi-square was non-significant for participants who regressed to an earlier stage of change at Time 2.
as compared to Time 1, $\chi^2(n = 23, 4) = 2.90, p = .58$. For participants whose stage of change remained static from Time 1 to Time 2, the chi-square was significant, $\chi^2(n = 182, 4) = 15.44, p = .01$. The chi-square was non-significant for participants who progressed to a later stage of change at Time 2 as compared to Time 1, $\chi^2(n = 47, 4) = 1.34, p = .85$. The percent of first-year students who engaged in each health behavior change pattern can be viewed in Table 5.

**Discussion**

First-year students did not meet recommended guidelines for all four health behaviors (i.e., exercise, fruit and vegetable consumption, high fat food avoidance, and stress management) simultaneously at either time point. Also, there were large groups of first-year students in the sample who practiced two to three behaviors at the recommended level, and other large groups of participants who failed to meet criteria for two to three behaviors. In short, two subsets of participants reflected either meeting or not meeting a majority of the criteria, and approximately ten percent of first-year students were not engaging in any of these behaviors at either time point. Therefore, the results of the present study suggested that MHBC interventions may be necessary to improve multiple behaviors simultaneously because most first-year students were not engaging in at least two of the four health behaviors at either time point.

Specifically, the results suggested that the majority of first-year students were regularly exercising at both time points. The percentages of students in an action stage for exercise in this study was greater (67.3% at Time 1 and 64.8% at Time 2) compared to a similar study conducted by Scioli, Biller, Rossi, Riebe, and Scioli (2009) who found that 51.2% of college students were in an action stage for exercise. This difference could be due to the fact that Scioli et al. (2009) utilized a slightly stricter definition of regular exercise than the present study in terms of days per week and minutes per session. In addition, the results suggested that many first-year students were not avoiding high fat foods at Time 1 (55.6%) or Time 2 (48.1%). Similarly, Wee et al. (2005) found that 63% of adults in their sample were not limiting fat in their diet all or most of the time. Moreover, almost all of the participants were not eating enough fruits and vegetables. Finally, the results suggested that the majority of first-year students were regularly managing their stress at Time 1 and Time 2, but there was still a large percentage of students who were not engaging in this behavior. Therefore, the results of the current study and previous research
suggest that many first-year students are not meeting recommended guidelines for their exercise, fruit and vegetable consumption, high fat food avoidance, and stress management, and that information about how to improve or maintain their behaviors may be beneficial.

The fact that the majority of students remained static in their stage of change for all four behaviors over time further implies that MHBC interventions may be beneficial for first-year students because most of them were not improving their behaviors on their own. In addition, most of the patterns in first-year students behavior changes involved a single behavior, which implied that changes in one behavior do not typically lead to changes in other behaviors. Moreover, almost all first-year students who engaged in MHBC only changed two behaviors simultaneously, and some positive and some inverse relationships existed among these behaviors change patterns. Also, behavior change patterns in which first-years changed three behaviors were incredibly rare and did not express a positive relationship. These results imply that single changes or combinations of two behaviors changes may be the most effective for aiding people if they need to improve more than one of these four behaviors. Finally, many students regressed to an earlier stage of change for at least one of their behaviors. In combination, these results suggest that MHBC interventions are warranted in order to increase the likelihood that multiple behaviors will improve simultaneously.

While there was not a set relationship among first-year students exercise, fruit and vegetable consumption, high fat food avoidance, and stress management behaviors, there were some common patterns among these four behaviors in first-year students. For example, almost all participants were not eating five or more servings of fruits and vegetables daily, and about half of these participants were also not avoiding high fat foods in their diet. In addition, the most common pattern of first-year students’ health behaviors at Time 1 was the second most common pattern at Time 2, and it suggested that many students were regularly exercising and managing their stress simultaneously. Moreover, almost half of participants who were meeting or not meeting criteria for regular exercise were also avoiding or not avoiding high fat foods respectively, and a significant percentage of those who were not exercising regularly were not meeting guidelines for consumption of fruits and vegetables. Finally, almost half of participants who were managing or not managing their stress regularly were also avoiding or not avoiding high fat foods respectively, and a significant percentage of those who were not managing their
stress regularly were not meeting guidelines for consumption of fruits and vegetables. These results are in line with previous research on MHBC, and they suggest that positive relationships between two of these four health behaviors is common (Hudd et al., 2000; Racette et al., 2005; Sanchez et al., 2007; Sanchez et al., 2008).

The results of this study suggested that almost all first-year students were not meeting recommended guidelines for fruits and vegetables consumption on a daily basis. While the percentage of individuals not meeting recommended guidelines for fruit and vegetable consumption were higher than previous research, an inability for people to meet the recommendation for daily fruit and vegetable consumption seems to be a common trend in health behavior research. For example, Racette et al. (2008) noted that 71% of college students were not eating five or more servings of fruits and vegetables daily at the beginning of freshman year and the same percentage was not meeting the guideline at the end of their senior year. In addition, Scioli et al. (2009) found that 58.5% of college students in their sample were not eating enough fruits and vegetables each day. Furthermore, two other studies reported that the majority of young adolescents (Sanchez et al., 2007) and overweight women (Sanchez et al., 2008) were eating less than the recommended servings of fruits and vegetables. In general, this study and previous research imply that fruit and vegetable consumption is an important health behavior to target in interventions that aim to reduce people’s risk of chronic conditions because many people do not meet guidelines or intend to improve this behavior on their own.

Since many people are not eating enough fruits and vegetables, two-behavior MHBC interventions that pair information about fruit and vegetable consumption along with information about avoiding high fat foods, engaging in regular exercise, or regularly managing stress are warranted because approximately 30-50% of participants who were not eating fruits and vegetables were also not engaging in one of the other three behaviors. For example, approximately half of first-year students were not engaging in either of the two diet behaviors at both time points, and this result is in line with previous research that suggested a positive relationship often exists between these two diet behaviors (Sanchez et al., 2007; Sanchez et al., 2008; Racette et al., 2005). Moreover, many students who were not eating enough fruits and vegetables were also not exercising regularly and/or managing their stress regularly, and prior studies have also found a similar relationship among these behaviors (Bock et al., 1998; Clark et
al., 2005; Hudd et al., 2000). Therefore, future studies could conduct single behavior change versus the three combinations of two-behavior MHBC interventions listed in this paragraph to further explore the most successful intervention strategies in terms of behavior improvements, time efficiency, and cost effectiveness.

The most common pattern of behaviors at Time 2 was the second most common pattern of behaviors at Time 1, and it indicated that people often meet exercise, high fat food avoidance, and stress management guidelines simultaneously. As such, MHBC interventions that target these three behaviors may also be an efficient and effective way to improve first-year students’ health behaviors and health indicators related to the development of chronic conditions (e.g., cancer, diabetes, heart disease, and stroke). Current MHBC interventions for patients with coronary heart disease (e.g., MCLIP and MLDP) provide credence to this point because they have successfully increased time spent exercising and managing stress as well as reduced dietary fat consumption simultaneously (Daubenmier et al., 2007; Govil et al., 2009; Koertge et al., 2003; Pischke et al., 2006). In addition, Koertge et al. (2003) and Pischke et al. (2006) noted that the health behavior changes made by MLDP participants resulted in positive reductions in a variety of health indicators (e.g., blood pressure, cholesterol, resting heart rate, body fat, and weight). Moreover, Daubenmier et al. (2007) found that MCLIP participants’ changes in each of the three health behaviors reduced coronary risk factors individually, additively, and interactively. Future studies could explore if MHBC interventions that target exercise, high fat food avoidance, and stress management lead to similar changes in first-year students’ health behaviors and health indicators, and it would also be interesting to determine if adding a fourth behavior (fruit and vegetable consumption) to these MHBC interventions would impact their effectiveness.

While approximately 50% of participants expressed a positive relationship between their exercise and avoidance of high fat food behaviors at both time points, only about 10% of the sample changed these behaviors simultaneously across the two time points. In addition, only 1.6% of that 10% of participants’ intentions to engage in these behaviors improved simultaneously without a clinical intervention. This is a low percentage compared to the 33.5% of participants who improved both of these behaviors in simultaneous or sequential clinical MHBC interventions (Vandelanotte et al., 2008). Since a positive relationship commonly exists
among exercise and high fat food avoidance behaviors in this study and previous research (e.g., Bock et al., 2008; Riebe et al., 2005; Wee et al., 2005), the results of Vandelanotte et al. (2008) suggest that clinical MHBC interventions for these two behaviors would be successful at improving the health behaviors of first-year college students as well. Thus, future studies could expand on the research of Vandelanotte et al. (2008) by determining if simultaneous and/or sequential MHBC interventions for exercise and high fat food avoidance during first-year college students’ first semester of college are also successful at improving their health behaviors.

The use of self-report measures may have limited the validity of this study, but this risk was minimized by the anonymity of taking the survey in a large lecture hall and the use of a participant identification code to compare responses at Time 1 and Time 2. There were also two potential limitations to the validity of the study related to the operational definition of the health behaviors. First, there was not an operational definition for stress management in the survey, which means that first-year students who reported regularly managing their stress may have been using unhealthy techniques (e.g., smoking and diet restriction). However, the fact that many students who reported exercising regularly also reported regularly managing their stress suggests that exercise may have been their primary stress management technique. Second, the operational definition of regular exercise excluded moderate physical activity because this type of exercise was not included in the guidelines at the time of the study, but the percentage of first-year students who were engaging in regular exercise was still comparable to previous studies on college students (Scioli et al., 2009). Thus, it is unlikely that the exclusion of moderate physical activity in the definition significantly impacted the study’s results. Finally, there were other aspects of health that may have been impacted during one’s first semester of college that were not assessed in this study (e.g., alcohol and sleep behaviors). These variables were not included in order to maintain a certain level of simplicity in the project and because the inclusion of these behaviors would have required a larger sample size to address that level of complexity.

First-year students’ did not meet recommended guidelines for exercise, fruit and vegetable intake, high fat food avoidance, and stress management simultaneously. Furthermore, first-year students behaviors were most often static and sometimes regressed over the course of their first semester of college. As such, the results of the current study imply that most first-year students could benefit from health behavior change interventions that target two or more of these
behaviors. It is imperative to utilize the results of this study to create more effective and efficient MHBC interventions for first-year college students because these behaviors (i.e., exercise, fruit and vegetable intake, high fat food avoidance, and stress management) are preventive factors for chronic conditions (e.g., heart disease, cancer, stroke, and diabetes) that are among the leading causes of death in the United States.
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http://www.cdc.gov/physicalactivity/everyone/glossary/index.html


Table 1.

Percent of Participants in Each Stage of Change at Time 1 (T1) and Time 2 (T2)

<table>
<thead>
<tr>
<th></th>
<th>Precontemplation</th>
<th>Contemplation</th>
<th>Preparation</th>
<th>Action</th>
<th>Maintenance</th>
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<td>10.3</td>
<td>19.6</td>
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<tr>
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<td>16.4</td>
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<tr>
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<td>2.0</td>
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<td>0.0</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>High Fat Avoidance T1</strong> <em>(n = 320)</em></td>
<td>31.6</td>
<td>14.4</td>
<td>9.7</td>
<td>17.5</td>
<td>26.9</td>
</tr>
<tr>
<td><strong>High Fat Avoidance T2</strong> <em>(n = 255)</em></td>
<td>24.7</td>
<td>11.8</td>
<td>11.8</td>
<td>24.7</td>
<td>27.1</td>
</tr>
<tr>
<td><strong>Stress Management T1</strong> <em>(n = 320)</em></td>
<td>7.2</td>
<td>14.1</td>
<td>15.0</td>
<td>15.3</td>
<td>48.4</td>
</tr>
<tr>
<td><strong>Stress Management T2</strong> <em>(n = 256)</em></td>
<td>5.5</td>
<td>6.6</td>
<td>19.1</td>
<td>14.8</td>
<td>53.9</td>
</tr>
<tr>
<td></td>
<td>Pre-Action</td>
<td>Action</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Exercise T1  ((n = 321))</td>
<td>32.7</td>
<td>67.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise T2  ((n = 256))</td>
<td>35.2</td>
<td>64.8</td>
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</tr>
<tr>
<td>Fruits &amp; Vegetables T1  ((n = 320))</td>
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<tr>
<td>Fruits &amp; Vegetables T2  ((n = 256))</td>
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<tr>
<td>High Fat Avoidance T2  ((n = 320))</td>
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<td>51.9</td>
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</tr>
<tr>
<td>Stress Management T1  ((n = 320))</td>
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<td>63.8</td>
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<td></td>
</tr>
<tr>
<td>Stress Management T2  ((n = 256))</td>
<td>31.3</td>
<td>68.8</td>
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</tbody>
</table>
Table 3.

**Patterns in Participants’ Health Behavior Engagement at Time 1**

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Fruits &amp; Vegetables</th>
<th>High Fat Avoidance</th>
<th>Stress Management</th>
<th>Percent</th>
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<tbody>
<tr>
<td>PA</td>
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<td>9.0</td>
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<td>(n = 37)</td>
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<td>PA</td>
<td>PA</td>
<td>10.0</td>
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<td>PA</td>
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<td>(n = 78)</td>
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<td></td>
<td></td>
<td>(n = 14)</td>
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<td>A</td>
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<td>12.8</td>
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<td></td>
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<td></td>
<td>(n = 41)</td>
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<tr>
<td>A</td>
<td>PA</td>
<td>A</td>
<td>A</td>
<td>19.9</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>(n = 64)</td>
</tr>
</tbody>
</table>

Note: PA = Pre-Action; A = Action; Percent = Percent of People in that Health Behavior Pattern
Table 4.

Patterns in Participants’ Health Behavior Engagement at Time 2

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Fruits &amp; Vegetables</th>
<th>High Fat Avoidance</th>
<th>Stress Management</th>
<th>Percent (n = 256)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA</td>
<td>PA</td>
<td>PA</td>
<td>PA</td>
<td>10.2 (n = 26)</td>
</tr>
<tr>
<td>PA</td>
<td>PA</td>
<td>PA</td>
<td>A</td>
<td>12.5 (n = 32)</td>
</tr>
<tr>
<td>A</td>
<td>PA</td>
<td>PA</td>
<td>PA</td>
<td>5.9 (n = 15)</td>
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<td>A</td>
<td>PA</td>
<td>PA</td>
<td>A</td>
<td>19.9 (n = 51)</td>
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<tr>
<td>PA</td>
<td>PA</td>
<td>A</td>
<td>PA</td>
<td>4.3 (n = 11)</td>
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<td>PA</td>
<td>PA</td>
<td>A</td>
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<td>8.2 (n = 21)</td>
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<td>10.9 (n = 28)</td>
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<td>27.3 (n = 70)</td>
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<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>0.8 (n = 2)</td>
</tr>
</tbody>
</table>

Note: PA = Pre-Action; A = Action; Percent = Percent of People in that Health Behavior Pattern
### Table 5.

**Patterns in Participants’ Health Behavior Changes from Time 1 to Time 2**

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Fruit and Vegetables</th>
<th>High Fat Avoidance</th>
<th>Stress Management</th>
<th>Percent (n = 254)</th>
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</thead>
<tbody>
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<td>o</td>
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<td>o</td>
<td>40.9 (n = 104)</td>
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<td>+</td>
<td>11.4 (n = 29)</td>
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<td>o</td>
<td>o</td>
<td>+</td>
<td>o</td>
<td>11.4 (n = 29)</td>
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<td>-</td>
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<td>o</td>
<td>o</td>
<td>5.9 (n = 15)</td>
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<td>5.5 (n = 14)</td>
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<td>1.2 (n = 3)</td>
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<td>0.8 (n = 2)</td>
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<td>0.8 (n = 2)</td>
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<td>0.4 (n = 1)</td>
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</table>

Note: + = Progression; o = Static; - = Regression;
P = Percent of People in that Health Behavior Change Pattern
Appendix A: Consent Form
College Health Study

Dear Participant:

You have been asked to take part in the research project described below. The researcher will explain the project to you in detail. If you have any questions, please feel free to call Dr. Rose Marie Ward, the person mainly responsible for the study.

The purpose of the study is to gather information from students about issues of health behavior change. Responses to these items will be completely anonymous. At no time will your name be tied to your responses. Only project personnel will have access to the survey responses.

1. **YOU MUST BE AT LEAST 18 YEARS OLD** to be in this research project.
2. **If you decide to take part in this study**, your participation will involve filling out a survey pertaining to attitudes towards different aspects of healthy living. The survey will ask you questions about your sleep, diet, exercise, smoking, drinking, teeth, and other health behaviors. The survey will take approximately 50 minutes to complete.
3. **The possible risks or discomforts of the study are minimal**, although you may feel some embarrassment answering some of the questions about private matters.
4. **Although there are no direct benefits of the study**, your answers will help increase the knowledge regarding the status of problems in psychology.
5. **Your part in the study is confidential**. That means your answers to all questions are private. No one else can find out what your answers are. Scientific reports will be based on group data and will not identify you or any individual as being in this project. You will be assigned a participant number for tracking purposes only.
6. **The decision to participate in this research is up to you**. You do not have to participate and you can refuse to answer any question.
7. **Participation in this study is not expected to be harmful or injurious to you**. However, if this study causes you any injury, you should write or call Dr. Rose Marie Ward at (513) 529-3751.

If you have questions about the study, you can contact the investigator, Dr. Rose Marie Ward, 513-529-3751 or wardrm1@muohio.edu.

If you have any questions or concerns about your rights as a subject, you may contact Miami University's Office for the Advancement of Research and Scholarship, (513) 529-3734 or humansubjects@muohio.edu.

You are at least 18 years old. You have read the consent form and your questions have been answered to your satisfaction. Your filling out the survey implies your consent to participate in this study.

If these questions are upsetting and you want to talk, please use the phone numbers below:

- Miami University Student Counseling Service 529-4634
- Psychology Clinic Benton Hall 529-2423
- Community Counseling and Crisis Center 523-4146

Thank you,

**Rose Marie Ward, Ph.D.**
Principal Investigator
Appendix B: Debrief Sheet for Time One

Thank you for participating in our experiment. You have finished the first part of a two-part study. The second part of the study will be later in the semester. We will contact you to remind you of your commitment.

The study in which you have just participated in was designed to examine attitudes and beliefs about health behaviors among college students. Each of you was asked the same series of questions. Specifically, we will be examining the situations in which college students feel most comfortable expressing their health beliefs. We will also examine the prevalence rates of certain health behaviors among college students. We hope to use this data to add to the body of literature concerning college student health behavior. We are interested in seeing if this decision to practice health behaviors occurs in a stage-like progression that is readily identifiable.

**We appreciate your participation in this study.**

If you would like more information concerning our theories, please read:


If you have questions/comments, or if you are interested in getting information about the results, please call Dr. Ward at 529-3751 or e-mail wardrm1@muohio.edu.
Appendix C: Debrief Sheet for Time Two

Thank you for participating in our experiment. You have finished the second part of a two-part study. The first part of the study was earlier in the semester.

The study in which you have just participated in was designed to examine attitudes and beliefs about health behaviors among college students. Specifically, we asked you questions about your smoking practices, alcohol consumption, eating practices, exercise habits, teeth care habits, and many other health related behaviors. Each of you was asked the same series of questions. Specifically, we will be examining the situations in which college students feel most comfortable expressing their health beliefs. We will also examine the prevalence rates of certain health behaviors among college students. We hope to use this data to add to the body of literature concerning college student health behavior. We are interested in seeing if this decision to practice health behaviors occurs in a stage-like progression that is readily identifiable. We are also interested in examined which health behaviors seem to impact the practice of other health behaviors. For example, are you more or less willing to exercise when you have had little sleep.

We appreciate your participation in this study.

If you would like more information concerning our theories, please read:


If you have questions/comments, or if you are interested in getting information about the results, please call Dr. Ward at 529-3751 or e-mail wardrm1@muohio.edu. Results will be available in the Spring of 2005.
Appendix D: Measures

**Exercise Stage of Change** (Marcus, Selby, Niaura, & Rossi, 1992).
Regular exercise is any planned physical activity (e.g., brisk walking, aerobics, jogging, bicycling, swimming, rowing, etc.) performed to increase physical fitness. Such activity should be performed 3 or more times per week for 20 or more minutes per session at a level that increases your breathing rate and causes you to break a sweat.

Do you exercise regularly according to the definition above?
- Yes, I have been for more than 6 months
- Yes, I have been, but for less than 6 months
- No, but I intend to in the next 30 days
- No, but I intend to in the next 6 months
- No, and I do not intend to in the next 6 months

**Fruit and Vegetable Consumption Stage of Change** (Laforge, Greene, & Prochaska, 1994).
How many servings of fruits and vegetables do you usually eat each day?
- Zero
- One to Two
- Three to Four
- Five
- Six or more

Have you been eating 5 or more servings of fruits and vegetables a day for more than six months?
- Less than 6 months
- More than 6 months

Do you intend to start eating 5 or more servings of fruits and vegetables a day in the next 6 months?
- No, and I do not intend to in the next 6 months
- Yes, I intend to in the next 6 months
- Yes, I intend to in the next 30 days

**High Fat Food Avoidance Stage of Change** (Greene & Rossi, 1998).
Do you consistently avoid eating high fat foods?
Stress Management Stage of Change (Velicer, Prochaska, Fava, Norman, & Redding, 1998).

Do you regularly manage your stress?

- No, and I do not intend to in the next 6 months
- No, but I intend to in the next 6 months
- No, but I intend to in the next 30 days
- Yes, and I have been, but for less than 6 months
- Yes, and I have been for more than 6 months