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# A Weight Intervention Dismantling Study: The Effect of Social Support and Self-Monitoring on Weight Management in College Students

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# A WEIGHT INTERVENTION DISMANTLING STUDY: THE EFFECTS OF SOCIAL SUPPORT AND SELF-MONITORING ON WEIGHT MANAGEMENT IN COLLEGE STUDENTS

by
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ABSTRACT
KATHRYN LOUISE PRENDERGAST: A Weight Intervention Dismantling Study: The Effects of Social Support and Self-Monitoring on Weight Management in College Students (Under the direction of John Young, Ph.D.)

Evidence shows that psychological intervention with obese individuals facilitates improved diet, increased physical activity, weight loss, and maintenance of stable body weight over time. These interventions use techniques derived from broader theory and empirical work related to the health belief model (HBM), theory of planned behavior (TPB), and social cognitive theory (SCT) to target general health behaviors in terms of diet, patterns of eating, sleep, stress, and level of physical activity. These behaviors have been effectively targeted by multi-component evidence-based practices utilizing self-monitoring and social support: two common components that facilitate implementation, requiring few resources. While evidence suggests that interventions including these components improve weight management, it is unclear what either components' individual effect on weight management is, or whether they interact to effect weight management. The present study aimed to investigate this relationship. Participants were randomly assigned into one of four experimental groups: social support alone, self-monitoring alone, combined social support and self-monitoring, and a control. All groups received psychoeducation in nutrition, exercise and injury prevention, and established goals for body weight. All groups met with the investigator on a weekly basis to weigh themselves and complete self-report measures of social support. Participants in social

support conditions met twice a week and those in self-monitoring conditions utilized MyFitnessPal daily to record nutrition, physical activity, and emotion and cognitions surrounding these behaviors. Manipulated groups reported additional adherence data each week. Results were calculated using a 2x2 ANOVA, and indicated no significant main effects for social support or self-monitoring on mean weekly weight change, as well as no significant interaction effect on mean weekly weight change. Additionally, a regression analysis was run to determine if scores on the social support self-report measure predicted mean weekly weight change, and no significant prediction was found. Subsequently, graphical analysis of this pilot study data, accounting for the low statistical power and likelihood of Type II error, showed the control group yielded a mean weekly weight change in the positive direction while intervention groups yielded changes in the negative direction, with the combined group showing the greatest weight loss. Future research should consider repeating the intervention with larger groups and examine the differential effects of social support subtypes on weight management.

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LIST OF ABBREVIATIONS

| | |
|---|---|
| HBM | Health Belief Model |
| TPB | Theory of Planned Behavior |
| SCT | Social Cognitive Theory |
| TTM | Transtheoretical Model |
| HPA | Hypothalamic-Pituitary-Adrenal |
| PA | Physical Activity |
| RCT | Randomized Controlled Trials |
| SSSM | Social Support and Self-Monitoring Group |
| SS | Social Support Only Group |
| SM | Self-Monitoring Only Group |
| C | Control Group |
| WHO | World Health Organization |
| SSEHS | Social Support for Eating Habits Survey |
| SSES | Social Support for Exercise Survey |

# INTRODUCTION

Weight management has become a crucial component of primary care as rates of obese and overweight individuals in America continue to rise. According to the Center for Disease Control and Prevention (CDC), 28.9% of adults and 13.9% of children in the United States are obese and experience resultant health risks, social adversities and negative economic impacts ("Nutrition, Physical Activity, and Obesity," 2017). Another third of the population is overweight and experiences similar adverse effects, according to the National Institute of Health (NIH; Fryar & Ogden, 2012). Weight management costs the US more than $147 billion annually (Finkelstein et al., 2009), and nowhere are the effects as notable or ubiquitous as in Mississippi where the rate of adolescent obesity (18.9%) is the highest in the nation, and the rate of adult obesity is tied for second (35.6%; Center for Disease Control and Prevention, 2017). This is particularly problematic in the medically underserved, economically disadvantaged context of Mississippi given the physical and social consequences of being overweight or obese over the lifespan. For example, obese and overweight individuals have elevated risk for cardiovascular disease, cancer, chronic pain, pulmonary disorders, and Type 2 Diabetes (Center for Disease Control and Prevention, 2017). Additionally, the risks for impaired social, emotional, physical, and cognitive functioning are greatly elevated, and overweight people are often the focus of social stigma (Taylor, 2010). Thus, there is a need for effective weight management interventions, and the literature has produced

extensive evidence for select interventions derived from broader theory and empirical work related to the health belief model (HBM; Rosenstock, 1966), the theory of planned behavior (TPB; Ajzen 1991), social cognitive theory (SCT; Bandura, 1977), and the transtheoretical model (TTM; Prochaska & Velicer, 1997).

The HBM says that an individual's likelihood of practicing a target health habit is determined by both the individual's perceived threat of a given health condition and the individual's perceived efficacy of performing the health habit (Rosenstock, 1966). The component perceived threat is composed of perceived susceptibility to the condition and the perceived seriousness of the illness, while the component perceived efficacy is composed of perceived benefits for taking action and barriers to taking action (Rosenstock, 1966). Rosenstock posits that an individual's perception of these factors, rather than objective facts about these factors, affect health behavior. Many studies have investigated this model as it applies to weight management, finding mixed evidence.

The HBM has been applied to weight management relevant behaviors. Nejad and colleagues (2005) investigated how HBM variables predict follow-up dieting and fasting in a college-aged female sample; this study will only reference the results for dieting, however, because fasting was conceptualized as a possible indicator of disordered eating, which is less relevant to the study at hand. HBM related variables assessed included perceived benefits and barriers, susceptibility, and health values. Additionally, assessment of individual intention was also included given that the study compared the HBM and the Theory of Planned Behavior (TPB), which includes behavioral intention (Nejad et al., 2005). They found that with the addition of intention to the HBM model, 38.3% of the variance in follow-up dieting was explained; however, it was also found that

the construct of intention was the stronger predictor within the HBM model (Nejad et al., 2005). These results indicate that perceived benefits and perceived severity of threat are predictors of intention to change, but that the non-HBM variable intention is more closely related to behavioral change.

To elaborate on the Theory of Planned Behavior (TPB), this is a model that incorporates individual behavioral intention to offer a theoretical rationale as to what drives health decisions. The TPB states that behavior can be directly predicted by behavioral intention (Ajzen, 1991). According to the TPB, an individual's behavioral intention is composed of his/her attitudes about the action, subjective social norms about the action, and perceived behavioral control (Ajzen, 1991). Ajzen describes perceived behavioral control as one's confidence in their ability to perform a behavior and compares it to Bandura's construct of self-efficacy, which will be discussed further as a central component of Social Cognitive Theory (Ajzen, 1991; Bandura, 1982). The TPB does not directly address motivation, but it proposes that behavioral intention captures motivational drives to engage in the behavior, including how hard an individual will work at the behavior.

The TPB has also been applied to behaviors relevant to weight management such as dieting. Nejad and colleagues (2005) also investigated the predictive ability of the TPB on fasting and dieting. Again, this study will only reference the results for dieting. In their study, both the HBM and TPB models explained a significant proportion of the variance in follow-up dieting and intention (Nejad et al., 2005). Interestingly, in comparing the two models as predictors for follow-up dieting behavior, the HBM modified to include intention predicted 3% more of the variance than the TPB (Nejad et al., 2005). However,

the TPB predicted 10% more of the variance in intention to diet than the HBM plus intention (Nejad et al., 2005). These findings suggest that both models are significantly related to health behavior change in the case of dieting, but because they do not explain a stronger percent of the variance in weight management behavior and weight loss, these findings indicate that the process is more complex than the two models describe.

Social Cognitive Theory (SCT) is a more comprehensive behavior model that has been applied to health behavior. Formed by Bandura in 1977, SCT states that an individual's self-efficacy for a target behavior influences his or her engagement in the behavior, and that target behaviors are best accomplished through establishing proximal goals (Bandura, 1982). Self-efficacy is defined by Bandura as an individual's beliefs about his/her ability to perform an action (Bandura, 1977). SCT also says that outcome expectancies (e.g. physical and social) influence the relationship between self-efficacy and behavior (Bandura, 2009). Outcome expectancies are defined as an individual's anticipated consequences of taking said action and are differentiated from self-efficacy because they include social commendation and reproof, material benefits or losses, or self-approbation and/or self-reproof (Bandura, 2009). It also states that sociostructural factors of facilitators and impediments influence the relationship between self-efficacy and behavior, because the presence or lack of necessary resources, instructive guidance, and social support can either facilitate or impede a target behavior (Bandura, 2009). As applied to weight management, social support is an example of a sociostructural facilitator, and lack of healthy food availability could be an impediment. The literature has found support for the application of Social Cognitive Theory to weight management interventions.

For example, in a study by Palmeira and colleagues (2007), 142 overweight and obese women engaged in a short-term, university-based intervention based on Social Cognitive Theory. The intervention involved 15 weekly meetings involving both educational and practical components including education in exercise, nutrition, and behavior modification, teaching self-monitoring and planning techniques, and the distribution of pedometers to participants (Palmeira et al., 2007). The study assessed outcome variables associated with 4 different health behavior models (SCT, TPB, Transtheoretical Model, and Self-Determination Theory). SCT-specific outcome variables measured were self-efficacy, social support, and perceived barriers (Palmeira et al., 2007). Results for SCT variables indicated that only self-efficacy was a predictor for weight loss, but that changes in all three SCT variables were significantly related to change in weight, with self-efficacy and social support being positively associated with weight loss and perceived barriers negatively associated with weight loss (Palmeira et al., 2007). The only health behavior model that outperformed the SCT in predicting weight loss in this study was the Transtheoretical Model (TTM), which will be described in more detail below. The authors noted, however, that this difference was largely due to the model's ability to detect change in self-efficacy with each Stage of Change that it proposes, as self-efficacy accounted for 19.4% of the variance in weight change independently (Palmeira et al., 2007). These findings indicate the strength of applying SCT to understand and predict weight management behaviors and provide evidence for the importance of addressing self-efficacy, social support, and perceived barriers in weight management interventions. The SCT is the only behavior model here discussed that includes extrinsic factors, and its success at modeling behavior change in a weight

intervention context suggests the importance of considering interventions within a systemic model of weight management rather than solely emphasizing individual factors.

The transtheoretical model (TTM), defined by Prochaska and Velicer (1997), posits that health behavior change occurs in a process progressing through a series of stages. These stages include precontemplation, contemplation, preparation, action, maintenance, and termination (Prochaska & Velicer, 1997). In the precontemplation stage, individuals are not yet considering taking action. In the contemplation stage, individuals realize the problematic nature of their current behavior and begin to consider making a change. The preparation stage occurs when the individual has decided to make a change in the behavior and may begin taking small steps. The action stage occurs when an individual is modifying their problematic behavior or developing new healthy behaviors. The maintenance stage happens once an individual has sustained behavior change for six months and works to prevent relapse. Finally, during the Termination stage, an individual no longer faces the temptation of a problem behavior.

The literature has found conflicting evidence on the usefulness of the TTM for modeling health behavior change. For example, a Cochrane systematic review of 5 studies that used the TTM as an intervention framework for weight management found that TTM interventions had limited impacts on weight loss, and that there was no conclusive evidence for sustainable weight loss (Tuah et al., 2011). Interestingly, as previously referenced, Palmeira and colleages (2007) found that the TTM had the greatest predictive ability in determining weight loss, but the authors noted that this was largely Nodue to the variation in self-efficacy— a component shared by the SCT, TPB and HBM— between stages of change in the TTM. These findings point to the lack of

demonstrable utility of using the TTM as a basis for interventions, but emphasize the importance of the difference in self-efficacy between stages of change. (As the SCT describes, increases in self-efficacy may be due to a variety of factors, including personal and sociostructural influences.)

Drawing on these more general models, the literature on the application of health behavior change models to weight management therefore points toward a more comprehensive model that encompasses both individual factors and extrinsic, sociostructural factors influencing target health behaviors. For example, in a broader sense, the literature shows that people with more money, education, social support, and youth, and less stress, have been shown to practice better health habits (Gottlieb & Green, 1984; Hanson & Chen, 2007). These personal and sociostructural factors may all influence self-efficacy as Bandura described, and point toward a framework for understanding weight management that is a multi-level, systems-oriented model encompassing individual, societal, and biopsychosocial factors that affect weight change.

Glass and McAtee (2006) describe a framework of this complexity. This model of weight management says that two factors have causal effects on weight: birth weight/early experiences as well as the health behaviors of energy input and energy expenditure (Glass and McAtee, 2006). It also says that the latter is amenable to change via risk regulators and psychobiological factors (Glass and McAtee, 2006). Psychobiological factors have a direct effect on energy input and expenditure and include hypothalamic-pituitary-adrenal (HPA) axis hormones, mood, metabolism, appetite, and genes (Glass and McAtee, 2006). Alternatively, risk regulators have indirect effects on both psychobiological factors and energy input and expenditure, and these include

cultural norms, area deprivation, psychosocial hazards, built environments (i.e. physical structure of the environment including connectivity and walkability), local food environment, and commercial messaging (Glass and McAtee, 2006). Risk regulators primarily affect individuals in "ground-level social conditions existing in schools, neighborhoods, and homes," (Glass and McAtee, 2006, p. 13) and they are closely related to Bandura's concept of sociostructural influences on self-efficacy in the SCT. Although this article was not a direct study involving data collection, Glass and McAtee (2006) described this model as a guide for future research directions based on the existing literature across behavioral public health disciplines.

On the basis of this model, then, intervention researchers have several domains through which to affect change—namely altering energy input and expenditure and factors affecting those health behaviors—and the literature has extensively investigated a multitude of intervention approaches that will be described in detail below (e.g., nutrition and physical activity education, social supports, and self-monitoring behaviors and cognitions). Cognitive behavioral approaches, which have theoretical roots in social cognitive theory, include several practice elements that address idiographic health issues amidst nomothetic challenges of the obesity epidemic, making this approach very appropriate considering the complex interactions of the individual and environment in influencing dieting and physical activity (as described by Glass and McAtee (2006)). To facilitate future implementation of an effective weight management intervention in University settings, practice elements of cognitive behavioral therapy requiring minimal resources are included in this study, and relevant review of practice elements and specific studies are included below.

**Nutrition and Physical Activity Education**

Psychoeducation through nutrition and physical activity (PA) education is widely supported by the literature on weight management interventions. For example, the National Weight Control Registry surveyed self-selected participants who lost at least 30 lbs and maintained it for a period of at least one year. They found that 89% of participants altered both diet and PA, 10% altered diet only, and 1% altered only PA (Wing & Phelan, 2005). These findings indicate the importance of addressing the need to change both feeding and energy expenditure behavior through weight management interventions, a conclusion that is consistent with the systems-oriented, multi-level framework (Glass & McAtee, 2006). These findings also suggest the superior importance of altering diet because the base rate of people who successfully lost and maintained weight without altering diet was only 1%.

Additionally, Johns and colleages (2014) conducted a systematic review dismantling components of several weight management Randomized Controlled Trials (RCTs). They included RCTs that had combined behavioral, nutrition and physical activity components, nutrition education components only, and physical activity education components only. They found that at a 3-6 month follow up the effects on weight loss were the same for nutrition only, physical activity, and combined interventions, but that at an 8-12 month follow-up, combined interventions led to greater weight loss than either component alone (Johns et al., 2014). These findings provide evidence for the necessity of including educational components for both nutrition and

physical activity in interventions, as well as including cognitive behavioral components, such as social support and self-monitoring.

**Social Support**

Social support is defined as knowing one is loved, cared for, esteemed, valued and part of network of communication and mutual obligation (Taylor, 2012). Social support can take many forms, including emotional support, informational support, and instrumental support (i.e., providing a service), and has extensive effects on psychological and physical well-being (Taylor, 2012). This is consistent with the multi-level framework for weight management, which suggests social environments influence eating behaviors and physical activity (Glass and McAtee, 2006). Interventions, therefore, have examined the individual effects of social support components, finding considerable effects on weight change.

For example, Lubans and colleages (2009) designed a weight-management intervention with adolescent high schoolers, where social support was delivered in conjunction with physical activity and nutrition education resulting in increased physical activity for males and females, and increased fruit and vegetable intake for girls (Lubans et al., 2009). Online social support interventions have also been found to be at least as effective as face-to-face, though they were not found to be necessarily more desirable and have limitations (Bensley et al., 2010). However, social support's effectiveness, even in a limited, online capacity, suggests that social support has utility in facilitating weight management and is an important component of weight management interventions.

**Self-Monitoring**

Self-monitoring involves the self-collection of cognitive and behavioral data. To the investigator's knowledge, no interventions have investigated the effects of self-monitoring on weight loss in isolated fashion (i.e., it has always been examined as part of a broader intervention involving multiple other techniques). These other intervention studies have most frequently incorporated this component into the design along with social support and other cognitive behavioral practice elements. For example, a study by Chambliss et al. (2011) compared two interventions: one involving nutrition education, PA education, and self-monitoring and another involving nutrition education, PA education, and an enhanced behavioral intervention involving social support, cognitive restructuring, time management, stress management, etc. They found that both interventions yielded significant effects on weight loss, but there was no statistically significant difference between the two interventions (Chambliss et al., 2011). These findings suggest that interventions including cognitive behavioral techniques are effective in improving weight loss, but suggest no differential or superior effects for self-monitoring versus the enhanced behavioral intervention that included social support.

Additionally, a randomized controlled trial by Wilfley et al (2007) examined two approaches to weight loss maintenance in children: one that used cognitive restructuring and self-monitoring to address motivation and health behavior change, and another that used only social support. Both groups resulted in significantly better weight loss maintenance than a control, but there was no significant difference in the results of both groups (Wilfley et al., 2007). These findings suggest evidence for the efficacy of weight management interventions that include cognitive behavioral components; however, they

do not explain which components of these interventions are most effective and/or central to their measurable success. These findings also do not explain why, thus far, there are no differential results when different components of these interventions are utilized in isolation. The literature has yet to provide evidence dismantling weight management interventions to understand the individual contribution of each intervention component to weight loss. Consequently, the necessity of including each component for a successful behavioral intervention is undetermined, leaving a gap in clinical knowledge.

The present study, therefore, investigates both the individual and combined effects of two cognitive behavioral components: social support and self-monitoring. These components are compatible in settings where there are limited resources, such as college campuses, and easily disseminated and implemented if found to be effective. These two components have been included in multi-component interventions that have withstood randomized controlled trial testing, but the literature is inconclusive on the individual contributions of each component. The current study aims to understand more about this issue through the use of a dismantling design to investigate four different interventions: social support and self-monitoring combined, social support only, self-monitoring only, and a control. Because of the abundant evidence suggesting that dietary and PA education are effective staples of weight management interventions, all four conditions will receive psychoeducation on nutrition and PA. The primary research objective is to understand both the individual and combined effects of social support and self-monitoring on weight loss in the context of an educational program about dietary behaviors and physical exercise. A secondary research objective was to understand the extent to which a social support group increases perceived social support, and whether

perceived social support was a better predictor of weight loss than involvement in the social support group.

# METHODS

## Trial Design

Participants were randomized into one of four conditions in a factorial design measuring independent variables Social Support and Self-Monitoring. The four conditions included: Social Support and Self-Monitoring combined (SSSM), Social Support only (SS), Self-Monitoring only (SM), and a control group (C).

## Participants

Participants (N=27) were recruited from the University of Mississippi via flyers and class announcements during group fitness classes and academic classes. In the recruitment script, participants were presented the benefits of possible weight loss, free intervention participation, and free education on the latest research, and were offered no other incentives (see Appendix A). Eligibility for the study required that individuals were seeking to lose or maintain weight, which was communicated during recruitment and

assessed via establishing an 8-week goal weight during the initial educational session with the experimenter.

**Interventions**

All participants met with the experimenter for an initial education session lasting approximately 30 minutes. During the initial education sessions, participants' weight and height were measured, a goal weight was established, and an educational presentation was given. The educational content and follow-up instructions were unique to each intervention group.

Participants in the control group (C) received only education in the latest nutrition and physical activity (PA) research and guidelines. This educational component communicated the nutritional and physical activity guidelines of the World Health Organization (WHO) and utilized two resources from the Harvard School of Public Health: a Healthy Eating Plate tool and Physical Activity Guidelines (WHO, 2017; Phares, 2013. Harvard University, 2011). This portion was common to all experimental groups.

Participants in the SS group received education in PA and nutrition, as well as education on research indicating the benefits of social support on weight management. They were presented in brief form the results from a systematic review on the benefits of social support for PA by the Community Preventative Services Task Force (Kahn et al., 2002). They were told that evidence has found that social support is related to increased total time and frequency of being physically active, that physical activity increased with increased frequency of social support interactions, that there was little difference between

the impact of highly structured vs. informal social support, and that social support also improved participants knowledge of exercise and confidence in their ability to exercise (Kahn et al., 2002). Additionally, these participants received instructions to meet with the other individuals in the SS group twice a week for a minimum of ten minutes each meeting. Suggestions were made for activities to comprise these meetings, including talking in the library, getting lunch, working out, etc.; however, choices regarding time, duration, and activities were left solely to the group members themselves. The group members were connected via GroupMe, an app that easily connects members of a group in a non-invasive format commonly used by college students.

Participants in the SM group received education in PA and nutrition, as well as education on the research of the benefits of self-monitoring for weight management and instructions on how to use MyFitnessPal to complete self-monitoring. Participants were presented in brief form results from a systematic review of the benefits of self-monitoring for weight management. They were told that evidence has shown that across 22 separate studies, more frequent self-monitoring was consistently and significantly associated with weight loss compared to less frequent self-monitoring (Burke et al., 2011). Participants in the group were educated in how to use MyFitnessPal, a free fitness tracking system available online or in app format (MyFitnessPal, 2017). The program contains daily nutrition and physical activity logs. The nutrition log provides the option to select from pre-entered data containing all of the nutrition facts for many food products available in grocery stores and common restaurants or manually enter in foods or recipes for foods cooked at home. The physical activity log estimates calories burned based on the intensity and type of activity selected (either from pre-entered activity options or one's

own manually inputted workout), users' reported height and weight, and time spent in the activity. The program even offers the option to connect a fitness tracker like a FitBit, Garmin, or even iPhone step counter. Both nutrition and physical activity logs contain a note section, where participants were instructed to write for each meal, snack, or bout of physical activity who they were with, time and location, emotions, and thoughts before, during, and after (See Appendix B). Participants were instructed to enter all nutrition and physical activity data every day, and daily logs were printed at follow-ups to monitor adherence.

The SSSM group received PA and nutrition education as well as education in research on the benefits of social support and self-monitoring for weight management. They also received instructions to meet with others in the SSSM group twice a week for at least ten minutes each time, and to self-monitoring for nutrition, PA, and emotions and cognitions surrounding target health behaviors each day. Effectively, this group combined all active components of all the other groups listed above.

Participants were asked to attend weekly follow-up sessions that lasted 10 minutes for 8 weeks. A weekly time for follow up sessions was scheduled at the end of the initial education session, and timing was adjusted via email communication as needed. During each follow-up session, weight change and perceived social support were assessed for all participants, adherence to self-monitoring was assessed for SM and SSSM participants, and adherence to social support meetings was assessed for SS and SSSM.

**Outcomes**

## Weight Change

Weight was measured using a digital scale. Each week, weight was measured and then computed into a weight change variable using SPSS, which documented the amount of weight lost or gained per week, as compared to the previous week.

## Social Support for Eating Habits and Exercise Surveys

Perceived social support was measured via the Social Support for Eating Habits Survey (SSEHS) and the Social Support for Exercise Survey (SSES; Sallis et al., 1987). Sallis and colleagues (1987) developed these scales with the intent of producing a measure that could assess the effectiveness of interventions aiming to increase social support for these two behaviors. The partner scales have four subscales, divided by support from friends and family, and positive vs negative support (See Appendix C, D, E). Psychometric support was found for the encouragement subscale of both friends and family on both scales, but none was found for the discouragement subscales (Sallis et al., 1987). Criterion-related validity was assessed by comparing the scales to actual dietary and PA behaviors, and significant positive correlations were found for the encouragement subscales (Sallis et al., 1987). Additionally, the test-retest reliability coefficients were moderate at 0.55-0.86, and internal consistencies tests produced high range values ($\alpha$= 0.61-0.91; Sallis et al., 1987). The test did not correlate to a more general measure of social support, which the authors suggested could be due to the large social networks of their college-aged participants. This could also be due to items on the scale used for convergent validity being more general in their measurement of social support (as opposed to more narrowly focused on eating and exercise behaviors). Considering the lack of support for the discouragement portion of the scale, and the greater relevance of

the friend social support subscale over the family subscale to college students, the present study utilized the encouragement portion of the friend subscale of both the SSEHS and the SSES.

### Self-Monitoring Adherence

Self-monitoring adherence was calculated based on percentage of requirements met, given a score out of 16 possible points each week: 7 points for daily food intake log, 7 points for daily food notes, 1 point for weekly exercise log, and 1 point for weekly exercise note.

### Social Support Adherence

Social Support adherence was assessed by asking for the date of the meeting and group members that attended. If members of a meeting reported matching data about the time and members present, the meeting was considered verified for the respective week. No participants gave unmatched information about social support meetings.

## Randomization

Once participants scheduled an initial session, they were randomized to conditions using the RAND function in Microsoft Excel. Participants' data sheets were then labeled with their condition, and the proper educational presentation and instruction set were administered accordingly.

## Statistical methods

Data analysis was conducted using a 2-Way ANOVA to examine the effect of social support and self-monitoring interventions on change in weight. Additionally, a *t*

test for Independent Means was used to assess whether the social support groups differed in perceived social support.

# RESULTS

## Participants

Participants meeting eligibility criteria of seeking to lose weight or maintain current weight (N= 26) were randomized into conditions: SSSM (N=6), SS (N=7), SM (N=7), and C (N=6). The attrition rate was 11.5 %. Participants were excluded from analysis (N=3) due to insufficient data if they attended less than 4 weeks of the 8 week intervention. Reasons given for attrition included physical health/doctor's orders (N=2) and not having time (N=1). The number of participants analyzed for each group was as follows: SSSM (N= 5), SS (N= 7), SM (N= 6), and C (N= 5).

## Recruitment

Recruitment occurred February 13-28, 2017 via on campus flyers and class announcements. Initial sessions assessing criteria and presenting education and instruction took place March 1-7, 2017. The eight follow-up sessions occurred once weekly from March 8, 2017- May 3, 2017.

## Analyses

After running descriptive statistics on mean weight change, it is evident that participants in groups SSSM, SS, and SM all had a negative mean weight change per week of M= -0.36 (SD=0.46), M= -0.12 (SD=0.35), and M= -0.29 (SD=0.67), respectively. The control group was the only group to have a positive mean weight change per week at M=0.13 (SD=0.52 See Figure 2.) The mean weight change per week for each group occurred weekly over the course of the 8 week intervention.

Univariate Analysis of Variance

Mean weight change was analyzed via a two-way analysis of variance by social support and self-monitoring conditions. Social support had two levels: participants in a Social Support condition (Groups SS and SSSM) and those with no social support condition (Groups SM and C). Self-Monitoring had two levels as well: participants in a Self-Monitoring condition (SM and SSSM) and those with no self-monitoring condition (Groups SS and C). The main effects and interaction were nonsignificant using a 95% confidence interval (See Table 3).

Table 1: Baseline Characteristics

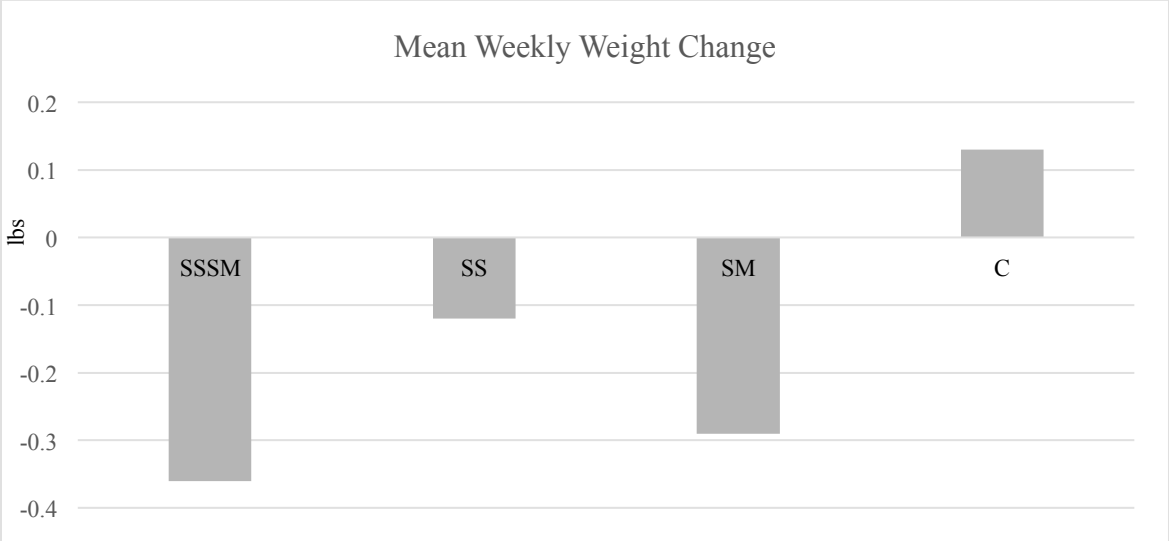
| **Baseline (Randomization)** | **SSSM** | **SS** | **SM** | **C** |
|---|---|---|---|---|
| Number of Subjects (n) | 5 | 7 | 6 | 5 |
| **Characteristics** | n (%) | n (%) | n (%) | n (%) |
| Race or ethnic group | | | | |
| White | 2(40) | 4(57.1) | 3(50) | 1(20) |
| Black/African American | 1(20) | 2(28.6) | 1(16.7) | 1(20) |
| Asian | 0(0) | 0(0) | 1(16.7) | 0(0) |
| Multiracial | 1(20) | 1(14.3) | 0(0) | 0(0) |
| Unknown | 2(40) | 0(0) | 2(33.3) | 3(60) |
| | | | | |
| | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) |
| Age (years) | 20.50 | 21.14 | 22.00 | 23.5 (3.53) |

| | | | | |
|---|---|---|---|---|
| | (1.29) | (4.06) | (3.54) | |

Descriptive Statistics

| Table 2: Mean Weekly Weight Change Descriptive Statistics | | | |
|---|---|---|---|
| Group | n | M | SD |
| SSSM | 5 | -0.36 | 0.46 |
| SS | 7 | -0.12 | 0.35 |
| SM | 6 | -0.29 | 0.67 |
| C | 5 | 0.13 | 0.52 |

Figure 2.




| Table 3: Analysis of Variance | | | |
|---|---|---|---|
| Condition | *df* | *F* | *p* |

| | | | |
|---|---|---|---|
| Social Support | 1 | 0.57 | 0.46 |
| Self-Monitoring | 1 | 2.31 | 0.15 |
| Social Support x Self-Monitoring | 1 | 0.17 | 0.68 |

*t* test for Independent Means

A *t* test for Independent Means was used to analyze the effect of the Social Support condition on mean scores of the SSEHS-Friends and SSES-Friends. No significant differences were found on either scale between individuals with or without the Social Support condition. Social support conditions had means of M= 10.01 and 20.15 on SSEHS and SSES, respectively. Those without the social support condition had means of M= 9.20 and 19.27 on the SSEHS and SSES, respectively.

Multiple Linear Regression

A multiple linear regression was calculated to predict mean weight change based on scores on the SSEHS and SSES. This analysis yielded non-significant results ($p = 0.070$; $R^2 = 0.003$). Thus, neither SSEHS nor SSES were significant predictors of mean weight change in this analysis.

Multiple Linear Regression with Bootstrapping

As a follow-up to the results of the multiple linear regression, the same regression was performed using bootstrapping (implemented because the sample violated the assumption of normality for regression analysis, which is accounted for by this approach

to generating parameter estimates). This model was non-significant as well, suggesting that the small sample size was unlikely to be the sole cause of non-significant findings.

# DISCUSSION

While the current study produced non-significant results, the data still have interesting implications for the design and implementation of weight management interventions. The mean sample size of 5.75 participants in each experimental group greatly limited the study's statistical power, increasingly the likelihood of finding false negative results (or committing a Type II error, in other words). Considering this limitation and regarding the present study as a pilot study, restricting the analysis solely to the results of statistical comparison may have impeded conclusions indicating the intervention's efficacy with a greater sample size.

## Two-Way ANOVA

In the analysis of variance, the effects of social support and self-monitoring were analyzed, which yielded non-significant results. Based on the statistical comparison alone, no experimental condition differed in their effect on weight change. However, considering the descriptive statistics, weight changed in the predicted negative direction

for manipulated groups, and actually exhibited the opposite trend in the control group. While these results do not support the efficacy of the intervention, the distinction between the intervention conditions yielding weight loss and the control yielding weight gain is notable. This difference indicates that the intervention may have more success in a larger sample, and future research should consider implementing this intervention in a larger group that would provide higher statistical power.

*t* test for Independent Means

The *t* test comparing the scores on the SSES and SSEHS for groups with and without social support likewise had non-significant results. These results suggest that the experience of social support for eating and exercise habits did not differ between groups with and without the social support condition. This implies that the current design of a social support condition was insufficient in yielding greater social support for participants than those not in a social support condition. Conversely, this could also imply that those assigned to the no social support condition developed social supports on their own. If the latter is true, then the current results suggest that providing a social support group may affect weight in approximately the same manner as developing friendships on one's own. This finding that has utility for those who find it difficult to cultivate their own supports as they begin a weight management intervention, as assigned or engineered social support groups may fulfill the same purposes. Future research should investigate the impact of

these social support interventions to individuals who have poor social support systems in order to determine if they are beneficial to weight management.

This finding is also important to note because the current literature suggests that even informal social support groups, whether in person or online, had positive effects on weight loss (Lubans et al., 2009; Bensley et al., 2010). The current finding is therefore inconsistent with the literature, and suggests that social support conditions may need more structure, to meet more frequently, or meet for longer durations to see increased social support scores and effects on weight management (again, the effects of small sample size and the null model notwithstanding). Future directions should include investigating the effects of increased frequency, prescriptiveness, and duration on social support intervention components' efficacy.

Contrarily, it could be the "quality" of the social support rather than the "quantity" that needed to be altered. The aforementioned studies used forms of social support that were informational and structural rather than emotional, while the social support utilized in the present study was primarily emotional. Consequently, future research should determine how emotional, informational, and structural social support differentially affect weight management (which would involve extricating new methods to assess each of these constructs in isolation). Regardless, the *t* test in the current study was further limited due to the sample size, and might have yielded significant results if replicated in a larger study.

Multiple Linear Regression

The multiple linear regression was non-significant, finding that scores on the SSES and SSEHS did not predict weight change, regardless of participation in a social support condition. When the same analysis was run with bootstrapping to account for the limited sample size, the same results were found. These results suggest that, involvement in a social support condition aside, increased social support levels do not predict increased weight loss (again, with emphasis on the small sample size in the current study). This too was inconsistent with the literature on social support, which indicates that increased social support yields greater weight loss (Lubans et al., 2009; Bensley et al., 2010). Social support as measured by the SSES and SSEHS may not have predicted weight change for similar reasons that the SSES and SSEHS did not differ between intervention groups with and without the social support conditions. The items on the SSES and SSEHS measures fall primarily under the realm of emotional support, with a few items suggesting structural support as well. If informational and structural support contribute to weight loss, as evidenced in the literature, but emotional support does not, as suggested by the current findings, then these scales that measure emotional support would be expected not to predict weight change (consistent with the findings in the current study). In the context of this literature, the present finding supports the need to determine whether social support intervention elements yield better weight loss results when they are primarily structural and informational than when they are emotional.

In conclusion, although the current study was limited in statistical power and found non-significant results, the data point toward interesting considerations for the design of social support interventions in the context of the literature on weight management interventions.

# REFLECTION

Pursuing my thesis quickly became a formative experience in my undergraduate education. Its very conception helped me discern my academic affinity for psychological research. As a double major, I originally found myself on an entirely different career and thesis path until fall of my senior year, when I discovered through work as a Research Assistant that I had a passion for health psychology and translational research in clinical psychology. My thesis developed from this realization combined with material from previous undergraduate coursework on nutrition, weight management, and cognitive behavioral interventions. Synthesizing knowledge from these experiences with subsequent literature review for my thesis excited me, always leaving me with new questions. My enjoyment of searching for empirical answers that could benefit people in

need of services confirmed my desire for a career path in clinical psychology, a confirmation that seemed elusive before I embarked upon the thesis journey.

In designing my thesis, I acquired skills for writing IRB protocols and grant proposals. The writing processes for both of these submissions required a critical analysis of the literature and application of current findings to future investigation. Prior to this process, I had minimal exposure to this kind of writing from my psychology laboratory course. Submitting these proposals allowed me to apply the skills I learned in this course with a topic more closely aligned to my research interests. I also made mistakes in the design process that became excellent learning opportunities. In my discussion, I considered that the inconsistency between my nonsignificant findings on the social support intervention and the literature on social support interventions may have been due to the use of two different subtypes of social support: emotional and structural or informational. Had I examined the literature more closely when designing the study, I may have considered this important distinction when designing the study and addressed it in the study's design. This mistake has afforded me understanding of the importance of diligence in delineating with extreme precision the findings of the literature as it applies to the current study.

Collecting original data for my thesis was another invaluable learning experience. Foregoing the thesis, I had only collected data at times established for me for projects designed by my professors. The thesis allowed me to recruit, schedule, and run participants through an intervention that I designed myself— though under very wise direction, I might add. It also allowed me to create and manage my own dataset. This cultivated my face-to-face recruitment skills, my teaching skills when administrating the

intervention, my organizational skills with managing sensitive data and complex scheduling, and my computer skills using SPSS and Excel.

I learned additional wisdom concerning statistics that I will take onward into my graduate studies. Namely, I learned the great limitation of insufficient statistical power. Because my analyses required dividing my already small sample into four groups, I had an average group size of N=5.75, which severely limited my ability to use statistical testing to discern relationships between the variables of interest. Going forward, I know to run a power analysis to determine the number of participants I will need. Conversely, I know that pilot study samples can be examined with the understanding of the limited statistical power and that these results are best interpreted in a more intuitive/graphical context than is traditionally acceptable with more statistical power.

Finally, I gained valuable knowledge on the latest research in a highly cross-disciplinary field. Research on weight management comes not only from the field of psychology, but also of public health, of nursing, of medicine, and of nutrition. Each of these fields have slightly different ways of reporting their research. For example, some nursing journals report extremely concise results and discussions, while psychology journals tend to examine many possible implications and future directions of the findings. These differences are important to note in any future work I do in a cross disciplinary research area, because communication of findings can be hindered by miscommunication because of cultural differences between fields.

Ultimately, my thesis shaped my interest in pursuing a Ph.D. in Clinical Psychology, hopefully studying translational research and health psychology, broadly. In pursuing this graduate degree, in post-doctoral positions, and in my long-term career, I

plan to seek additional opportunities to focus on cognitive behavioral interventions for obesity and metabolic disorders. This would afford me the humbling opportunity to build upon the knowledge gained through this formative experience to bring empirically sound services to patients in need.

## FIGURES

Figure 1: Consort Attrition Diagram

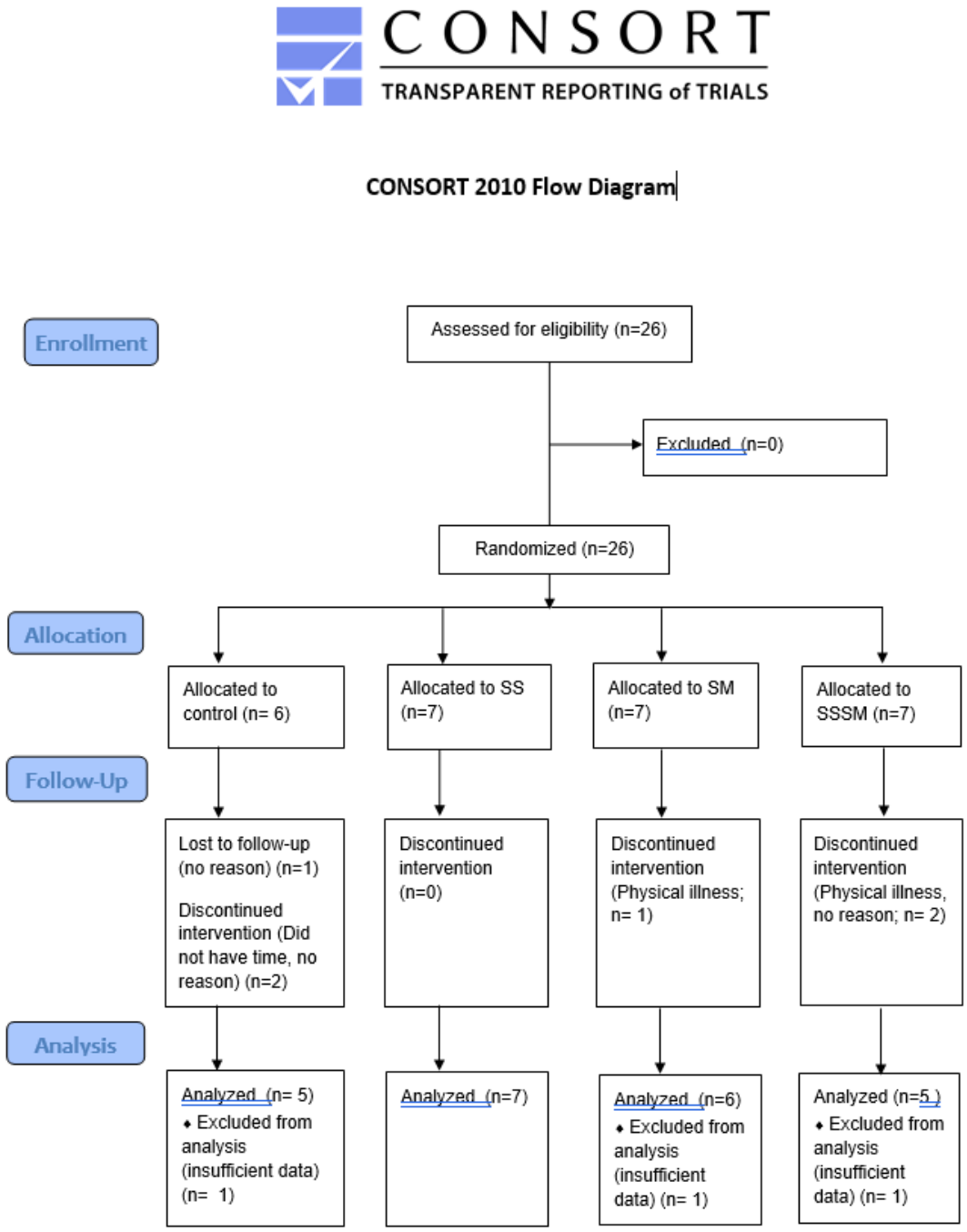
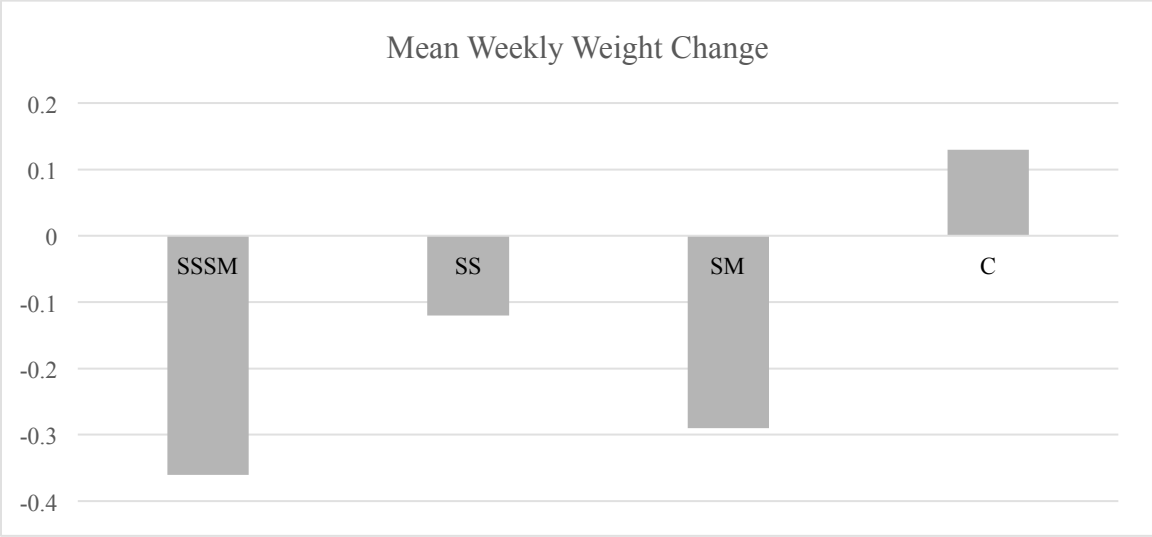



Figure 2: Mean Weekly Weight Change

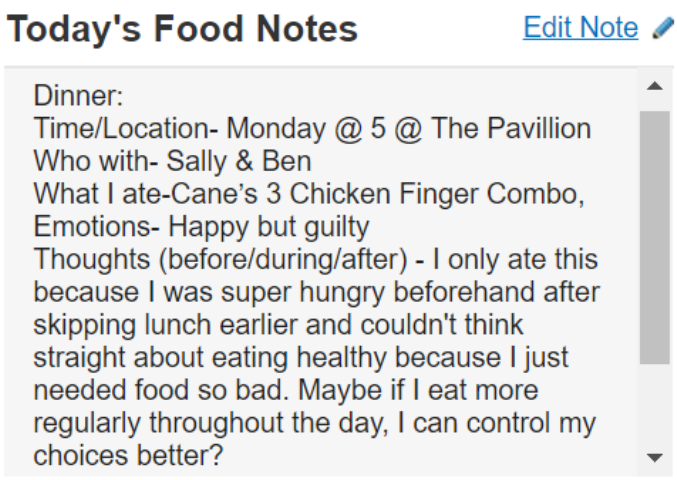

Mean Weekly Weight Change
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
SSSM
SS
SM
C

# APPENDIX

A. “Hi, my name is Kathryn Prendergast, and I am a senior in the Honors College conducting my senior thesis on weight management. I am looking for participants

who are interested in losing weight or maintaining their current weight. Participants will participate in a free weight management intervention that will last until the end of the semester. All participants receive free nutrition and exercise education, and most participants will receive free education in evidence-based behavioral change techniques. All participants will receive the benefit of knowing they've contributed to the body of scientific knowledge! If you are interested in participating, please contact me at klprende@go.olemiss.edu. I have flyers as well with my contact information, if anyone is interested. Thank you for your time, and have a great day!"

B.



C.

## SOCIAL SUPPORT AND EXERCISE SURVEY

Below is a list of things people might do or say to someone who is trying to exercise regularly. If you are not trying to exercise, then some of the questions may not apply to you, but please read and give an answer to every question.

Please rate each question *twice*. Under *family*, rate how often anyone living in your household has said or done what is described during the last three months. Under *friends,* rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

Please write *one* number from the following rating scale in each space:

| none | rarely | a few times | often | very often | does not apply |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 8 |

During the past three months, my family (or members of my household) or friends:

| | | Family | Friends |
|---|---|---|---|
| 11. | Exercised with me. | 11. | 11. |
| 12. | Offered to exercise with me. | 12. | 12. |
| 13. | Gave me helpful reminders to exercise ("Are you going to exercise tonight?"). | 13. | 13. |
| 14. | Gave me encouragement. to stick with my exercise program. | 14. | 14. |
| 15. | Changed their schedule so we could exercise together. | 15. | 15. |
| 16. | Discussed exercise with me. | 16. | 16. |
| 17. | Complained about the time I spend exercising. | 17. | 17. |
| 18. | Criticized me or made fun of me for exercising. | 18. | 18. |
| 19. | Gave me rewards for exercising (bought me something or gave me something I like). | 19. | 19. |
| 20. | Planned for exercise on recreational outings. | 20. | 20. |
| 21. | Helped plan activities around my exercise. | 21. | 21. |
| 22. | Asked me for ideas on how *they* can get more exercise. | 22. | 22. |
| 23. | Talked about how much they like to exercise. | 23. | 23. |

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September 26, 1986

D.

## SOCIAL SUPPORT AND EATING HABITS SURVEY

Below is a list of things people might do or say to someone who is trying to improve their eating habits. We are interested in high fat and high salt (or high sodium) foods. If you are not trying to make any of these dietary changes, then some of the questions may not apply to you, but please read and give an answer to every question.

Please rate each question *twice*. Under *family,* rate how often anyone living in your household has said or done what is described during the last three months. Under *friends,* rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

Please write *one* number from the following rating scale in each space:

---

SAMPLE:

| | Family | Friends |
|---|---|---|
| A. If my family *rarely makes fun of the foods I eat, and my friends very often* do, I would answer like this: | | |
| A. Made fun of the foods I eat | A. 2 | A. 5 |

---

| none | rarely | a few times | often | very often | does not apply |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 8 |

During the past three months, my family (or members of my household) or friends:

| | Family | Friends |
|---|---|---|
| 1. Encouraged me not to eat "unhealthy foods" (cake, salted chips) when I'm tempted to do so. | 1. | 1. |
| 2. Discussed my eating habit. changes with me (asked me how I'm doing with my eating changes). | 2. | 2. |
| 3. Reminded me not to eat high fat, high salt foods. | 3. | 3. |
| 4. Complimented me on changing my eating habits ("Keep it up", "We are proud of you ") . | 4. | 4. |
| 5. Commented if I went back to my old eating habits. | 5. | 5. |
| 6. Ate high fat or high salt foods in front of me. | 6. | 6. |
| 7. Refused to eat the same foods I eat. | 7. | 7. |
| 8. Brought home foods I'm trying not to eat. | 8. | 8. |
| 9. Got angry when I encouraged them to eat low salt, low fat foods. | 9. | 9. |
| 10. Offered me food I'm trying not to eat. | 10. | 10. |

E.

**SDSU** **JOINT DOCTORAL PROGRAM IN CLINICAL PSYCHOLOGY** UCSD

October 1996

TO: Users of Social Support Surveys for Diet and Exercise Behaviors

FROM: James F. Sallis, Ph.D.

RE: Scoring of scales

Enclosed are copies of abbreviated versions of the Social Support and Eating Habits Survey and Social Support and Exercise Survey. These were designed to be easier to use than the original, complete scales reported in Preventive Medicine.

In scoring either the complete or abbreviated scales "8" should be recoded to "1."

The abbreviated Social Support for Eating Habits Survey should be scored separately for family and friends.

Encouragement: sum items 1 -5
Discouragement: sum items 6 -10

The Social Support and Exercise Survey should be scored differently for friends and family.

Family Participation: sum items 11 - 16 and 20 - 23
Family Rewards and Punishment (an optional scale): sum items 17 - 19
Friend Participation: sum items 11 - 16 and 20 - 23

The Rewards and Punishment subscale should not be scored for friends because it did not emerge in the factor analysis.

Reference:

Sallis, J.F., Grossman, R.M., Pinski, R.B., Patterson, T.L., and Nader, P.R. (1987). The development of scales to measure social support for diet and exercise behaviors. **Preventive Medicine, 16**, 825-836.

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References

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*. Retrieved from http://psycnet.apa.org/journals/rev/84/2/191/

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American psychologist*. Retrieved from http://psycnet.apa.org/journals/amp/37/2/122/

Bensley, R. J., Brusk, J. J., & Rivas, J. (2010). Key principles in internet-based weight management systems. *American Journal of Health Behavior, 34*(2), 206.

Burke, L. E., Wang, J., & Sevick, M. A. (2011). Self-Monitoring in Weight Loss: A Systematic Review of the Literature. *Journal of the American Dietetic Association*, *111*(1), 92–102. http://doi.org/10.1016/j.jada.2010.10.008

Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps [online]. [accessed Jan 8, 2017]. Retrieved from: https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html.

Chambliss, H. O., Huber, R. C., Finley, C. E., McDoniel, S. O., Kitzman-Ulrich, H., & Wilkinson, W. J. (2011). Computerized self-monitoring and technology-assisted feedback for weight loss with and without an enhanced behavioral component. *Patient Education and Counseling, 85*(3), 375-382. doi:10.1016/j.pec.2010.12.024

Fryar, C. & Ogden, C. (2012). *Overweight & Obesity Statistics*. Retrieved from https://www.niddk.nih.gov/health-information/health-statistics/overweight-obesity

Gottlieb N.H. & Green, L. W. (1984). Life events, social network, life-style, and health: An analysis of the 1979 national survey on personal health practices and consequences. *Health Education Quarterly*, *11*, 91-105.

Hanson, M.D. & Chen, E. (2007). Socioeonomic status and health behaviors in adolescence: A review of the literature. *Journal of Behavioral Medicine, 30,* 263-285.

Harvard University (2011). *Healthy Eating Plate & Healthy Eating Pyramid*. Retrieved from https://www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/

Johns, D. J., Hartmann-Boyce, J., Jebb, S. A., Aveyard, P., & Behavioural Weight Management Review Group. (2014). Diet or exercise interventions vs combined behavioral weight management programs: A systematic review and meta-analysis of direct comparisons. *Journal of the Academy of Nutrition and Dietetics, 114*(10), 1557-1568. doi:10.1016/j.jand.2014.07.005

Kahn, E.B., Ramsey, L.T., Brownson, R.C., Heath, G.W., Howze, E.H., Powell, K.E., Stone, E.J., Rajab, M.W.. Corso, P. (2002). The Effectiveness of Interventions to Increase Physical Activity: A Systematic Review. *American Journal of Preventative Medicine, 22*. Retrieved from https://www.thecommunityguide.org/sites/default/files/publications/pa-ajpm-evrev.pdf

Lubans, D. R., Morgan, P. J., Callister, R., & Collins, C. E. (2009). Effects of integrating pedometers, parental materials, and E-mail support within an extracurricular school sport intervention.*Journal of Adolescent Health*, *44*(2), 176–183.

MyFitnessPal (2017). Retrieved from https://www.myfitnesspal.com/

Nejad, L. M. (2005). Comparison of the Health Belief Model and the Theory of Planned Behaviour in the Prediction of Dieting and Fasting Behaviour. *E-Journal of Applied Psychology: Social section. 1*(1): 63-74.

Palmeira, A., Teixeira, P., Branco, T., Martins, S., Minderico, C., Barata, J., … Sardinha, L. (2007). Predicting short-term weight loss using four leading health behavior change theories. *International Journal of Behavioral Nutrition and Physical Activity, 4(*1), 1–12. doi:10.1186/1479-5868-4-14

Phares, Emily H. (2013, Nov 20). *Physical activity guidelines: How much exercise do you need?* Retrieved from https://www.hsph.harvard.edu/nutritionsource/2013/11/20/physical-activity-guidelines-how-much-exercise-do-you-need/

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion: AJHP, 12*(1), 38.

Rosenstock, I. (2005). Why People Use Health Services. *Milbank Quarterly*, *83*(4). doi:10.1111/j.1468-0009.2005.00425.x

Taylor, S.E. (2010). Social Support: A review. In H.S. Friedman (Ed.), *Oxford Handbook of Health Psychology*. New York: Oxford University Press.

Taylor, S.E. (2012). *Health Psychology*. New York: McGraw Hill.

Tuah, N. A., Amiel, C., Qureshi, S., & Car, J. (2011). Transtheoretical model for dietary and physical exercise modification in weight loss management for overweight and obese adults. *Cochrane database of systematic reviews*. doi: 10.1002/14651858.CD008066.pub2

Wilfley, D., Stein, R., Saelens, B., Mockus, D., Matt, G., Hayden-Wade, H., … Epstein, L. (2007). Efficacy of Maintenance Treatment Approaches for Childhood

Overweight: A Randomized Controlled Trial. *JAMA*, *298*(14), 1661–1673. doi:10.1001/jama.298.14.1661

Wing, RR, & Phelan, S. (2005). Long-term weight loss maintenance. *The American journal of clinical nutrition*. Retrieved from http://ajcn.nutrition.org/content/82/1/222S.short

World Health Organization (2017). *Health topics: Physical activity*. Retrieved from http://www.who.int/topics/physical_activity/en/

World Health Organization (2017). *Health topics: Nutrition*. Retrieved from http://www.who.int/topics/nutrition/en/