Use of Social Media in Adolescent Obesity Intervention

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Use of Social Media in Adolescent Obesity Intervention

by

Helen H. Hansen

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Use of Social Media in an Adolescent Obesity Intervention Program

by

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at the

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as a Dissertation for the PsyD degree

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Abstract

Childhood and adolescent obesity strongly predicts adult obesity (Spruijt-Metz, 2011) and literature highlights the transitional period into college as a “high risk weight gain period” (Holm-Denoma, Joiner, Vohs, & Heatherton, 2008). Obesity is associated with poor physical outcomes (Freedman, Dietz, Srinivasan, & Berenson, 1999; Katz & D’Ambrosio, 2010) and psychological conditions are found in 34% of children and adolescents with an obesity-related condition, in comparison to 20% of the children in the general population (Wang & Beydoun, 2007). In the context of obesity programs, growing evidence supports the efficacy of increasing physical activity without calorie restriction to decrease body fat in children and adolescents (Kim & Lee, 2009). With a rising number of obesity interventions incorporating technology and social media, it becomes especially important to assess the efficacy of such delivery methods on physical and psychological factors. The current study tested four hypotheses concerning the effect of varying types of obesity intervention delivery on compliance, physical activity level, weight change, and a number of psychological traits in a sample of adolescent females. The
three intervention types involved the use of in-person psychoeducation, technology (email and text messaging), and no contact. The focal point of this program was to engender more healthy lifestyles utilizing a physical activity-based program protocol for adolescents. Although there were various trends toward improvement, no statistically significant changes were found across the domains assessed in this eight-week intervention.

Utilization of face-to-face and technology methods to obesity intervention resulted in higher compliance in the program than the control group. The other variables (physiological, psychological, physical activity) examined regarding health behaviors yielded mixed results in improvement as a result of the eight-week intervention. This study presents meaningful considerations for future studies providing obesity intervention for college students and their preference for technology contact given their specific lifestyle. Also, it further explores barriers in developing a lifestyle of healthy behavior toward overall physiological and psychological health.
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Chapter 1

Introduction

Obesity in America

Obesity is a public health crisis in the United States. According to World Health Organization, obesity is defined as a disease condition associated with having excess body fat to cause health impairment (World Health Organization, 2000). More technically, obesity is having a body mass index (BMI) at or above the 95th percentile, when compared with the persons of same age and sex, following an algorithm based on weight and height (Ogden & Flegal, 2010). Overweight is defined as a BMI between 85th percentile and 95th percentile, for children of the same age and sex (Barlow & Expert Committee, 2007).

Among children aged 6 to 11, the prevalence of obesity has tripled from 6.5% in 1980 to nearly 20% in 2008. Similarly, in adolescents between the ages of 12 to 19, the prevalence increased from 5% to more than 18% in three decades (Ogden, Carroll, & Surveys, 2010). Research shows a current rate of 18% of U.S. children between the ages of 2 to 19 being overweight (Ogden, Carroll, & Surveys, 2010). The efforts to reduce the current epidemic of obesity has proven challenging, indicated by the continued increase in obesity prevalence despite the vast interventions that have been implemented in the last few decades (Spruijt-Metz, 2011).

Obesity Risk of the College Population

Research indicates that childhood and adolescent obesity strongly predicts adult obesity (Spruijt-Metz, 2011) and highlights the transitional period into college as a “high risk weight gain period” (Holm-Denoma, Joiner, Vohs, & Heatherton, 2008). According to this longitudinal...
Adolescent Obesity Intervention and Social Media

study, the individuals entering college were found to be gaining double the expected adult national weight gain averages and were found to be higher than national weight gain averages for adolescents between 17 and 18 years of age (Holm-Denoma et al., 2008). Attributed by some of these factors, both males and females are likely to gain weight in the early years of college also widely known as the phenomenon, “Freshman Fifteen”, the gaining of about 15 lbs in the freshman year of college. There is some evidence suggesting that college students are more prone to weight gain than their non-college attending counterparts (Howell, Mewborn, Randle, & Fowler-Johnson, 1985). A study that examined a large sample of males and females in their early years of college found that 77% of the public institution sample was affected by weight gain in their freshman year, with the greatest gain occurring in the first semester. These data also suggest that males tend to gain weight during their sophomore year while the rest of the group may not lose weight over time, resulting in about a quarter of the participants ending up about 15 pounds heavier than when they started college (Lloyd-Richardson, Bailey, Fava, & Wing, 2008).

A national college survey investigated health risk behavior in college students and found that 35% were overweight or obese and the majority was not involved in regular exercise.

The Task Force on Community and Preventive Services reported a need for research interventions in college and university settings (Katz et al., 2005). Along with some of the aforementioned weight gain factors and the trend of weight gain especially in the first semester of college, there exists a higher probability of unhealthy weight control behaviors especially in female students (Laska, Pasch, Lust, Story, & Ehlinger, 2011). These include taking diet pills, binge eating, and self-induced vomiting affecting more female students at 4-year institutions than their peers in 2-year institutions (Laska et al., 2011). Interventions promoting weight-related healthy lifestyle in the early years of college are needed.
Obesity and Health

Obese adolescents are likely to continue to be obese into adulthood. In a 2010 study by Schwenk, 76% of severely obese adolescents remained severely obese adults and of the normal weight or obese adolescents, 8% became severely obese in adulthood. This research indicates that obese adolescents are more likely than normal-weight or overweight adolescents to become severely obese adults, with age and ethnicity adjusted (Schwenk, 2010). Obese adolescents are also at increased risk for poor health outcomes related to obesity such as asthma, diabetes, cardiovascular diseases and sleep apnea (Freedman et al., 1999; Katz & D’Ambrosio, 2010). Obese children are at increased risk of cardiovascular factors and in one study, 70% of obese children showed at least one cardiovascular risk factor and the remaining 30% showed two or more risk factors (Freedman, Mei, Srinivasan, Berenson, & Deitz, 2007). When compared with healthy children, obese children have such poor health-related quality of life that it is comparable to children with cancer (Schwimmer, Burwinkel, & Varni, 2003). Although obesity is not a direct cause of most diseases, it leads to increases in risk factors such as blood pressure and blood cholesterol (Gearheart, Gruber, & Vanata, 2008).

Research supports a higher prevalence of obesity in older children and teens when compared with preschoolers (Odgen, Carroll, Curtin, Lamb, & Flegal, 2010) and highlights the importance of intervention in adolescence. Obesity, particularly among young adults, is associated with reduced overall adult life expectancy (Fontaine, Reden, Wang, Westfall, & Allison, 2003) and associated with increased morbidity and mortality in adulthood independent of adult weight status (Must, Jacques, Dallal, Bajema, & Dietz, 1992), shown in a longitudinal study following overweight adolescents into adulthood. For example, the longitudinal study by Fontaine, et al. (2003) determines the effect of varying BMI level on the number of years of life...
lost (YLL) in adults of ages 20 to 70. This study determined that for any level of overweight, younger adults had greater YLL than older adults. For younger white men and women with a severe level of obesity (BMI of 45), the maximum YLL is 13 and 18, respectively. This represents a 22% reduction in expected remaining life span for younger white men. Blacks at younger ages with severe levels of obesity had a maximum YLL of 20 for men and 5 for women (Fontaine, et al., 2003). The lifetime risk of diabetes assessed at 18 years of age for underweight men was 8% compared with 70% for very obese men, and 12% for underweight women vs. 73% for very obese women (Narayan, Boyle, Thompson, Sorensen, & Williamson, 2003). These findings emphasize the importance of effective intervention with this population that will improve overall health-related risk factors, life quality, and life expectancy.

**Obesity and Mental Health**

Obesity has psychological implications with research showing that approximately half of the sample of children presenting for weight loss treatment were found to have at least one clinical elevation on the Child Behavior Checklist (CBCL) with 45% of boys and 28% of girls displaying Social Problem indications on the scale (Epstein, Meyers, & Anderson, 1996). Psychological conditions are found in 34% of children and adolescents with an obesity-related condition, in comparison to 20% of children in the general population (Wang & Beydoun, 2007). Some mental health factors related to obesity include depression, anxiety, somatoform disorders, and eating disorders (Britz, et al., 2000).

Research shows some indication that obese children may have more negative physical self-perceptions and overall self-worth than their non-obese peers (Braet, Mervielde, & Vandereycken, 1997), although the findings in this area are mixed (Friedman & Brownell, 1995). Since the behaviors associated with obesity, including eating patterns and physical
activity, are exhibited similarly in mood disorders, obesity is tied closely to the behaviors that affect one’s mental health status. Both depression and anxiety are found to be associated with an increased BMI among children and adolescents when compared with their healthy counterparts (Rofey, et al., 2009) and a strong association between self-perceived weight and depressive symptoms has been shown in a study of more than 13,000 adolescents (Ali, Fang, & Rizzo, 2010). Further, a study found that among women who were obese as adolescents, the risk for major depressive disorder or anxiety disorder increased four-fold over a 20-year period (Anderson, Cohen, Naumova, Jacques, & Must, 2007).

**Obesity Prevention and Intervention**

Several variables related to effective obesity prevention programs have been identified (Stice, Shaw, & Marti, 2006). The authors of this 2006 meta-analytic review listed the variables that are found predictive of positive outcome in weight gain prevention programs: age (children and adolescents have better outcomes than preadolescents), gender (females with better outcome), briefer interventions, narrower focus (targeting only weight control rather than other health behaviors such as smoking), self-selection sample, and pilot trials.

In opposition to Stice et al. (2006), older children and teens were shown to have more positive outcome than younger children (Baranowski, Cullen, Nicklas, Thompson, & Baranowski, 2002). However, both studies showed that programs targeted toward teens were found effective. It could be theorized that, developmentally, adolescents desire more autonomy, and therefore are more motivated to make independent choices related to their food intake and activity level, among other weight-related decisions. Although research shows greater efficacy with parental involvement in programs involving reduction of childhood obesity (Story, 1999), for older teens, programs that encourage development of self-regulatory skills and autonomous
style, without parents’ involvement, are more effective (Stice et al., 2006).

Efficacy rates vary based on gender representation of the sample and the design of the prevention program. One treatment study found that an intervention aimed at increasing physical activity and decreasing sedentary behavior produced more weight loss with males than females, however, focusing on increasing activity only was equally effective for both genders (Epstein, Paluch, & Raynor, 2001). Obesity prevention programs that were delivered solely to females yielded a significantly larger effect than mixed gender or male-only groups (Stice et al., 2006). Additionally, programs that focus solely on obesity prevention rather than other additional health behaviors such as smoking cessation, have shown to have more success. It has been shown that relatively short and simple interventions yield maximum effects (Stice et al., 2006). Examples of brief, simple interventions include programs lasting for less than 16 weeks rather than interventions lasting more than 16 weeks. Shorter duration produced significantly larger effects possibly because simple programs show greater initial enrollment and lower dropout rates (Stice et al., 2006). Psycho-educational interventions have also been effective in producing significant weight gain prevention (Stice & Shaw, 2004).

**Effects of Physical Activity**

Physical activity has significant implications toward lowering obesity-related health risks such as hyperlipidemia, hyperinsulinemia, and elevated blood pressure, even without weight reduction (Gutin, et al., 2002). In the context of obesity programs, growing evidence supports the efficacy of increasing physical activity without calorie restriction to decrease body fat in children and adolescents (Kim & Lee, 2009), and links decreased health risks with body fat reduction. Obese children who incorporated regular activity for an average of 30 minutes per day in their schedule, showed significant improvements including lowered cholesterol, other
blood lipids, depression, blood pressure, injury, obesity, and improved bone density and metabolic status (Janssen & LeBlanc, 2010). Additionally, physical activity improves adiposity levels, musculoskeletal health, cardiovascular health, as well as several components of mental health such as self-concept, anxiety, and depression (Janssen & LeBlanc, 2010). In order to gain the health benefits shown, Janssen and LeBlanc (2010) recommend that children and adolescents between ages 5-17 should accumulate between 60 minutes to several hours of physical activity per day of at least moderate intensity with some vigorous activities including muscle and bone strengthening components when possible. They suggest that muscle and bone strengthening activities be incorporated at least three days per week with the majority of the physical activity comprising of aerobic exercises.

**Technology Use and Obesity Intervention/Prevention**

With the rapid development of social media technology such as is found with the Internet, personal electronic devices (PED) such as iPods and iPads, and cellular phone devices, older children and adolescents are spending increased amount of time interacting electronically. It has been reported that 8- to 18-year olds spend as much as 7.5 hours a day so involved (Rideout, Foehr, & Roberts, 2010). One study that asked college students about their online activities and the closeness of friendships, found that they often used the Internet, especially social networking sites (e.g., Facebook and Twitter), to establish connections with friends and family, and used these sites to strengthen different aspects of relational dynamics (Subrahmanyam, Reich, Waechter, & Espinoza, 2008). Another survey-based study, involving 452 young people, indicated that most health-related information was learned from television, radio, print, Internet, and social networking media. Internet and online social media were found more important for rural adolescents than for their urban counterparts (Lariscy, Reber, & Paek, 2010). Based on this
trend toward increased technology usage and consequent social reinforcement, many efforts have been made by dieticians and weight-loss experts to provide weight loss management care through social networking websites such as Calorie-Count.com and DietTV.com (Avila, 2007).

In recent years, several studies have been done examining the effect of various social media platforms and the internet to demonstrate weight loss efficacy. An article by Li, Barnett, Goodman, Wasserman, and Kemper, (2012) provided an overview of childhood obesity prevention and management approaches utilizing technology and social media. Several studies have demonstrated the benefit of social network, social media sites, internet-based approaches, email, and text message interventions but yielded mixed results in weight loss or weight gain prevention (Li et al., 2012). Although some of these studies have included the effect of interactive vs. non-interactive interventions utilizing technology and involve some face-to-face time built into the interventions, none of the studies known to date have examined the effect of in-person interaction in conjunction with technology vs. technology only.

Aligning with this movement toward weaving health behavior promotion with social media, the current study will explore the effect of implementation of technology alone vs. technology and in-person contact in a physical activity-based obesity prevention program on female college students. The protocol used in this study designed to improve physical activity in adolescent females will provide the following:

1) Psycho-education regarding physical exercise and its short- and long-term benefits
2) Motivational interviewing to overcome personal barriers and motivation to start and continue in the program
3) Choices around the type of physical activity that will be chosen and maintained
4) Peer support to facilitate vicarious learning and peer motivation.
The hypotheses of this study are as follows:

H1) The Full Intervention group will yield the highest compliance rate (participants involved in more than 50% of sessions), followed by the Partial Intervention group. The Partial Intervention group will yield a higher compliance rate than the Control group.

H2) The Full Intervention group will show a higher physical activity level measured by minutes of activity and number of steps than the Partial Intervention group.

H3) The Full Intervention group will yield the highest decrease in weight between Time 1 and Time 2. The Partial Intervention group will show higher decrease in weight over time than the Control group.

H4) The Full Intervention group will show highest levels of improved psychological factors such as mood (depression, anxiety), self-efficacy, motivation for physical activity, social stress, inadequacy, self-esteem, self-reliance, and Emotional Symptoms Index (ESI). The Partial Intervention group will show a higher level of improved psychological factors than the Control group.
Chapter 2

Method

Participants

This study involved 30 adolescent females between 18-20 years of age in their freshman year of college. These participants were recruited from George Fox University’s freshman pool and those enrolled in an Introduction to Psychology course. Ten participants were recruited for each of the three groups. The participants for this study were asked to enroll in an eight-week program through the Student Health and Counseling Center at George Fox University in order to facilitate healthy behavior changes. The participants received an informed consent prior to the start of the program (see Appendix A). Any participants with known health concerns such as cardiovascular disease, pulmonary disease, diabetes, or other medical contraindications that hinder physical exercise were excluded from this study because of the possible physical and medical complications that may result from a short-term physical activity program. Participants who were involved in a sports team at the time of the intervention were also excluded from the study because of the level of physical activity routine that these students are assumed to already be provided with, which would confound the effect of the present program on their level of physical activity. The aforementioned exclusionary criteria was listed in the informed consent and additionally screened for in the initial information gathering session prior to the intervention.

Procedures

The research project was implemented upon approval from George Fox University
Institutional Review Board. The research participation opportunity was presented to the freshman female student email list at George Fox University through a one-page flier including a general description of the program “Healthy Together”, exclusionary criteria, and an email address for the researchers to be contacted through. The students with expressed interest were provided with a website link to Survey Monkey where they were provided with an initial description of the program, an informed consent with possible risks for participation listed, and a few pages gathering general demographics information (as shown in Appendix B). Due to the low number of expressed participants recruited through this approach, an additional recruiting measure was taken with students enrolled in undergraduate introductory psychology course, with a recruitment limitation on freshman students only. A formal, in-person presentation of the research opportunity was given in the beginning of the course semester and those with preliminary interest were asked to provide their contact information for a follow-up inclusionary screening and the same website link for Survey Monkey was provided with an initial description of the program, an informed consent with possible risks for participation listed, and a few pages gathering general demographics information. These students were informed that the participation in this program would be one of many research experience options they were offered toward their required experiential credit hours for the course.

After the preliminary screening of the demographic information, those found eligible were scheduled for an appointment at the Health and Counseling Center to obtain the following measures in this order: 1) informed consent form, 2) blood pressure, weight, and height, and 3) the pre-test intervention measures (found in Appendix C), including the BASC-2, General Self-Efficacy Scale, and Exerciser Checklist. The physiological measures (blood pressure, weight, height) were completed using a sphygmomanometer, a scale, and a stadiometer. Prior to the pre-
intervention measure, each participant was given a number and randomly assigned to one of three groups using an online random number generator: http://www.randomizer.org/form.htm. Ten participants were be recruited for each of the three groups: Full Intervention group, Partial Intervention group, and Control group.

Each participant was provided a private room to fill out the information at the time of pre-intervention and privately informed of instructions after the measures were completed. Each participant was advised to refrain from sharing about their program experience during the eight-week intervention outside of their group members. The participants assigned to the Full Intervention group (FI) were informed that they were in a group that will be meeting weekly, contacted using a form of technology daily, and they were provided with a pedometer. The participants assigned to the Partial Intervention group (PI) were informed that they were in a group that will be contacted weekly via email, daily using a form of technology daily, and they were also provided with a pedometer. The Control group participants were simply asked to research information on the web regarding health behaviors with a few examples provided, and asked to report back weekly. They were not provided with contact for the next eight weeks regarding the content of their search and they were not provided with a pedometer.

The intervention was implemented using the *Healthy Together Instructors Manual* developed with support of a licensed clinical psychologist with work emphasis on child and adolescent obesity intervention. This manual provides a series of physical activity-based obesity prevention modules for children and adolescents ages 6-19. The manual provides four exercise options for each participant to choose from at the onset of the program: 1) a set of cardio exercises through an online video platform called YouTube or other cardio options, 2) daily pedometer usage with specific individualized goals, 3) both cardio exercise and pedometer usage,
and 4) no exercise. Two masters-level Clinical Psychology Graduate students were the instructors for this eight-week program. These students were candidates for a doctoral degree in Clinical Psychology at George Fox University with training in Motivational Interviewing.

The FI group was required to come into the Health and Counseling Center weekly for a 30-minute group psycho-education session. Attendance was tracked and recorded by one of the instructors at every meeting. Immediately following the group session, the participants in this group were asked to engage in 5-minute individual check-in sessions designed to track progress of goals, discuss barriers, and set new goals for the following week. A Motivational Interviewing approach (Miller & Rollnick, 2002) was employed during these check-in sessions. In addition, the FI group received daily contact using the participant’s preferred modality of technology (text message, email, or Facebook) determined at the time of gathering pre-intervention data through the demographics questionnaire.

The morning contact provided daily encouragement comprised of an inspirational quote. These quotes were chosen from a list of pre-selected motivational statements comprised of messages related to motivation and information about physical fitness (see Appendix D). The response from the participants to the morning contact was not required. Another contact via technology was provided in the late afternoon daily asking for each participant to respond with information regarding the duration of exercise and the recorded steps on the pedometer for the day. Each participant’s adherence to the program was tracked by their response rate each day to the afternoon texts, as well as the amount of physical activity recorded in the weekly activity log (see Appendix E). The observance made from these response rates were not used toward disqualifying a participant for the reasons of noncooperation but it was used as a way to gauge the level of intervention needed in bringing them to a level of adherence that is fitting for the
The PI group was provided with introductory information and further psycho-education material weekly via email. These emails were delivered on the same day that the FI group received their weekly in-person intervention for consistency of timing of intervention. The content of the email stayed consistent with the material delivered to the FI group in person, following the same psycho-education material based on the Healthy Together Instructors Manual. They were encouraged to read it on their own and respond to the worksheet questions via email to track engagement with the material. The PI group was also provided with same contact via technology that the full intervention received consisting of daily encouragement and reminders to track daily physical activity.

The Control group did not meet as a group throughout the program and they were not contacted for the duration of the eight-week intervention. On the eighth week, they were given a reminder to return for the second round of measurements at week nine. At week nine, upon the completion of the post-intervention measures, the participants in the Control group received the same psycho-education material electronically. This group was given the email information to reach the instructors regarding the packet information up to eight weeks after the program was complete.

The FI group received technology intervention and in-person psycho-education, while the PI group received only the technology intervention and email-format psycho-education. The Control group did not receive any intervention until the end of eight weeks, at which time they received the psycho-education in an electronic format (see Table 1).

During week nine, the participants from all three groups were asked to return to the Health and Counseling Center to complete post-intervention measures of 1) blood pressure, weight, and
height, and 2) post-test intervention measures (see Appendix C), comprised of BASC-2, General Self-Efficacy scale, and Exerciser Checklist. The participants were assigned to individual rooms at the Health and Counseling Center to fill out the measures in order to prevent distractibility. Further, feedback was solicited regarding their personal experience with the group assignment and the overall psychoeducational opportunity of the program on their health behavior.

Table 1

Schedule of Three Intervention Groups

<table>
<thead>
<tr>
<th>Week</th>
<th>Full Intervention</th>
<th>Partial Intervention</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Pre-intervention measures</td>
<td>Pre-intervention measures</td>
<td>Pre-intervention measures</td>
</tr>
<tr>
<td>1</td>
<td>IP, T</td>
<td>Email M, T</td>
<td>No contact</td>
</tr>
<tr>
<td>2</td>
<td>IP, T</td>
<td>Email M, T</td>
<td>No contact</td>
</tr>
<tr>
<td>3</td>
<td>IP, T</td>
<td>Email M, T</td>
<td>No contact</td>
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<tr>
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<td>IP, T</td>
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<tr>
<td>8</td>
<td>IP, T</td>
<td>Email M, T</td>
<td>No contact</td>
</tr>
<tr>
<td>9</td>
<td>Post-intervention measures</td>
<td>Post-intervention measures</td>
<td>Post-intervention measures + Email M</td>
</tr>
</tbody>
</table>

Note. IP= in-person intervention; T= technology; M = program manual
Measures

Behavior Assessment System for Children-2 (BASC-2), SRP, College Version. The BASC-2 Self-Report of Personality for College students (BASC-2-SRP-CV, Reynolds & Kamphaus, 2004) was given at pre-intervention and post-intervention to assess for personality characteristics, affect, and self-perceptions of college students. This version of the BASC-2 is a measure of adaptive and maladaptive scales comprised of 185 items to be used for ages between 18-25. The College version includes scales such as Alcohol Abuse and School Maladjustment to address issues that are more pertinent to this specific age group. The six subscales of the SRP-CV include Social Stress, Anxiety, Depression, Sense of Inadequacy, Self-Esteem, and Self-Reliance and the measure yields one global Emotional Symptoms Index (ESI) score (Nowinski, Furlong, Rahban, & Smith, 2008). The internal consistency reliability of the composite scores range from middle .80’s to middle .90’s, and the internal consistency reliability of the primary scales range from middle .70’s to upper .80’s (Reynolds & Kamphaus, 2004). The SRP-CV scales were found to be generally consistent over a 5-week period, with Spearman rho correlations ranging from .46 to .87, depending on subscales. Intraclass correlations ranged from .62 to .93 (see Table 2.1). All test-retest correlation coefficients were moderate to large in size. These results suggest that SRP-CV shows significant temporal stability to assess the self-reported behavior and personality of an individual (Nowinski et al., 2008).

General Self-Efficacy Scale. Self-Efficacy was measured using the General Self-Efficacy Scale (GSE, Schwarzer & Jerusalem, 1995). Self-Efficacy is defined as a “broad and stable sense of personal competence to deal effectively with a variety of stressful situations” (Schwarzer & Jerusalem, 1995). GSE reflects a person’s generalized judgment of own efficacy in various domains (Luszczynska & Schwarzer, 2005). The GSE is a brief, self-administered
scale consisting of 10 items with statements soliciting answers on a 4-point Likert scale ranging from *not at all true* to *exactly true* (see Appendix C). The sum of all 10 items yields a final composite score, ranging from 10 to 40. Higher scores on this measure indicate a high level of General Self-Efficacy. In samples from 23 nations, Cronbach’s alphas for GSE ranged from .76 to .90 (Scholz, Gutiérrez-Doña, Sud, & Schwarzer, 2002). Criterion-related validity reported in various correlation studies found favorable positive coefficients for emotions, dispositional optimism, and work satisfaction and negative coefficients for depression, anxiety, stress, burnout, and health complaints.

**Exerciser Checklist.** The Exerciser Checklist, developed by Mark H. Anshel (2006) and adapted by Kameron C. Dill (2009), was used for measuring the students’ value of physical activity at pre- and post-intervention in order to find the possible effect of the intervention on each participant’s change in value of physical activity. The Exerciser Checklist was not used as an exclusionary measure for participation in the program but rather to assess each participant’s baseline value of physical activity as well as the effect of the intervention on this construct.

**Exercise Log Sheet.** The participants were asked to log the number of minutes they spent in physical activity on a daily basis using a paper form provided (see Appendix E), and electronically report the same result to the instructors daily via text, email, or Facebook to maintain established connection. These exercise log sheets were submitted to the instructor during the weekly check-ins for the full intervention group. The partial intervention group submitted their daily progress via text, email, or Facebook and submitted their weekly log sheets via email following a weekly reminder. This measure was used as an assessment of overall adherence to the program and as a tool to guide the weekly check-in sessions.
Weekly Check-In Form. During the weekly individual check-ins, the participants in the FI group had an opportunity to discuss possible barriers to goal attainment and celebrate achievement of goals with one of the masters-level instructors. The individual check-ins took place immediately after the group psycho-education session. The PI group was given an opportunity to discuss the same content via email format weekly. A numerical value for their motivation level was elicited each week on a scale of 1-10, along with their rationale for their chosen motivation number. This form is provided in Appendix F.

Physical Measures. Blood pressure, height, and weight were measured for each participant one week prior to start of intervention. The post-intervention measures for blood pressure, height, and weight were completed two weeks after the 8-week intervention, due to the scheduling of Spring Break the week immediately following the end of intervention. The measure at pre-intervention provided a baseline for each individual’s level of physical fitness and physiological status. The baseline provided by these measures at the onset of the program was used to determine those changes resulting from the 8-week intervention program.

The weight and height information was used in an algorithm to determine the Body Mass Index (BMI=weight (lb) / [height (in)]^2 x 703), since BMI is easy to measure, has high test-retest reliability, is cost-effective, and easily accessible (Stice et al., 2006). Although BMI does not directly measure body fat, it is correlated with high health risk markers such as high blood pressure, diabetes, and insulin levels among other diseases (Stice et al., 2006).
Chapter 3

Results

The obesity intervention program utilizing technology and in-person delivery methods was assessed. Demographic characteristics of each of the three groups at the outset of the study are found in Table 2. Analyses of age and ethnicity were conducted to determine if the three groups were equivalent before the intervention was started. No difference in age ($F(2,27) = 1.29, p = .29$) or % of non-white participants ($\chi^2 (2) = 1.02, p = .38$) was found. Using a one-way ANOVA, the Partial Intervention (PI) group was found to have a lower grade point average than the Full Intervention (FI) and Control groups ($F(2,23) = 4.42, p = .02$). 32% of the total sample received some incentive for participating in the study and those recipients were evenly distributed across three groups, as indicated in Table 2 ($\chi^2 (2) = .033, p = .87$). Of the technology options provided (email, text messaging, Facebook) for communication throughout the program, 36.7% of participants preferred email (FI= 5, PI= 2, C= 4), 63.3% preferred to be contacted via text message (FI= 5, PI= 8, C= 6), and none of the participants opted to be contacted through Facebook, ($\chi^2 (2) = .2.01, p = .37$).

Based on the Body Mass Index calculations at the onset of the program, each participant was classified based on the CDC growth chart (2000) providing body mass index-for-age percentiles for girls. Overall, 15 girls were within normal ranges for BMI, 11 girls were classified overweight (between 85th and 95th percentile), and 4 girls were classified obese (over
95th percentile). In order to determine any difference between the three groups for the BMI classifications prior to the start of the interventions, a chi square analysis was conducted. The distribution of normal, overweight, and obese participants did not vary significantly across groups at T1 ($\chi^2(4) = 5.17, p = .27$).

In order to further establish the equivalence of groups at baseline with regard to all of the T1 dependent variables noted in Table 3, a one-way ANOVA was conducted to examine group differences for each of the physiological variables (weight, height, BMI, and blood pressure), and the psychological variables of self-efficacy and motivation for exercise. In addition, a repeated measures ANOVA was conducted for the psychological variables contributing to the ESI index score (anxiety, depression, inadequacy, self-reliance, social stress, and self-esteem). A separate one-way ANOVA was also conducted for the ESI, which is a composite index of the aforementioned psychological variables. The assumption of equal variances was met on all T1 dependent variables except the BMI, for which a Welch’s ANOVA value was employed for BMI. All of the above ANOVAs yielded no significant differences between the groups at T1; the ANOVA values are reported in Table 3. Thus, the equivalence of the groups at the outset of the study was established for each of the dependent variables utilized.

The first hypothesis of this study stated that the FI group would yield the highest compliance rate followed by the PI group, and the PI group would yield a higher compliance rate than the Control group. Treatment compliance was analyzed to determine whether it may have influenced a particular intervention regimen. Compliance, meaning involvement with the material provided, was defined as engagement in 50% or more of the ten possible meetings (pre- and post-intervention meetings and 8 treatment sessions) using any method of communication (in-person, email, or text) measured by the number of weekly responses from the participant.
Table 2

Mean (SD) or Percentage of Various Characteristics of each Subgroup at Baseline

<table>
<thead>
<tr>
<th>Variables</th>
<th>Full Intervention (n=10)</th>
<th>Partial Intervention (n=10)</th>
<th>Control (n=10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>18.2 (0.4)</td>
<td>18.4 (0.5)</td>
<td>18.6 (0.7)</td>
</tr>
<tr>
<td>GPA</td>
<td>3.6 (0.4)</td>
<td>3.1 (0.5)</td>
<td>3.7 (0.3)</td>
</tr>
<tr>
<td>BMI Distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WNR</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
</tr>
<tr>
<td>Overweight</td>
<td>50%</td>
<td>20%</td>
<td>40%</td>
</tr>
<tr>
<td>Obese</td>
<td>10%</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>70%</td>
<td>80%</td>
<td>50%</td>
</tr>
<tr>
<td>Nonwhite</td>
<td>30%</td>
<td>20%</td>
<td>50%</td>
</tr>
<tr>
<td>Incentive (%)</td>
<td>70%</td>
<td>60%</td>
<td>70%</td>
</tr>
</tbody>
</table>

Note. GPA = grade point average; BMI = body mass index; WNR = within normal range

The average number of compliance observed by participants weekly over the 10-week period was assessed for each of the three intervention groups. The FI group was compliant an average of 6.7 weeks (SD = 3.1), PI group was compliant an average of 5.3 weeks (SD = 3.6), and the Control group was compliant an average of 2.7 weeks (SD = 3.3). To examine if there was a difference in rate of compliance across the three groups, a one-way ANOVA was completed. A significant difference between subgroups in program compliance was obtained (F(2, 18) = 3.73, p = .037, eta² = .07), with compliance in the FI group significantly greater than
the control group, but not significantly different from the PI group. The results indicate that the intervention methods of in-person and technology vs. technology only did not differ significantly in compliance, although some form of ongoing communication seemed to be more effective for promoting compliance than absence of communication for the duration of the program. Lastly, there seemed to be a statistically significant correlation between the number of attendance and the presence of an incentive ($r = .95, p < .01$).

Given the varying rates of compliance in each of the three groups and the limited number of participants with completed measures at T2 (shown in Table 6), it was deemed worthwhile to include an additional group called “noncompliant” made up of noncompliant participants who may differentially affect the dependent variables under consideration. Accordingly, sixteen participants engaged in fewer than 4 meetings and so were eligible to be assigned to the noncompliant group (three from the FI group, five from the PI group, and eight from the Control group). However, of the sixteen participants who did not engage in more than 50% of the 10 sessions, only five participants completed T2 measures and so these five comprised the noncompliant group analysis (two from the FI group and three from the PI group). This noncompliant group was used in future analyses of dependent variables to test this study’s other hypotheses in place of or in addition to the Control group data in order to observe various relationships with noncompliance. It should be noted that in any analyses in which FI, PI or Control groups are being compared to the non-compliant group, the number of participants for the FI, PI and Control groups has been reduced, accordingly, as the identified noncompliant participants were removed to create an independent noncompliant group.
### Table 3

**Means and SDs of Physiological and Psychological Variables for Each Subgroup at T1**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Full Intervention (n=10)</th>
<th>Partial Intervention (n=10)</th>
<th>Control (n=10)</th>
<th>F</th>
<th>d(f)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lbs)</td>
<td>150.4 (27.1)</td>
<td>161.8 (39.7)</td>
<td>133.1 (23.4)</td>
<td>2.20</td>
<td>2(27)</td>
<td>0.13</td>
</tr>
<tr>
<td>Height (in)</td>
<td>64.3 (3.7)</td>
<td>64.4 (3.1)</td>
<td>62.7 (2.3)</td>
<td>0.95</td>
<td>2(27)</td>
<td>0.40</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>25.5 (3.7)</td>
<td>27.5 (6.8)</td>
<td>23.8 (27)</td>
<td>1.34</td>
<td>2(27)</td>
<td>0.29*</td>
</tr>
<tr>
<td><strong>Blood Pressure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>124.3 (11.2)</td>
<td>120.7 (13.5)</td>
<td>125.9 (8.0)</td>
<td>0.57</td>
<td>2(27)</td>
<td>0.57</td>
</tr>
<tr>
<td>Diastolic</td>
<td>74.2 (6.1)</td>
<td>77.1 (7.6)</td>
<td>71.3 (3.5)</td>
<td>2.36</td>
<td>2(27)</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Self-Efficacy</strong></td>
<td>57.0 (8.3)</td>
<td>53.0 (7.4)</td>
<td>57.0 (7.6)</td>
<td>0.91</td>
<td>2(27)</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td>43.0 (8.7)</td>
<td>39.7 (8.8)</td>
<td>43.8 (5.8)</td>
<td>0.76</td>
<td>2(27)</td>
<td>0.48</td>
</tr>
<tr>
<td><strong>ESI</strong></td>
<td>49.4 (4.7)</td>
<td>50.5 (5.1)</td>
<td>47.5 (4.9)</td>
<td>0.95</td>
<td>2(27)</td>
<td>0.40</td>
</tr>
<tr>
<td>Anxiety</td>
<td>51.2 (11.5)</td>
<td>51.7 (9.4)</td>
<td>50.1 (8.9)</td>
<td>0.07</td>
<td>2(27)</td>
<td>0.94</td>
</tr>
<tr>
<td>Depression</td>
<td>46.1 (5.9)</td>
<td>47.3 (4.9)</td>
<td>44.4 (3.1)</td>
<td>0.94</td>
<td>2(27)</td>
<td>0.40</td>
</tr>
<tr>
<td>Inadequacy</td>
<td>49.7 (10.5)</td>
<td>48.6 (9.0)</td>
<td>45.4 (4.6)</td>
<td>0.71</td>
<td>2(27)</td>
<td>0.50</td>
</tr>
<tr>
<td>Self-Reliance</td>
<td>53.0 (9.8)</td>
<td>47.2 (7.5)</td>
<td>54.9 (7.8)</td>
<td>2.27</td>
<td>2(27)</td>
<td>0.12</td>
</tr>
<tr>
<td>Social Stress</td>
<td>47.6 (8.7)</td>
<td>49.7 (7.9)</td>
<td>48.4 (8.3)</td>
<td>0.16</td>
<td>2(27)</td>
<td>0.85</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>45.9 (6.4)</td>
<td>47.9 (6.3)</td>
<td>49.2 (5.5)</td>
<td>0.75</td>
<td>2(27)</td>
<td>0.48</td>
</tr>
</tbody>
</table>

*Note. BMI= body mass index; ESI = emotional symptoms index. *Welch’s ANOVA value.
The second hypothesis stated that the FI group would show a higher physical activity level measured by minutes of activity and number of steps than the PI group. Number of steps was determined by the pedometer reading reported by the participants at the end of each day for the duration of the program. Minutes of activity was determined by adding the daily recorded minutes of exercise on the Exercise Log sheet tracked by each participant in a given group. An independent t-test was computed comparing the total number of steps recorded by the FI and PI groups; it was found that those in the FI group did not differ significantly from the PI group \((t(10) = .35, p = .73)\). Since the control group was not provided with instructions for physical activity or asked to record their movement levels, this group was not included in the analysis. Instead, the FI and PI groups were then compared to the noncompliant group to assess for possible compliance factor contributing to physical activity. A one-way ANOVA was computed between the performance of the FI, PI, and noncompliant groups and showed that the number of steps recorded by those in the FI group was significantly greater than those of the noncompliant group \((F(2,15) = 5.41, p = .01, d = 1.7)\), displaying a large effect size. It was found that PI group did not differ significantly from the noncompliant group but the analysis yielded a very large effect size \((d = 2.61)\). A one-way analysis was conducted focusing on minutes of activity for the FI, PI and noncompliant groups; a significant difference between the groups was found \((F(2,15) = 3.99, p = .028)\) but post-hoc analyses showed no significant difference between any two groups. The mean number of total steps and minutes of total activity recorded at T2 by those in the FI, PI and noncompliant groups are provided in Table 4.

The third hypothesis stated that those in the FI group would experience a greater decrease in weight between T1 and T2 than the PI and Control groups. Additionally, it was hypothesized
that the PI group would show a greater decrease in weight than the Control group between T1 and T2. Based on the limited number of Control group participants that completed T2 weight measurements \((n = 3)\), the noncompliant group was added to the analysis of weight change. Table 3 shows the scores for T1 dependent variables, and Table 6 the corresponding T2 values. A 2 (T1 vs T2) x 4 (group) repeated measures ANOVA was used to evaluate whether the weight in the participants across the four groups changed from T1 and T2. No significant main or interaction effects were obtained. However, the partial eta squared, an estimate of effect size, was large for both the main effects of time and group as well as their interaction; the values for this analysis are summarized in Table 5. This large effect size suggests that if the sample sizes had been larger, these weight differences might have shown significant change. Therefore, taken overall, no significant change in weight was observed across groups at week ten measurements as a result of the intervention.

Table 4

**Mean (SD) Number of Total Steps and Minutes of Activity at T2 for Compliant Participants in the FI, PI, and NC groups and p values for group differences**

<table>
<thead>
<tr>
<th>Variables</th>
<th>FI ((n=7))</th>
<th>PI ((n=5))</th>
<th>NC ((n=5))</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps</td>
<td>304875.1 (199134.1)</td>
<td>269821.0 (109770.7)</td>
<td>35575.4 (36279.4)</td>
<td>0.01</td>
</tr>
<tr>
<td>Minutes of Activity</td>
<td>1430.0 (651.2)</td>
<td>1490.4 (1361.8)</td>
<td>148.2 (205.1)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

*Note. FI= full intervention group; PI = partial intervention group; NC= noncompliant group*
Table 5

Summary Table for 2(T1 vs T2) x 4 (groups) ANOVA for Weight

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>df</th>
<th>p</th>
<th>Partial eta²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>25.8</td>
<td>25.8</td>
<td>2.96</td>
<td>1</td>
<td>0.11</td>
<td>0.165</td>
</tr>
<tr>
<td>Group</td>
<td>8727.58</td>
<td>2909.2</td>
<td>1.29</td>
<td>3</td>
<td>0.32</td>
<td>0.204</td>
</tr>
<tr>
<td>Interaction</td>
<td>17.42</td>
<td>5.81</td>
<td>0.66</td>
<td>3</td>
<td>0.59</td>
<td>0.118</td>
</tr>
<tr>
<td>Error within</td>
<td>130.68</td>
<td>8.71</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error between</td>
<td>33962.88</td>
<td>2264.19</td>
<td></td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. T1= pre-treatment; T2=post-treatment; SS= type III sum of squares; MS= mean square.

The final hypothesis stated that, compared to PI and the control groups, the FI group would show more improvement in the psychological measures found on the ESI (anxiety, depression, social stress, inadequacy, self-esteem, and self-reliance) as well as the composite ESI score; similarly, FI self-efficacy and motivation for exercise measures would be greater when compared to PI and control groups, between T1 and T2. The measures for each of these psychological variables at T1 and T2 can be found in Tables 3 and 6, respectively. Table 7 provides a comparison of the aforementioned variables at T1 and T2 and the percentage of change observed.

A 2 (T1 v. T2) x 4 (groups) repeated measures ANOVA using T score values was conducted to examine the effect of intervention on each of the six ESI subtests. Each of these analyses yielded no significant main effect or interaction effect. A 2 (T1 v. T2) x 4 (groups) repeated measures ANOVA was also conducted using the ESI composite score. Despite its
higher reliability, the analysis of the ESI score was also found non-significant; no significant main effect \( (F(1,15)= 2.65, p = .13) \) or interaction effect was observed for ESI \( (F(3,15) = 3.08, p = .06) \). Therefore, it was concluded that there was no impact of the intervention on the psychological variables contained in the ESI. A 2 (T1 v. T2) x 4 (groups) repeated measures ANOVA using T score values was conducted for Self-Efficacy and a significant main effect was observed \( (F(1,15)= 11.44, p = .004) \) but no interaction effect was observed \( (F(3,15)= 1.55, p = .24) \). Overall, self-efficacy improved for all groups as indicated in Figure 1. A 2 (T1 v. T2) x 4 (groups) repeated measures ANOVA was conducted for Motivation for exercise and a significant main effect was observed for Motivation for exercise \( (F(1, 15)= 19.74, p < .001) \) and a significant interaction effect was observed \( (F(3, 15)= 3.69, p = .036) \). Overall, motivation for exercise improved for all groups over time as indicated in Figure 2.
Figure 1. The effect of intervention type (Full Interventio
n, Partial Intervention, Control, and Noncompliant groups) on reported self-efficacy between Time 1 and Time 2.

Figure 2. The effect of intervention type (Full Intervention, Partial Intervention, Control, and Noncompliant groups) on motivation for exercise between Time 1 and Time 2.

In order to determine the predictive relationship between the various physical and psychological dependent variables of this study at T1, on compliance, minutes of activity, and steps, a correlation matrix was constructed and appears as Table 8. These correlations were calculated since knowing what factors at the onset of a program predicted subsequent compliance and physical activity levels would be helpful in understanding the influence of
participant characteristics in future obesity intervention programs. Specific findings that were of special interest included a significant positive correlation between Self-Efficacy and Motivation for exercise \((r = .56, p < .01)\) indicating that self-efficacy was highly correlated with a person’s motivation for exercise; however, this relationship with the Self-Efficacy measure was not found with Compliance, Minutes of Activity, or Steps. It is also noteworthy that, as expected, Self-Efficacy had a significantly negative correlation with Depression \((r = -.63, p < .01)\) and Social Stress \((r = -.54, p < .01)\). These data indicate that, understandably, those in this study with higher levels of depression and social stress did not feel self-efficacious.

The variables related to depression and social stress were considered further. Social Stress was negatively correlated with Motivation for exercise \((r = -.55, p < .01)\), Self-Efficacy \((r = -.54, p < .01)\), Self-Reliance \((r = -.53, p < .01)\), and Self-Esteem \((r = -.44, p < .05)\). Although Social Stress did not yield a significant correlation with Compliance in the program, it remains an important variable to consider in obesity intervention programs highlighting the significance of social support in promoting motivation for exercise and a sense of self-efficacy, self-esteem, and self-reliance. Consistent with research (Aanes, 2005; Dumont & Provost, 1999; Krull, 2012), Social Stress was positively correlated with Depression \((r = .61, p < .01)\).

Depression was the only variable significantly correlated with Compliance \((r = .38, p < .05)\), indicating, contrary to popular understanding, that those with a higher level of depression can show greater compliance. However, it is important to note that the mean values of depression gathered from the BASC-2 for each of the FI, PI and Control groups did not exceed the normal range of depression (i.e., \(T > 70\)); therefore the depression scores reported in this study do not represent those who would be clinically diagnosed as depressed. Further, the data showed a significant negative correlation between Depression and Motivation for exercise \((r = -\)
.63, \( p < .01 \), indicating that those individuals with higher levels of depression showed lower motivation for exercise. The implications of the discrepancy between actual compliance vs. reported motivation for exercise will be discussed further in the following chapter.