# Consumers' Views Regarding the Use of Smart Phones

# For Tracking Dietary Intake and Exercise:

# A Qualitative Study

by

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ABSTRACT

The purpose of this study was to gather qualitative data on different and novel methods used to self-monitor diet and exercise during a weight loss study. Participants who used either a traditional paper and pencil method or a smart phone weight loss app for diet and exercise tracking were recruited for focus groups. Focus group discussions centered on the liked and disliked aspects of recording, perceived behavior changes, and suggestions for improved self-monitoring. Focus groups were organized based on the method of self-monitoring. The app group tracked calorie intake and expenditure via the "Lose It" app on their smart phones. The paper & pencil group recorded exercise and food intake in a journal and self-regulated diet based on recommended servings from each food group (or exchange lists). Focus group sessions were audio-recorded, transcribed and coded by the researcher and an independent coder. Results indicated that app participants liked the convenience, affordability, and user-friendly features, but wanted more nutrition advice. App participants liked self-managing their diet, not restricting certain foods or food groups and allowing for indulgences by balancing calories and exercise. Also, they desired an accurate estimation of energy expenditure from an app, based on individual characteristics (i.e., gender and age). Participants who recorded on paper liked the size for a visual layout of food entries, but desired a technology-enhanced method with an auto-calculation of calorie intake and expenditure. They also suggested increased accountability and opportunities for social support would enhance self-monitoring. Overall, an ideal technology-assisted self-monitoring app or program would be free and include an

auto-calculation of calorie intake, a gender- and age- specific estimation of calories expended, easy entry of foods from a large database, the ability to enter whole recipes, nutrition information and recommendations, and be available via phone, tablet or computer (based on personal preference).

# DEDICATION

This paper is dedicated to my parents, Robert and Christine. I am incredibly grateful for their everlasting support through my adventures, including a career change and grad school. Thanks for always inspiring me to work hard. This paper is also dedicated to my sisters, Lauren and Allison. They planted the seed and encouraged me that to pursue this career path. Thanks for your great insight and constant support.

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TABLE OF CONTENTS

Page

LIST OF TABLES ..... vii

CHAPTER

1 INTRODUCTION ..... 1

2 REVIEW OF LITERATURE ..... 5

Obesity ..... 5

Dieting and Weight Loss ..... 7

Behavior Therapy for Weight Loss ..... 12

Technology and Weight Loss ..... 16

Mobile Phones and Healthcare ..... 20

Focus Group Methodology ..... 24

3 METHODS ..... 28

Data Collection ..... 30

Data Analysis ..... 31

4 RESULTS ..... 34

5 DISCUSSION ..... 49

Limitations ..... 53

6 CONCLUSION ..... 55

REFERENCES ..... 58

APPENDIX Page


A IRB APPROVAL SMART PHONE TRIAL ..... 65

B IRB MODIFICATION FOR FOCUS GROUPS ..... 67

C CONSENT FORM ..... 70

D FOCUS GROUP QUESTIONS ..... 72

E APP THEME CODE BOOK ..... 74

F PAPER THEME CODE BOOK ..... 82

G OPEN-CODED TRANSCRIPTS ..... 87

H DATA SPREADSHEET ..... 92

LIST OF TABLES

Table Page

1. App Group Themes ..... 35

2. Paper Group Themes ..... 47

# Chapter 1

## INTRODUCTION

The prevalence of overweight and obese Americans reached 68.8% (BMI≥ 25) in 2010 (Flegal, 2012). Expanding waistlines adversely impact quality of life and the upward trend in adiposity is unrelenting. The overweight and obese population is at increased risk of developing dyslipidemia, Diabetes Mellitus (type II) and hypertension; all risk factors of cardiovascular disease (Artinian, 2010). Much evidence exists for the influence of physical activity, diet and weight loss towards preventing health disparities. However, Americans have a difficult time maintaining behavior change long term (Artinian, 2010). Along with a supportive environment, there is a growing need for behavioral approaches to help overweight and obese individuals achieve weight loss and maintain a healthy weight over time.

One component of a successful weight loss intervention is the promotion of behavior change through self-monitoring (Baker, 1993). Self-monitoring can enhance awareness of food intake and exercise habits by keeping a daily record. Weight Watchers developed a “Points” system based on calories, fat and fiber, and encourages self- monitoring by counting the “points” of foods (Dansinger, 2005). Self-monitoring can reinforce accountability of daily food and nutrient consumption, physical activity and weight. People who track daily food and exercise are more likely to shed pounds and maintain weight loss, while increased consistency in self-monitoring correlates with increased weight loss over time (Baker, 1993). Keeping track of daily food and exercise is intended to help people

recognize behavior patterns and make changes through self- management of diet and physical activity.

Writing in a paper journal is the long-established method of recording behavior. However, remembering the notebook, carrying it around and actual note-taking can all lead to non-compliance. For instance, in a study exploring perceptions of recording on paper, subjects noted that keeping a journal requires extra time and organization (Burke, 2009). Also, the quality of the data in hand written records is inconsistent. Paper diaries have also been used to document chronic pain (Stone, 2003). In Stone's study measuring compliance between paper and electronic recording of pain symptoms, it was noted that paper diary submissions were recalled and backfilled, introducing room for inaccuracies. The purpose of self management is defeated if behaviors or symptoms are not monitored in a reasonable time frame of occurrence (Stone, 2003). Overall, recording by pen and paper may be too cumbersome and is questionable as an effective method of tracking behavior.

As technology improves, so have options for self-monitoring. A few studies have investigated the use of a personal digital assistant (PDA) to manage daily food and exercise habits. Glanz and researchers developed a program for the PDA that recorded dietary intake, delivered feedback and gave nutrition information (Glanz, 2006). The subjects commented that recording was easy, convenient and reinforcing; as a result, 90% of the subjects expressed likelihood of long term use (Glanz, 2006). Another benefit of the PDA was privacy. Participants using a PDA liked that they could remain anonymous to friends and

family of their weight loss efforts (Yon, 2007). By recording with a PDA, people were more likely to maintain their goals of decreased fat intake, total calories or total calories from fat (Glanz, 2006). Self-monitoring may be easier to sustain with portable technology.

A modern development in technology allows for self-monitoring through the use of smart phones. A smart phone incorporates both the cellular phone and computer capabilities (Busis, 2010). By the year 2013, it is predicted that 20% of phones purchased in the world will be smart phones (Busis, 2010). Not only are they used for internet, email and media, but are also capable of accessing information through applications. Applications or "apps" can provide novel tools to support a healthy lifestyle, including nutrition information, recipes, exercise plans and mental stimulation (Arsand, 2008). In addition, apps have the ability to tailor individual needs and goals. Apps for food tracking such as the "Lose It" program have a large database of nutrition information, including restaurant foods. The app allows the user to create a personalized calorie allotment and monitor daily and weekly progress toward their goal weight. The mobility and access to immediate information provided by smart phones can help incorporate self- monitoring into everyday life.

Only a handful of studies exist regarding the use of smart phones in healthcare. For instance, one study employed a smart phone application for diabetic patients to record food intake for better blood glucose control. Participants liked receiving feedback and the ability to view the status of nutrition goals (Arsand, 2008). Also, mobility was indicative of long term use (Arsand,

2008). Another benefit of using smart phones in healthcare involves documenting symptoms; for example, of a seizure. A case study described a video taken with a smart phone as helpful in recording indications of a seizure and emailing it to a neurologist (from the smart phone), for a fast and thorough diagnosis (Busis, 2010). New possibilities of sending and accessing information are available through smart phones and include benefits to healthcare.

This primary objective of this research is to explore attitudes of a few diet and exercise tracking methods used in a weight loss trial, including smart phone app technology. Technology may or may not enhance consistency or quality of self- monitoring. Understanding barriers and benefits of tracking food and exercise behaviors may be informative for future healthcare interventions and weight loss.

Chapter 2

# REVIEW OF LITERATURE

## Obesity

Obesity is a "public health concern" worldwide (Giskes, 2007). Heath disparities that accompany obesity are well known. The risk of diabetes, hypertension, elevated cholesterol, stroke and heart disease are all higher among the obese population (Catenacci, 2009). With obesity on the rise, it is not only affecting the wellbeing of Americans but also the cost of healthcare (Finkelstein, 2010). Some theories are looking at our environment as attributing to obesity. Environment is a contributing factor, but a lot has to do with the individual (Giskes, 2007). These issues surrounding obesity are prominent topics among the news media. An abundance of health and disease related information is accessible through books and the internet. However, there is a lack of knowledge among society on how to implement a healthy lifestyle for effective weight loss and maintenance (Thomas, 2008).

Obesity is currently categorized by BMI or body mass index (Catenacci, 2009). Adults and children have a separate scale of measurement for BMI. The BMI range for a healthy adult weight is 18.5 to 24.9 $kg/m^2$. The overweight category falls within 25 to 29.9 $kg/m^2$. Obese individuals are identified as having a BMI equal to or greater than 30 $kg/m^2$. In children, the risk of becoming overweight includes the range between the $85^{th}$ and $95^{th}$ percentile (Catenacci, 2009). A child with a BMI greater than the $95^{th}$ percentile is considered overweight.

Obesity has been on the rise for the past 30 years, among all ethnicities and age groups in the US. Hill estimates that the average American adult gains 1 to 2 pounds a year (Hill, 2003). Over time, the gradual weight gain adds up to a heavier population. Two groups in particular, African American and Hispanic women represent a high proportion of obese individuals (Catenacci, 2009). Also, low socioeconomic status and education are correlated with increased obesity (Catenacci, 2009). It is not incomprehensible that poorer populations have an increased incidence of obesity, partly due to the fact that accessible and cheap "fast food" is high in fat and calories. Overall, the rise in obesity is prevalent across the entire US population, including adults and children.

Environment is a large contributor of gradual weight gain among Americans (Hill, 2003). There is less physical activity required for jobs, activities of daily living and in schools. Children are taking part in more sedentary activities, such as television, social networking on the computer and video games. Also, the family dynamic is changing (Hill, 2003). No longer are the majority of households containing two parent families. Single working mothers are very common and this lifestyle has an effect on the amount of physical activity engaged in and food choices within the home. Also, the greater number of parents working means the greater reliance on convenience items (Hill, 2003). The rise in "fast food" can likely be attributed to busy, overworked families seeking meals to satisfy their needs and cravings.

Obesity has many negative attributes. Not only is obesity related to a decline in physical well-being, but it is also correlated with social and

psychological stress (Catenacci, 2009). One way to assess physical and mental status in overweight and obese individuals is through a Health Related Quality of Life score or HRQOL (Bish, 2006). The HRQOL measured basic health status, physical and mental well-being and activity limitation in a large sample of overweight and obese individuals (Bish, 2006). This study correlated high quality of life and excellent or good health with increased attempts of weight loss among women. Moderate or poorer quality of life scores had a correlation with greater weight loss attempts among men. Low scores on the HRQOL test were associated with little or no physical activity for both sexes (Bish, 2006). Not all overweight or obese individuals were concerned with losing weight. Physical and mental well-being can be compromised with obesity. Understanding motivating factors for weight loss may help healthcare professionals encourage healthy lifestyle behaviors.

**Dieting and Weight loss**

Treatment of obesity typically includes regimens of calorie reduction and increased physical activity. It is common that overweight and obese individuals have tried more than one diet plan. Attempting to lose and maintain weight loss through fad diets is discouraging (Thomas, 2008). Many people give up or lose their self-efficacy through impossible diet strategies or multiple failed attempts. The ability to adhere to a healthy eating plan is the key to weight loss; the specific diets are not significant (Dansinger, 2005). New public health information and weight loss interventions need to encourage realistic goals for long term lifestyle habits, rather than promote many quick fixes. Obese individuals are recommended

to lose 10% of their body weight (Hill, 2003). This percentage of weight loss can improve health and comorbidities.

Diet programs are a popular weight loss strategy in the US and in other industrialized countries. According to the 2003 BRFSS, cutting calories was the most common practice for weight loss (Bish, 2007). Many overweight and obese individuals look toward a reduced calorie, reduced fat or reduced carbohydrate regimen as a quick fix to drop pounds. A research study looked at the effectiveness of a few popular and commercial diet plans (Dansinger, 2005). Researchers wanted to understand whether the Atkins, Weight Watchers and Ornish diet regimes are practical. The Atkins and Ornish diets showed the least adherence, probably due to limiting or omitting food groups, such as carbohydrates and fat, respectively (Dansinger, 2005). Many people enjoy the social dynamic and support network formed by participating in Weight Watchers. Also, Weight Watchers is one of the more affordable options (Dansinger, 2005). However, one criticism of Weight Watchers is that the program does not promote long term behavior change. Consumers also emphasized that they had repeatedly gone back to Weight Watchers, unable to maintain weight loss on their own (Dansinger, 2005).

Experiences from a Jenny Craig diet program in Australia were negative (Thomas, 2008). The expense and time commitment were deterrents of this commercial program. It was not affordable to purchase the food for the length of time it would take to achieve weight loss. Also, participants described feeling alone and only attempted it once (Thomas, 2008), unlike other programs where

people come back repeatedly. The representatives of Jenny Craig were alluring and persuasive. Overall, Jenny Craig was perceived to be unrealistic for a long term weight loss solution. More research is needed to examine results of commercial diet plans; are they designed to benefit health status or are they just a waste of consumers' money (Wing, 2010).

A select group of individuals who have been successful at weight loss and maintenance belong to the National Weight Control Registry (Wing, 2005). The National Weight Control Registry includes over 4,000 members, who have lost an average of 30 pounds and have kept it off for at least 1 year (Wing, 2005). They share common habits such as tracking weight daily or weekly, high amounts of exercise, eating low calorie, low fat foods and consuming breakfast (Wing, 2005). Forty four percent of the adults lost weight on their own, while fifty six percent experienced weight loss with the input of a physician, program or nutritionist (Wing, 2005). The key to maintaining a goal weight is consistency. The people who have not regained weight continued their exercise and eating habits on weekends, weekdays and holidays (Wing, 2005). Losing weight and maintaining it is not an impossible goal. However, it requires a lifelong commitment. Some of the "biggest losers" have maintained their weight loss for 30 years (in the National Weight Control Registry), and have consistently stuck with their eating and exercise habits.

One of the most important components of a weight loss regime is behavioral therapy (Wadden, 2003). The targets of behavior change are diet and physical activity. In addition to making more nutritious food choices and

incorporating exercise, the behavior component involves learning strategies and techniques to balance energy intake and expenditure (Wadden, 2007). Knowledge of portion size and the calorie content of foods are a few examples of education needed for better cognitive control of eating (Hill, 2003). The environment is full of tempting foods high in calories, fat and sugar. In order to maintain a healthy weight, a conscious effort is needed to manage the temptation. Our society thrives at a time when food is abundant and there is no threat of a possible scarcity. Instead of protecting ourselves from famine as our ancestors did, we have to protect ourselves from overconsumption (Hill, 2003).

A cross-sectional study describes participants' previous experience with weight loss regimens, while identifying preferences for future treatment. Overweight and obese individuals pursuing a future weight loss program had conflicting ideas of desired treatment and outcome. Participants expressed interest in a lifestyle change, not a particular diet; however they desired a regimen with the quickest results (Burke, 2008). Flexibility and remaining in control of food and exercise was preferred, but supervision or support from a professional was a satisfying attribute of a program. Barriers included lack of motivation to maintain or lose weight, self-control issues when hungry and using food as positive reinforcement (Burke, 2008). Additionally, this study found that despite numerous attempts at weight loss, individuals still maintained self-efficacy for behavior change. Overall, this descriptive study gave good insight into participants' preferences and obstacles when attempting weight loss.

Self-efficacy is a contributor to behavior change (Bandura, 2004). Some researchers have measured self-efficacy and weight loss. Having confidence in the treatment's outcome can increase adherence to a weight loss protocol (Warziski, 2008). A study measured self-efficacy at baseline and at the finish of the trial. The results indicated that low self-efficacy at baseline did not equate to failure (Warziski, 2008). Self-efficacy improved after achieving positive results, even while adhering to a calorie-restricted diet. Enhanced self-efficacy was seen over time and was congruent with weight loss (Warziski, 2008).

Methods of improving adherence to healthier eating patterns are needed. Some behavior theories attribute the individual's choice of treatment as gaining better results (Burke, 2008). Researchers were curious to see if this theory could be extended to weight loss. A study by Burke examined weight loss efficacy between participants who chose a diet compared to those who were randomly assigned a diet; either a standard calorie reduced plan or a lacto-ovo vegetarian plan (Burke, 2008). The results of this study showed that all participants who adhered to a calorie-restricted eating plan lost weight. Participants who were given their preferred diet did not achieve greater results. Perhaps the subjects who received their chosen diet were too self-assured in the expected outcome. Overall, adherence to a treatment or eating plan may be enhanced by the subject's input, but following either weight loss regime showed success (Burke, 2008).

For many people, a group support network enhances adherence to a weight loss regime. A strong support system has been identified as a crucial component of weight loss (Khaylis, 2010). Behavior treatment typically includes a personal

session with a nutrition or weight loss counselor. It is more affordable to partake in group therapy. Many commercial programs utilize the group method. Participants often rely on each other for motivation. Being a part of a group provides empathy, support and some healthy rivalry (Wadden, 2009). Also, a weekly weigh-in was a good motivator (Wadden, 2009). Overall, the group structure tends to produce better results than individual attempts (Wing, 2006).

**Behavioral Therapy for Weight Loss**

One of the important components of behavior change in healthcare is utilizing a program tailored to meet the individual's needs. Patient satisfaction can increase or decrease adherence and the outcomes of an intervention (Arnold, 2005). A modern approach to healthcare and treatment involves more emphasis on the patients' needs and preferences (Lane, 2006).There is a need for people to maintain health-related behaviors long term. Designing behavior change through methods that complement a person's lifestyle allow for a greater chance of compliance.

A Dutch study looked at the effect of a computer tailored feedback program to heighten the awareness of dietary habits and promote willingness to change, compared to minimal feedback from a self-test method and general nutrition information (Oenema, 2003). In the Netherlands, a national food consumption survey concluded that the majority of citizens consumed excess fat and low amounts of fruits and vegetables (Oenema, 2003). Dutch citizens were unaware of the need to reduce saturated fats or increase daily servings of fruits and vegetables. One of the barriers of a healthy diet was the discrepancy between

actual intake and perceived intake. This theory was described as unrealistic optimism (Oenema, 2003). In addition, people estimated that they ate less fat than their colleagues and did not think of their behavior as a health risk. Feedback may allow for enhanced awareness and help motivate behavior change. Interactive nutrition feedback tailored to the individual's needs provided a greater awareness and desire to change than the self-test feedback or general nutrition education (the control group). Participants appreciated receiving individualized information. This intervention also helped bring attention to saturated fat consumption. Tailored feedback may help with steps toward behavior change, including the reduction of fat in the diet.

Self-monitoring is encouraged in behavior therapy, but is difficult to maintain long term. Some personalities adhere better than others. People who commit to self-monitoring are typically positive, determined and loyal, according to a qualitative study (Burke, 2009). Subjects who demonstrated success at losing weight by tracking their food and exercise may have better adaptive skills and the ability to stay focused, despite pressures from the environment (Burke, 2009). These people are likely to be committed to achieving a goal. On the other hand, emotional issues correlate with non-compliance (Burke, 2009). Any depression or low self-esteem can hinder the self-monitoring process and weight loss attempts. Often, people who are simply writing down their foods miss the point and expect a magical weight loss to occur (Baker, 1993). People who missed the message about self-monitoring shared common traits; not able to mentally incorporate recording of behavior into routine, did not devote enough time to self-care and ate

due to emotional pain (Burke, 2009). Additionally, if a behavior such as eating is not monitored throughout the day, the opportunity to learn from it is gone (Stone, 2003). Tracking food and exercise must be consistent and incorporated into a lifestyle. Being self-aware of calories consumed and burned is crucial for weight loss. When using paper diaries, many people try to go back and fill in entries in an untimely manner. Lastly, self-monitoring and weight loss was helped by a supportive environment (Burke, 2009). People with little encouragement from family, friends or health professionals are least likely to continue tracking eating behaviors. Even though self-monitoring is considered an excellent way to initiate behavior change, many people cannot implement it possibly due to personal or social issues.

A traditional method of recording behavior is a paper diary. Paper diaries or journals have been used to document pain symptoms and helped other healthcare interventions (Stone, 2003). First, writing in a journal requires literacy. Typically, paper journals are not usually filled out in a timely manner (Stone, 2003). Carrying around a paper journal can be cumbersome and lead to failed compliance (Burke, 2009). Subjects in a self-monitoring study complained about having to remember to take the diary with them (Burke, 2009). Also, keeping an updated journal requires time and organization. According to Stone's research study, 75-85% of the information recorded in paper diaries was filled in at a later date (Stone, 2003).These diaries had an electronic method to document the date and time when opened, so researchers could see the accurate time stamp while checking the diary submissions. Furthermore, if diaries are being analyzed by a

professional, hand written entries may be vague and illegible. Recording on paper is not effective for some people and does not seem realistic for an extended period of time.

A self-monitoring study using the pen and paper method wanted to measure weight gain during the temptation filled, regime-breaking holiday season. The holidays are known as a high risk time of weight gain associated with irregular schedules, increased socializing, and the likelihood of overeating (Baker, 1998). Participants in this study recorded daily food, exercise, calories and fat grams in small paper diaries. The holiday season and increased risk of weight gain was blunted by consistent self-monitoring (Baker, 1998). By continuing this health behavior, participants were more likely to be in control and not let occasional slips turn into a major setback. It has not been determined whether better weight control leads to a positive mental state or vice versa. However, this research has highlighted the beneficial relationship between weight maintenance, positive feelings of self-control and increased self-monitoring (Baker, 1998).

Modern options for self-monitoring include creating an online diary or tracking food and exercise using a PDA (or other handheld device). Internet or electronic diaries showed greater results than traditional pen and paper methods (Yon, 2007). Recording in an electronic diary and submission of daily or weekly food records to a counselor enhances accountability and boosts weight loss results, as opposed to simply recording alone (Hunter, 2008). Also, compliance tends to increase with a sleek and modern self-monitoring tool (Bennett, 2010).

Handheld computers were preferred to the paper recording method by 95% of patients in a record keeping trial (Arnold, 2005). A qualitative component of the study revealed attitudes and preferences for using the handheld computers among the hemophilia patients. The participants expressed a need to record symptoms of their condition to feel involved in the health care process, increase communication, awareness and knowledge (Arnold, 2005). The clinic was gaining information from the qualitative portion for future patient inspiration and treatment. The prior history of patients recording on a consistent basis was poor and did not allow the staff to advise the patient in a timely manner (Arnold, 2005). Opinions of the paper journal included that it was "messy", "inconvenient", "gets lost" and "too much paper" lying around, adding to clutter (Arnold, 2005). Handheld computer users commented that it was "foolproof", "fast" and "accurate" (Arnold, 2005). They also described feeling free, while not having to keep up a notebook. The patients were partial to the handheld computers for recording and they greatly increased the number of entries submitted.

**Technology and Weight Loss**

A review of technology-based weight loss interventions describes five key characteristics for success; self-monitoring, counselor feedback and communication, social support, a structured regime with a learning component and a program designed based on individual needs (Khaylis, 2010). Using technology such as cell phones, computer applications, PDA's or the internet can help implement an intervention more simply and allow for continuous use.

Heetderks and researchers used a computer application vs. a notebook for recording food and beverage intake. The computer group entered specific brands, portion sizes and methods used in cooking, while the program calculated approximate energy values. The subjects liked viewing calorie totals throughout the day and made adjustments to their consumption (Heetderks, 2001). In addition, participants in the computer group reported that viewing nutrition information allowed them to make better food choices. This study was the first to self-monitor using a computer application and gathered qualitative data post-study. The intervention group recorded more days than the notebook group and did not complain about the computer program being too time consuming. Having nutrition information readily available during self-monitoring heightened awareness and enabled people to modify daily food choices.

A few studies have investigated the use of a personal digital assistant (PDA) to manage daily food and exercise habits. Glanz and researchers designed a program for the PDA that recorded dietary intake, delivered feedback and gave nutrition information (Glanz, 2006). The subjects commented that recording was easy, convenient and reinforcing; as a result, 90% of the subjects expressed likelihood of long term use (Glanz, 2006). At baseline, 61% of participants described self-monitoring as cumbersome. At the end of the trial, only 13 % of participants reported the same feeling toward self-monitoring. By recording with a PDA, people were more likely to maintain their goals of decreased fat intake, total calories or total calories from fat (Glanz, 2006). Using an electronic device

that automatically recorded time and gave immediate feedback allowed for continuous use, while also increasing adherence.

Another study used PDA's for tracking eating and exercise habits. Participants using PDAs liked that they could remain anonymous to friends and family of their weight loss efforts (Yon, 2007). PDA subjects reported about 80% of the food they consumed in a day, while enduring some technical difficulties with the device. People who self-monitored more frequently (regardless of method) lost the highest amount of weight, consistent with other self-monitoring research (Yon, 2007). The data collected on the PDA was more thorough and consistent, concluding that electronic data collection is an easy and helpful tool.

Weight loss interventions on the internet are gaining popularity. Through the internet, weight loss techniques and education may reach a broader scope of people (Tate, 2001). Research has shown positive outcomes with internet weight loss programs, particularly with feedback or accountability (Tate, 2001). Tate and researchers designed a behavioral weight loss program online that incorporated weekly lessons, tracking and submitting food records and interacting with a therapist for guidance. For the intervention group, weekly communication with a counselor was conducted via email. Participants in the intervention group were made accountable by turning in food logs and lost a greater amount of weight than those in the control group. The control group lacked contact with an advisor and was simply given access to the program website for the weight loss regime. Feedback from a counselor increased compliance and results (Tate, 2001).

Hunter found that communicating with a counselor through email was just as effective as typical in-person weight loss counseling (Hunter, 2008). Furthermore, it was easy to schedule and did not require extra time for a face to face meeting. Hunter's internet-based behavioral therapy study found that the internet program in addition to standard care, significantly prevented weight gain compared to standard care (Hunter, 2008). Standard care consisted of a primary care visit with a physician, access to healthy cooking classes, nutrition counselors and a fitness center. Overall, many adults wish to tackle weight loss on their own (Tate, 2001). Due to hectic schedules and busy lives, it is more practical for people to utilize resources that complement their lifestyle.

A weight maintenance study conducted by Wing and Tate compared three groups; a face to face intervention, an internet based intervention and a control group (Wing, 2006). Regular weighing and self-monitoring were reiterated through contact, either face to face or over the internet. The control group received no education or emphasis on self-monitoring. They were simply mailed instructional newsletters with weight loss advice. The internet delivered system was used because the ease and convenience was thought to enhance results. Controlling weight regain in the intervention groups was accomplished by submitting weekly weigh-in reports. Also, the face to face group had an individual weigh-in and group meetings with a team of nutrition and exercise experts. Both intervention groups claimed frequent weighing was one of the keys to success (Wing, 2006). The most successful weight maintenance was seen in the group having face to face contact with expert staff. The internet group was also able to

maintain weight loss compared to the control group. Consistent contact (Wadden, 2003) and accountability have shown positive outcomes for weight control, either by attending meetings or through the internet.

**Mobile Phones in Healthcare**

Mobile phones are being used in the healthcare field as a means of managing behavior (Krishna, 2009). Since cell phones are widely used and a part of everyday life, they may easily incorporate health behavior management (Krishna, 2009). For example, calorie counting is available through applications on mobile phones. Also, clinical trials have looked at the benefits of text message reminders. Overall, eighty percent of studies reviewed utilizing cell phones found positive behavior change (Krishna, 2009). Cell phone users are increasing rapidly. Therefore, it is an efficient mode of communication including health messages or lifestyle interventions.

Insulin goals were communicated through text messaging for type 1 diabetics and improved insulin management (Franklin, 2006). The study by Franklin used "Sweet Talk" software to communicate personalized messages based on age, sex and insulin regimen (Franklin, 2006). The target audience was adolescents, who are known to be hard to reach (Franklin, 2006). The text message intervention was combined with standard insulin therapy and intensive insulin therapy. Also, the control group was treated with standard insulin therapy. The $HbA_{1c}$ levels improved significantly in the intervention group receiving "Sweet Talk" texts and intensive insulin therapy, compared to the two other groups. Additionally, self-efficacy was higher for the management of diabetes in

this group. Typically with intensive insulin therapy, support and coping tactics are needed (Franklin, 2006). The phone was a reliable way to communicate tips, information and reminders for improving blood glucose levels. This study concluded that a text message health intervention is effective for the adolescent population and is well received. The majority of participants actually wanted to continue the treatment. Many people could benefit from greater education on health behaviors and mobile phones may be an appropriate vehicle to reach younger generations.

A study by Patrick used a text message intervention to promote weight loss and maintenance (Patrick, 2009). The four month randomized trial consisted of two treatment groups; an intervention group received 2 to 5 personalized messages a day and the control group received a monthly newsletter regarding methods to control weight. This is the first study to use a text-message-based program for weight loss. The results show the text messaging to be effective, a weight loss on average of 2.88 kg (3.16%) was seen in the intervention group (Patrick, 2009). Overall, the participants were very satisfied and 92% would recommend the program to others. This program is inexpensive to initiate and with the gaining popularity of texting, may prove to be a good tool for behavior change.

Other cell phone studies uses in healthcare research include data monitoring and recording for the self-management of asthma and alcohol consumption. Ryan and researchers looked at the feasibility of asthma patients managing peak flow monitoring on their mobile phone. Participants (aged 12-55

years of age) liked the autonomy, became more self-aware of symptoms and increased understanding of asthma management (Ryan, 2005). Overall, 74% of participants responded that self-monitoring through the phone allowed for better control of their asthma. Another cell phone study used the device as a means of data collection of alcohol consumption in young social drinkers (Collins, 2003). The investigators compared self-monitoring between paper and cell phone methods. Both groups recorded a comparable amount of days, yet the paper group could have filled in their data at a later point in time. The study concluded that recording details of drinking behavior on a cell phone through the use of prompts or reminders produced high levels of compliance among young people (Collins, 2003).

Mobile phones have introduced modern ways to record dietary intake. Arsand and colleagues looked at using a smart phone for monitoring food intake along with blood glucose in diabetes patients (Arsand, 2008). Smart phones have combined the productivity of a computer and cell phone (Busis, 2010). Their applications allow access to databases with vast amounts of information, including nutrition. One group of participants used a smart phone to test recording their food intake. Items were entered using a touch screen and selecting an icon to best portray the foods. Participants gave insight for future interventions, including a program tailored to individual needs. The feedback towards daily goals was motivating (Arsand, 2008). They also expressed a desire for accessibility of nutrition information to learn more about nutrient and energy content of foods. Mobility of the hand held device was seen as important for sustaining long-term

use (Arsand, 2008). Managing daily nutrition goals seems easier and enlightening for diabetes patients, through the use of smart phone technology.

Another mobile phone study by Six and researchers looked at designing a mobile food record based on feedback from potential consumers (Six, 2010). Mobile phones have broad capabilities, including high quality pictures and expanded memory capacity. Younger generations are growing up amid dynamic technology, particularly with mobile phones. As a reflection of this lifestyle, adolescents prefer using their phone to record food intake (Six, 2010). The mobile record aims to minimize the burden of recording and enhance the quality of dietary assessment (Six, 2010). The program user takes a picture of meals or snacks before and after consumption. Based on the photo, the application determines the amount and types of food consumed. Following analysis, the calorie and nutrition information is given. Tools that promote accurate self-monitoring of dietary intake are needed, especially for adolescents who lack knowledge on nutrition details such as portion size (Six, 2010). Overall, health professionals are helping create new applications for tracking and analyzing dietary intake, while keeping in mind the desires of a technology-savvy population.

A recent weight loss intervention delivered through podcast (accessible on mobile device or computer), incorporated weekly nutrition lessons, self-monitoring and social support via Twitter. The experimental group used a mobile app to record and was compared to a group who chose their self-monitoring method; an app, the Web or in a paper journal. The experimental group did not

show greater adherence utilizing an app when compared to the group that used their choice of method. However, when analyzing the collapsed results of all subjects reportedly using app to self-monitor, the app users recorded significantly more days (Turner-McGrievy, 2011). Overall, minimum face to face contact was the premise for this weight loss intervention and proved successful with a mean weight loss of 2.7%, with comparable levels of self-monitoring and social support (Turner-McGrievy, 2011).

**Focus Group Methodology**

A focus group is a type of qualitative research that collects peoples' thoughts and opinions. Information is acquired through group discussion and interaction (Stevens, 1996). People bond over similarities and are likely to open up more than in a one on one interview (Stevens, 1996). They are encouraged to communicate with other members of the group (Kitzinger, 1995). Often times the discussion ventures off in another direction, allowing for new information to be discovered (Kitzinger, 1995). Focus groups originated around the 1920's for market research purposes (Powell, 1996). Overall, focus groups encourage further analyses of a topic and the insight gathered can help generate new hypotheses (Powell, 1996). The descriptive data can also be used to design or evaluate future healthcare interventions.

There are many advantages to focus group research. Focus groups further knowledge on the challenges of different demographic groups (Stevens, 1996). Quantitative research does not typically consider different experiences between cultures and socioeconomic classes. Methods used in quantitative research include

controlling or evenly dispersing people from different demographics among the groups being tested (Stevens, 1996). Within focus groups, there is no discrimination against people that are not able to read or write (Kitzinger, 1995). Focus groups can also bring out information on topics considered off limits, by some participants willing to "break the ice" (Kitzinger, 1995). Shy individuals may be less inhibited and open up more in a group setting, as opposed to a one-on-one interview. Additionally, focus groups promote feelings of importance and people feel their opinions are valued. Lastly, group discussions can provide a sense of support. Overall, focus groups can tap into a great depth of information not available in quantitative studies.

Not all focus group outcomes are positive. The group may derive a consensus of criticism (Kitzinger, 1995). Negative feelings may be fueled by other opinions in the room and take over the conversation. Also, the norms expressed among the group may discourage opposing viewpoints or alternative opinions (Kitzinger, 1995). Participants may change their viewpoint due to the group effect. Another consideration of a focus group is the issue of confidentiality. Confidentiality cannot be guaranteed and may also hinder some information from being shared in the group. There are a few downsides of focus groups, including possible negativism and compromised confidentiality.

Focus groups are a means of formative assessment, used in the planning of experimental research (Thompson, 2011). For instance, a few Texas schools wanted to incorporate obesity prevention into their curriculum and were seeking information from their target audience (the parents of the children), to help design

an effective intervention (Thompson, 2011). Surveys and focus groups addressed eating patterns, grocery shopping, goal-setting and problem solving within the homes. Participants expressed that problem foods were sugar-sweetened beverages and lack of vegetables. The parents wanted to serve their children healthy foods and had multiple strategies for resisting unhealthy foods desired by the children. Also, preferences got in the way of healthy goals for the family. Participants wanted more education on meal planning and making recipes healthier. Common themes among the formative studies (focus groups and surveys) were to include hands-on learning techniques in food and nutrition education (Thompson, 2011). This study used data from focus groups and surveys in order to capture descriptive information from the target population, to help design an appealing curriculum effective for many needs and interests.

Another qualitative study used focus groups as a way of understanding possible contributors to childhood obesity, with a future intervention in mind. The UK is also experiencing a rise in obesity, including children (McPherson, 2009). Investigators were interested in infant feeding practices, parental beliefs with regards to growth and the idea of an early intervention to prevent childhood obesity (Redsell, 2010). The research was conducted in five various demographics, including five high risk areas of childhood obesity and one considered low risk. They wanted the bulk of information from high risk areas and a low risk area for comparison. Also, cultural differences were of interest. Obese women were found to want large babies and therefore adopted unhealthy infant feeding habits (Redsell, 2010). There was also a lack of knowledge

surrounding feeding practices and interpreting infant distress. Many parents simply assumed infant crying indicated hunger. The response to the intervention was positive. Feeding strategies started before weaning the infant from breast milk or the bottle. Some of the common themes researchers identified were to provide support and more education for parents on breastfeeding and infant feeding (Redsell, 2010). Since the risk of adult obesity is increased with being overweight during childhood, formative assessment aided in understanding factors possibly related to childhood obesity.

Focus groups have also been used to design self-monitoring tools and increase adherence to a weight loss intervention (Glanz, 2006). Glanz conducted the qualitative research in order to obtain participants' perceptions of recording diet and exercise. Opinions were gathered about creating a program to self-monitor using a PDA. The participants desired a program that included immediate feedback and a daily reminder. After using the PDA within the long term weight loss trial, participants recorded more frequently and indicated it was easy, informative and reinforcing (Glanz, 2006). Also, the subjects were improving their dietary choices and making greater progress towards weight management goals. Not only can electronic recording help people manage their weight and possibly implement a long-term behavior change, the technology can lead to more accurate results in weight loss interventions.

# Chapter 3

## METHODS

This exploratory study was supplementary to a semi-randomized controlled trial. The ASU Smart Phone Trial involved 47 adults who completed an 8-week self-monitoring weight loss intervention. The purpose of the smart phone trial was to measure adherence of self-monitoring among the three different methods: using an "app" on a smart phone, logging dietary intake on the smart phone notepad or 'memo' function, or keeping a paper diary. After finishing the study, focus groups engaged participants in a group discussion to evaluate the recent intervention and gather ideas for future research.

Inclusion criteria for the smart phone trial limited participation to healthy individuals ages 18 to 65, with a BMI between 25 – 40, and owners of a smart phone. Subjects were recruited from four ASU campuses. The participants were stratified by gender, BMI, and age, and were semi-randomized into 3 groups. Group 1 used an application for the iPhone ("Lose It"). Group 2 typed daily food records on the memo feature of their Blackberry or notepad on the iPhone while tracking physical activity on paper. Group 3 consisted of participants recording food and exercise in a paper journal, provided by the investigators.

The groups varied in the method used to self-monitor and what they were tracking. Group 1 or the "Lose It" group utilized the app to monitor calories and energy expenditure based on their daily calorie goal. This group received weekly emails, with information such as the success of mobile apps in promoting health behaviors. Group's 2 and 3 were given a tailored weight loss plan, including a

daily calorie allotment (derived from the Mifflin St. Jeor equation, with 500 calories less for weight loss) and the number of servings from each food group to incorporate in their day (Mifflin, 1990). However, these participants were not monitoring calories, but trying to incorporate their designated portions of carbohydrate, protein, dairy, fruits, vegetables, fat and (minimal) sweets. Additionally, the notebook provided a template or grid for recording exercise, with a designated box for each day. Lastly, the paper and memo group received weekly emails of food-related tips, such as "Ways to incorporate more servings of fruits and vegetables."

The subjects had a total of 4 visits with investigators (initial visit, week 1, week 4 and week 8). On the initial and last visit the subjects were weighed using a body composition analyzer, including BMI and body fat percentage. On the second and third visits the subjects were weighed only. The paper group turned in their journal after 4 weeks and received a new one for the remaining 4 weeks.

Subjects were recruited for the focus groups upon completing the trial. During the last meeting with investigators, subjects were invited to partake in the post-study focus groups. Each group was scheduled to have at least 5 participants and the meetings took place on 3 of the ASU campuses. Snacks and beverages were provided to participants, along with a ten dollar Target gift card for compensation. The focus group sessions were around 60 minutes in length. This research was approved by the Arizona State University Institutional Review Board, Human Subjects Committee.

**Data Collection**

Five focus groups were conducted, with a total of 16 participants. Each group consisted of people using the same method to self-monitor. For instance, one of the focus groups contained all memo group participants (n=3). Two of the focus groups (n=5, n=4) comprised all app users. The other two focus groups consisted of participants who recorded in a paper diary (n=2, n=2).

The researcher asked approximately 10 questions (see Appendix A), as part of the semi-structured focus group design. The sessions were audio-recorded and notes were taken by a co-moderator. After initial introductions, the icebreaker question started out the discussion, "When I say the phrase 'diet success' what does that mean to you?" Participants were encouraged to share their impression of the study (both positive and negative opinions), the most and least liked part, their thoughts about recording exercise, whether their behavior changed and if they would recommend their method to others.

After conducting the memo focus group, it was apparent the study protocol was not followed and the data were dismissed. Even though the participants were directed to type in their food on the memo or notepad of their smart phone, the individuals within this group did not follow the designated protocol. One participant used an app to aid in recording food intake during the study. Another participant switched to an app post-study, and was using the app at the time of the focus group. Therefore, the focus group discussion highlighted smart phone apps, while uncovering individual methods used to assist with the daily recordings.

**Data Analysis**

A common approach to analyzing qualitative data is grounded theory. It originated from sociologists Barney Glaser and Anselm Strauss circa the 1960's (McCann, 2003). Grounded theory is an inductive approach, created from the "ground-up" (McCann, 2003). Techniques from grounded theory were used to assist with the data analysis. Grounded theory involves analyzing data throughout the process of collecting information. After reflecting on each focus group, the researcher and co-moderator reviewed common themes of the discussion. This allowed new ideas to be explored more thoroughly in following groups. For instance, accountability was a theme that emerged from the first group discussion and was asked about in subsequent focus groups. Finally, a hypothesis is generated at the end of data analysis, rather than at the beginning of the research study.

The analysis began with transcribing and coding the data. Audio recordings of the data were transcribed by the researcher (moderator of the focus groups) and two undergraduate honor students. The analysis included open coding of the transcripts line- by- line and organizing the data in Microsoft Excel spreadsheets. Open coding was used to assign descriptions to raw data (Krueger, 1998). Each comment was given a phrase or code to identify the content (see Appendix G). First, the researcher coded the data using specific codes. After initial codes were created, the researcher assigned more broad or axial codes, to connect the concepts. A few of the codes were derived verbatim from the data,

also known as “in-vivo” coding (Corbin & Strauss, 1990). Examples of in-vivo codes included “awareness” and “not feeling like a prisoner” while self-monitoring. Next, the data was organized into Excel spreadsheets (Stockdale, 2002). Each row of the spreadsheet included the focus group question, individual response and corresponding codes. This allowed the researcher to easily view the codes by question and see the frequency of codes. Also, a theme dictionary or code book was created in an Excel spreadsheet to organize and define the codes used, while showing a representative quote for each (Stockdale, 2002). The code book for both app and paper themes may be viewed in Appendices E and F (respectively).

After the codes were established, each transcription was analyzed by question. Categories or themes were initially created per question. Next, the categories per question were compared to the remaining questions to create overarching themes. Constant comparison helped with building a theme, by comparing similarities or differences among codes (Corbin & Strauss, 1990). Also, the codes and themes were compared to existing literature on self-monitoring. A few core categories collapsed related categories, while attempting to explain the overall thoughts and behavior from our self-monitoring study (Pinto-Foltz, 2010).

**Inter-coder reliability**

For the app group data, a second coder was utilized to demonstrate reliability and helped derive themes. Inter-coder reliability was measured at 92% of codes agreed upon for app data. Inter-rater reliability was calculated by the

number of agreements divided by agreements and possible agreements (Auld, 2007). The few probable agreements included attributes liked about the smart phone and app. Following the second coder analysis, both coders discussed and established themes in concurrence.

# Chapter 4

# RESULTS

Sixteen people (5 male, 11 female), who completed the Smart phone weight loss trial participated in the focus groups. The mean age of the participants was 45 years, with a range from 22-60 years old. The focus groups consisted of members who utilized the same method to record dietary intake and exercise. Two app-user focus groups were conducted, with a total of 9 participants (n=5, n=4). Paper and pencil users participated in one of two focus groups, with a total of 4 participants (n=2, n=2). Lastly, one focus group was conducted for people tracking by the memo or note function on the smart phone (n=3). However, this focus group revealed a divergence from the study protocol and the results were not included.

After analyzing data within the Excel spreadsheet (see Appendix H), common themes surfaced within the app focus groups and within the paper focus groups. However, data saturation was likely not met due to small subject pool and limited number of groups. Participant quotes representing the themes are present in Table 1 for app and Table 2 for paper, with initials before each quote representing the different contributors.

## *App Themes*

Five themes emerged in the app focus groups, falling under one of four categories: most liked about recording, positive features of the app, least liked characteristic of the app and suggestions. App respondents described qualities

most liked about self-monitoring, which included: 1.) The gained sense of dietary awareness, and 2.) Controlling calories, while not restricting certain foods or food groups. The app was well received; participants noted simplicity, its extensive food database and the ability to customize as the most liked features. Meanwhile, focus group contributors disliked the exercise component of the program and desired more nutrition advice from the app. (See Table 1)

**Table 1.**

| **App GroupThemes** | **Quotes** |
|---|---|
| Awareness | (SM) "I think the other thing was just raising my awareness of how many calories are in some of the things I was eating."<br>(KW) "So for me the best way to lose weight is to count my calories, and like you said, being aware of how much I was eating, like 550 calories for a burger."<br>(CS) "Yeah, I was just going to add about restaurant food - it kind of puts it into perspective. You don't realize, but that's 2/3 of my daily calories in one meal, or even more than that" |
| Suitable to lifestyle | (BS) "You can plan around it. Like you were saying, most diets, just don't eat it. Well that is not going to work. Cause I want to eat it, but I'll just swim longer, run longer or bike longer, at least that is what you want to do."<br>(SM) "But it was not a diet to deny yourself something. You could treat yourself however often you'd like. I like that too."<br>(GM) "Because with other diets, you feel like a prisoner. You are following the diet, but you are really not happy with it."<br>(YD) "It's so convenient. Cause with Weightwatchers I had to carry a bigger purse to put all that stuff in there. It's always with me. So I love the convenience. For my lifestyle, it's wonderful." |

| | |
|---|---|
| Liked the app | (SP) “I personally was pretty impressed with the lose-it program - the app- because of all the extensive information that was already on there, as far as food items.”<br>(CS) “Definitely the simplicity. How quick and easy it is and how comprehensive the database is.”<br>(YD) “ I was able to enter all the foods that I eat on there. You could find it on the internet and it gives you the calorie breakdown, and I entered them in lose-it. So I customized lose-it to be more usable for me.”<br>(SP) “And it's free. That's a biggie.” |
| Exercise was least liked feature | (YD) “It gave me way too many calories for the exercise I did. I would have gained weight if I would have followed those numbers.”<br>(KW) “I do floor exercises, like um sit-ups, and weight lifting. I didn’t find anything like that in the app.”<br>(SM) “It calculates exercise a little differently. I like accuracy and this one seemed to be a little loose.” |
| More Nutrition Advice | (MS) “I wish it had more education, like choose this over that. Cause you could fill up on fruit-roll ups all day and you'd be within the calories and that's not good for you.”<br>(YD) “We need tips of the day or something, on Lose-it.”<br>(SM) “That would have been helpful, how to look at something and know approximately what size it is.”<br>(BS) “You could totally lose weight with this and eat junk.” |

**Awareness**

Counting calories can provide eye-opening information about the energy content of food and beverages. The auto-calculation of caloric intake offered immediate feedback provided by the app. All participants commented on a greater awareness of food consumption during the self-monitoring trial. They learned what foods were “cheap in calories” and indulgences to have less frequently.

> (YD) “It made me aware of calories and danger foods.”
> (SP) “You can eat more food if you make better choices.”
> (SM) “And then you realize you don’t need that many calories, which is the other shocker. You’ve always heard eat right, eat less and exercise if

> you want to lose weight. Until you see with this kind of a gage, you don't know what less is."

Respondents spoke of consuming greater amounts of lower calorie, satiating foods such as broccoli, green beans, yogurt, bananas and edamame. Overall, self-monitoring helped participants understand the quantitative component of food and encouraged consumption of lower calorie fare.

Additionally, the increased mindfulness led to portion control. Six out of nine participants mentioned reading labels more frequently, buying a scale and measuring foods.

> (SM) "I'm also checking labels a lot more. They are sneaky on those labels too."
> (MS) "I've changed my habits. I'm no longer dipping my spoon into the peanut butter jar."

Reading labels and learning the amount of food designated in a single serving can be surprising. Measuring food was a new habit formed by some group members. Participants discussed counting out M&M's or weighing food on a scale in an attempt to stay within their calorie budget. Therefore, awareness of serving size and calorie content is crucial for behavior change. Mentally processing nutrition information provided by the app and food labels encouraged regulation of serving size and calories consumed.

More than half of the participants (56%) mentioned the heightened sense of awareness influenced habits of dining out. Many restaurant foods were available in the app database, or participants made a habit of looking up nutrition information online (using calorie information provided by a restaurant's website) and manually entering it in.

> (RC) “I went to a restaurant and recorded a meal I really like; chorizo, eggs and enchiladas. It's really good, but it showed the calories and it was pretty high. So, if I do eat it, it will be once in a great while, and I'll make sure to halve it, or something.”

Being cognizant of the high amount of calories in restaurant fare encouraged participants to take half of the portion home, eat out less frequently or to pack a lunch. Eating at restaurants is enjoyable and a part of many social cultures. Attention to calories and portions of restaurant food is important for weight loss and maintenance.

**Suitable to lifestyle**

Sixty-seven percent of app participants mentioned controlling calories or managing the numbers was a doable approach to weight loss. Compared to other dieting strategies of eliminating certain foods or food groups, this method was flexible and likeable for long term adherence. Participants compensated for indulgences through exercise or a balance of high calorie foods with lower calorie foods.

> (GM) “If I want a chocolate, because sometimes I cannot avoid it, I go for a milky way fun-size. At the end of the day, I’ll walk for 10 more minutes and I can burn it. With other diets, you feel like a prisoner. You go back to old habits because it was not enjoyable.”

The term “prisoner” was deemed an appropriate description of being on a restrictive diet, coined by focus group members. Many respondents had experienced other dieting regimes and agreed that this method of managing calories was not depriving. Overall, learning to self-manage calories may be a better tool for weight loss and maintenance.

More than half of the participants (56%) stated that recording on the phone was convenient and complimented their lifestyle. The mobile app allowed independent weight loss efforts and faster, more efficient recording.

> (YD) “Because I'm busy and I don't have to listen to these boring ladies try and give me a pep talk. I can just record. So I like this better than going to Weightwatchers.”
> (KW) “I can just immediately record it, because if I wait I’ll forget and having my phone with me all the time helps me, it’s there and I won’t forget.”

Their comments suggested that face to face weight loss interventions might not compatible be with demanding schedules. Also, the time between eating and self-monitoring was important. Recording soon after meals was perceived as to produce more effective results. For an individual who always has their smart phone accessible, tracking food and exercise on an app is not only practical, but may enhance the quality of data and allow for continuous self-monitoring throughout the day.

**Liked the app**

The app was noted as user-friendly by the participants. Eight out of nine participants discussed likeable characteristics, including the ability to customize recipes, easy entry of foods, immediate calorie feedback and the affordability. One group member was initially frustrated because her traditional Mexican foods were not available in the app, but soon personalized the program by manually entering in her own ingredients and calorie information.

> (YD) “I was able to put in pozole, menudo, things that I eat. You could find it on the internet and it gives you the calorie breakdown. I entered them in Lose-it, so I customized Lose-it to be more usable for me.”

> (SM) "It had a lot of the foods I already eat in it. I love that I could program it for my foods. I eat on campus a lot. They provide the nutritional information and I can program that in. I also love the recipe feature. If you have your own recipes you can program them in and it will tell you what the calories are and how many servings."

Additionally, more than half of participants (56%) commented on the ease of retrieving commonly eaten foods and the extensive food database. It was rare if a food was not in the database, according to group members. In a self-monitoring study utilizing a PDA for recording food intake, technology deterred people from following the protocol (Yon, 2007). Some participants noted the PDA was hard to see and finding foods in the database was difficult. Luckily, the "Lose It" app was user-friendly and the extensive food database enabled a positive influence on self-monitoring.

Participants expressed enjoying the immediacy of calorie information from the "Lose It" database, upon entering meals and snacks during the day. An individual calorie allotment was created based on an average weight loss of 1 pound per week for 8 weeks (for the ASU Smart Phone Trial). Calories from dietary intake were deducted and energy expended through exercise was added back into the calorie "budget." Focus group members recognized the value in monitoring net calories, by guiding food choices and planning remaining meals of the day.

> (SM) "After plugging in breakfast and lunch, I'd see how well I did on my choices. I'd know for dinner what to have…"
> (KW) "You got an answer right away, you knew where you were at."

Four out of nine participants mentioned affordability. Accessing a free app was satisfying, especially after paying for weight loss programs in the past.

(YD) “I liked the app, because with Weightwatchers you had to pay 13 dollars a week. I would go to the meetings and be really mad because the ladies aren't very motivational.”
(SP) “It's free. That's a biggie.”

Money can be a barrier to joining a weight loss intervention. A benefit of owning a smart phone is access to hundreds of thousands of free apps, including apps that promote positive health behaviors.

**Exercise component**

The least liked feature of the app was the exercise tracking. Seven out of nine focus group members expressed that the calories given towards exercise were too generous. One participant used a heart rate monitor to gain a more accurate estimate of energy expenditure. A contributing factor to the exercise calories being too lenient was the lack of specificity to age, gender or levels of intensity within sports.

(YD) “It was giving me too many calories and I wasn’t losing any weight.”
(MS) “At one point I changed my settings to a male and increased my weight to see if the calories expended during exercise changed, and they didn’t”.
(BS) “I play goalie on an intramural soccer team, and there is going to be different amounts of calories burned if you are a forward or mid running the entire time, compared to a goalie”.
(SM) “Yoga is only one level of intensity and my wife who is a yoga teacher, would disagree.”

Additionally, an exercise mentioned by the group that had no equivalent was weight lifting. The inaccuracy and generic settings of the exercise component was least liked among the app users; however it encouraged participants to adjust their calories for weight loss or seek a more truthful number of energy expenditure.

**More Nutrition Advice**

Many of the focus group contributors had suggestions for the "Lose It" program. One of the common criticisms of using the app was that the program simply monitored the numbers of energy intake and expenditure. It did not include any information on healthy eating, such as nutrient-dense choices. Eight out of nine participants desired more nutrition information, feedback on their food choices or ideas for healthy substitutions.

> (BS) "Cause you could eat junk and still be within the calorie limit".
> (SM) "One of the other apps gave specific coaching, such as, 'you need more fiber'. Ok, that's something I can work on."

Another idea was a "Tip of the Day" on the app, to provide information and keep people motivated. Overall, the majority of participants wanted more nutrition advice and information from the mobile app.

Also, respondents expressed attention to serving sizes, including more education on a serving size and help with eyeballing portions of restaurant foods. Eating food prepared away from home was particularly challenging, noted the majority of group members.

> (BS) "I thought it was difficult with restaurants for servings because a lot of restaurants give you two and three servings, they give you a ton of food and it's like, how much is this? I don't know."
> (GM) "We love going out to the movie theaters and my husband cannot watch a movie if we don't have popcorn. So, before putting my hand inside that box, or whatever the bag, I was measuring. I was like, is this a cup?"

Once again, the increased awareness helped participants focus on serving size and curb some mindless eating. However, there was a lot of guessing and uncertainty about portion sizes. Other studies have reported estimating portion sizes as a

barrier to weight loss and recommend practical exercises for learning portions (Burke, 2008). Participants also noted guesstimating larger amounts than actually consumed, to be in favor of weight loss. Nutrition advice including education on portion sizes was desired by app users, particularly to assist with dining out.

## *Paper Themes*

### Awareness

Despite the small number of participants in the two paper focus groups (n=2, n=2), some common themes emerged (see Table 2). Consistent with the app group findings, all paper group members experienced increased awareness. Participants expressed thinking about their food choices and trying to include the recommended number of servings from each of the food groups. Focusing on food groups enhanced the awareness of daily servings of fruits and vegetables.

> (JH) "I realized how hard it is to get 5 fruits and vegetables a day."
> (JL) "One thing we started doing is ordering baskets of local produce biweekly". That really encourages me to eat more vegetables."

Increasing consumption of produce was viewed as a challenge, but three out of four contributors embraced new strategies of buying and preparing vegetables.

> (PH) "We stopped going to Costco, there's just two of us. We just buy smaller portions, especially fresh vegetables."
> (JH) "I'm more conscious of trying to stay ahead of keeping good stuff in the refrigerator, the vegetables and the fruits. I go to Fresh and Easy a lot more than I used too."

Shopping frequently was effective for keeping fresh produce accessible at home. Also, half of the group members commented on making fewer trips to Costco because purchasing food in bulk encouraged stocking up on less nutritious items.

Three out of four participants were also cognizant of portion sizes, mentioning the use of measuring cups on a regular basis. Overall, the awareness led participants to increase the availability of nutrient-dense foods in the house and to be mindful of serving sizes.

**Recording in a notebook was a burden**

Self-monitoring allows focused attention on food consumption and the ability to correct or modify behavior throughout the day (Baker, 1993). All four participants agreed that recording in the notebook was often ineffective due to the size, having to remember it, or the tedium of hand writing notes. A female participant admitted carrying around a notebook was not conducive to her lifestyle or purse size.

> (JH) "I would have probably been able to carry a smaller notebook with me. I was carrying around big pieces of paper in my purse and then trying to put them into the notebook later."
> (JL) "Sometimes I would forget to bring the notebook with me. I usually kept it in the kitchen, but then if I was out a lot I'd forget to bring it."
> (PH) "I just couldn't drag the thing around. I was going to go to all these parties, holding a glass of wine and hors d'oeuvres. I needed somehow to keep a mental picture. That was negative about the paper, note-taking."

Group members revealed the size, accessibility or carrying the notebook to special events was a hassle and led to non-compliance. Social gatherings may lead to overeating. Recording in a quick, convenient manner may be particularly helpful during this vulnerable time for individuals trying to maintain or lose weight. Also, writing all of the foods, portion sizes and ingredients could be time consuming. Typing or selecting foods from a database may be easier to create a food diary. In

order to record consistently and monitor behavior throughout the day, convenient and portable methods of self-monitoring were desired.

**Wanted a user-friendly method**

All focus group participants talked about needing an organized format for recording food, allowing easier entry and to assess progress throughout the day. Three out of four participants tried to keep a tally of the number of servings consumed from the food groups.

> (JL) "I'd like to have something on each page where I could just check it off when I fill it in. Like two blanks for fruits."
> (JH) "Smaller size, more fill in the blank, rather than just a list. Something that has a format to it, where you are filling in what you ate and off to the side you are checking off your fruits and vegetables. Something that keeps a tally."
> (DO) "I planned my day around what I needed to get off that list. If I was going out for lunch I would get protein because I knew I needed it, knowing that I don't get enough protein. So, I would keep the servings in mind for the day and use that as a guideline."

The exercise template provided in the notebook was a framework that allowed a space for each day's physical activity. Participants wanted to record in a template to allow quick and easy tracking, while showing progress towards daily goals. In addition to a user-friendly format for recording food and exercise, all four participants desired a sizable page or screen to view food records. Even though the notebook was a burden to carry around, an advantage was the size of the paper.

> (PH) "That is a positive about the notebook; you actually see the physical layout of a whole day's meals. On a little phone you can't."
> (JH) "I can't record food on my blackberry. You can't see it. It's too hard to search for the food."
> (DO) "I like the visual aspect of charting. I'm very much a visual learner. I typed my entries because I just needed to see it come on the screen."

This group of smart phone owners did not want to utilize a mobile app to self-monitor, due to the small size of the phone. The participants emphasized the ability to see entries on an adequately sized computer monitor or paper. Focus group members agreed that they wanted to take advantage of modern technology to record, but tracking via their phone was not ideal.

Another feature desired by the paper recorders was a calculation of energy intake. Even though the paper group was not instructed to count calories, half of the group members noted they would like a calculation of calories consumed.

> (JH) "Being able to somehow quickly calculate, and then realize, I better watch it because I've had a lot of food, a lot of calories."
> (PH) "I could never figure out how many calories I ultimately consumed."

**Accountability**

Three out of four paper participants indicated accountability as motivation for behavior change. Keeping a journal and weighing in only 3 days in 8 weeks (after baseline), was not enough to keep one person encouraged to continue.

> (DO) "I think I have to be held accountable in a different way. Just me and the notebook was not enough. If I were held accountable to submit something; sometimes when you've submitted it then it's done, it's in."
> (JH) "I think if I had brought my journal in every couple of weeks, you want to try a little harder because somebody's going to look at it. If I were provided feedback or a rough calorie count, something that adds value or someone to help you with it".

An idea to enhance accountability was submitting diet records regularly, noted by half of participants. The feeling of accomplishment or completing a task may sustain motivation. Also, feedback regarding food choices or total calories consumed may have been beneficial. Weekly counselor feedback on food diaries was strongly influential and motivating, noted participants in a behavioral weight

loss intervention delivered on the internet (Hunter, 2008). Interaction with a counselor or nutrition professional is an important component of a successful behavior change program. Friends or peers may also enhance accountability, known as structural support (Verheijden, 2005). A lack of structural support was mentioned as hindering weight loss efforts.

> (DO) "I didn't have any colleagues or friends doing this, so I didn't have anyone. You know, someone looking out for you."
> (JL) "If we had a meeting with the other people, somebody who is going through the same thing and able to give you some support."

**Table 2**

| **Paper Group Themes** | **Quotes** |
|---|---|
| Awareness | (PH) "It forced me to pay attention to what I ate and how much I ate. Because I have to write this down, I have to figure out what I'm grabbing."<br><br>(JH)"I think that is what I liked is being aware, trying to organize my meals around things that were healthy and the guidelines. Also, being aware of serving sizes, that kind of thing."<br><br>(JL)"And it does help you look at what you've eaten for the day and see your patterns."<br><br>(DO)"I would say overall it made me more aware of portion sizes and increased my vegetable intake." |
| Recording in the notebook was a burden | (DO) "I don't like recording everything because I found it very tedious. Time is very precious to me and so I wasn't seeing the bang for my buck writing it all down. But just the fatigue of writing stuff down, didn't fit into my life really well"<br><br>(JH) "What I liked the least was the fact that it was a big notebook. I would have probably been able to carry like a small notebook around with me. Um, because what I found was I was carrying around big pieces of paper in my purse and then trying to put them into the notebook later."<br><br>(PH) "I just couldn't drag the thing around. I was going to go to all these parties, holding a glass of wine and hors d'oeuvres. I needed somehow to keep a mental picture. See that was negative about the paper, note-taking." |

| | |
|---|---|
| Recording in the notebook was a burden (cont.) | (JH) "I would leave the notebook at home. And then I'd leave it at work." |
| Wanted a user-friendly method | (JH) "I copied the template in the front of the notebook for number of servings to have and put it on to every page because a fill in the blank kind of thing is faster for me."<br><br>(JL) "It would have been nice if I'd typed it online, I could have cut and pasted for the next day." |
| Accountability | (DO) "Just me and the notebook was not enough. I think if I was sending it to someone every day or if someone was expecting it, would have made me more accountable."<br><br>(JH) "If I had brought my journal a couple of weeks and someone would have looked at it; that makes you want to try a little harder, do it better because somebody's going to look at it, you know, help you with it." |

Peer input can provide new ideas and encouragement to keep up the motivation, and provide people to empathize with. Group treatment has led to significant weight loss in a behavior change intervention, compared to individual therapy (Befort, 2010). Participants also highlighted the support of family as helpful in implementing change.

> (JL) "My sister is visiting me. She was kind of doing it along with me. She's basically just eating what I'm eating and we have been walking a half hour a day."
> (PH) "I don't cook in my family; my wife won't eat my cooking. But then I learned different ways of preparing vegetables, more importantly my wife started eating what I grilled, not just me."

Having family or friends partake in eating more vegetables or new exercise habits was beneficial, as noted by half of group members. Overall, three out of four participants acknowledged social support as a positive influence of behavior change.

# Chapter 5

# DISCUSSION

Increased self-awareness, gaining knowledge and taking control all contribute to the process of behavior change (Hindle 2011). Self-monitoring is a key player in behavioral weight loss interventions. However, if recording behavior is not feasible long-term, than self-monitoring is deemed less effective (Burke, 2011). Uncovering benefits and barriers of this process can help elucidate more efficient means of monitoring behavior. The results give perspectives of self-monitoring diet and exercise, using two different methods.

The app group mentioned many benefits of app self-monitoring that complimented their lifestyle. Qualities included the convenience and simplicity of the program, affordability, immediate nutrition information and the ability to customize the app. Another likeable aspect of self-monitoring was counting calories and not restricting foods. Participants enjoyed the ability to allow for indulgences by compensating with exercise or balancing calories and not feeling like a "prisoner." Another study used mobile phones for self-monitoring asthma and recording peak flow. Asthma sufferers appreciated the increased awareness and the gained capacity for managing their asthma, as well as the ease of recording using the phone (Ryan, 2005). Lastly, app self-monitoring was well received due to the affordability. A survey of consumer preferences noted low cost and minimal contact as high priorities of a behavior change program (Sherwood, 1998). Mobile apps are a convenient and inexpensive method of

increasing awareness of eating behaviors, while providing users with increased independence and self-efficacy in managing their health.

App participants also spoke of disliked features and ideas to improve the program. The calculation of energy expenditure on “Lose It” was deemed inaccurate. The calories added back into the net calculation were too generous. Group members were disappointed in the lack of specific exercises and intensities of sport options. Also, participants sought more nutrition advice, along with counting calories. Group members agreed more nutrition information on healthful choices and serving sizes was needed. A quasi-experimental study tested the feasibility of an app that provided personalized food recommendations (based on exchange lists), created a food and exercise diary, and incorporated nutrition education. Seventy-six percent of participants claimed the program greatly expanded their food knowledge, including energy content and characteristics of foods (Rossi, 2010). Another suggestion for the app was personalized dietary feedback. Research has shown personalized counselor feedback administered in an intervention resulted in greater weight loss, compared to a control group with no communication or interaction with a professional (Tate, 2001). Additionally, tailored health messages are more pertinent to the individual and have a greater likelihood of being applied (Noar, 2011). App group members modified eating behavior based on calorie information provided by the program, but sought additional education and feedback to encourage long-term self-monitoring.

Participants who recorded on paper noted positive and negative aspects of self-monitoring. Recording in a paper diary gave participants a heightened

awareness, helping implement behavior change. “Seeing it in black and white” was informative and startling, noted participants in another self-monitoring study (Burke 2009). Participants focused on eating the recommended number of daily fruits and vegetables. Also, the awareness led to modifying grocery shopping habits to increase fruit and vegetable consumption. A favorable aspect of self-monitoring using a notebook was the size of the page. Participants who recorded on paper preferred a large food diary for viewing purposes and realized that recording on their smart phone was not ideal, due to the small size of the screen. The size of the notebook was also a deterrent from consistent self-monitoring, along with the tedium of note-taking and having to remember it. Carrying the notebook out of the house or during special occasions was not always practical, as it was too bulky to fit in a purse.

Participants from the paper group had suggestions to improve self-monitoring. They desired a technology-assisted program to aid in recording, including an auto-calculation of calorie consumption, expenditure and professional feedback. Participants self-monitoring with an app noted the immediate calorie calculation as one of the most liked features (Rossi, 2010). The paper group also expressed a need for increased accountability. Submitting diet records and peer support were ideas to drive motivation. The sense of accountability created by having food and exercise diaries reviewed by a counselor was effective for continued self-monitoring and weight loss, compared to personal accountability (Hunter, 2008; Tate, 2003). Tracking progress towards goals and feedback from a professional was suggested by contributors. Overall,

recording in a paper journal may heighten awareness and lead to behavior change short-term, but a user-friendly program incorporating technology and accountability were desired to continue with weight-loss efforts.

Overall, the two methodologies to self-monitor and dietary instruction given in the ASU Smart Phone Trial were different. The app group regulated dietary intake by tracking calories using an app on their smart phone and received no further nutrition guidance. The paper group was instructed to manage their dietary intake based on customized exchange lists or recommended servings from each of the food groups, while recording on paper. This group also received weekly emails about foods to increase in the diet and ideas for preparing fruits and vegetables.

Participants indicated that both methods were imperfect; however, combining some qualities from each design may enhance self-monitoring. For instance, the app group had the quantitative component of foods, but desired feedback regarding dietary choices. Tailored text messaging was used to encourage adherence to lifestyle changes for weight-loss in adolescents (Woolford, 2010). The study concluded that automated text messages were a feasible a way of administering tailored feedback. Participants noted the tailored messages were personally applicable and a pleasurable way of encouraging healthy eating behaviors, which included recipes and meal suggestions (Woolford, 2010). Feedback on food diaries was mentioned by both groups as a preferred attribute of a self-monitoring program.

The paper group focused on eating recommended servings from each food group encouraging a balanced diet, with optimal servings of fruits and vegetables. However, this group wanted the energy content of foods accessible in their diary, along with a convenient, technology-assisted method to record. Paper group members had greater information on the variety of food groups to include and portion sizes, but were unaware of exactly how many calories they were consuming. An ideal self-monitoring program would include a convenient and user-friendly format, an auto-calculation of calories and professional dietary advice provided by a counselor or automated through the application.

**Limitations**

One limitation of focus group findings is the lack of ability to generalize, even to the group being studied. Participants in the study represented overweight men and women associated with Arizona State University. They were owners of a smart phone and represent a sub-sample from the smart phone trial, residing in the local Phoenix area.

Another limitation of this qualitative research is the small number of participants (n) within focus groups likely disallowed saturation of theme identification. A larger sample of people could have generated more ideas and provided greater insight into likes, dislikes, as well as differences between, methods of dietary tracking. Also, the data were collected retrospectively and may be influenced by recall or memory.

The focus group data may have been influenced by the researcher's involvement in the Smart Phone Trial. The researcher who moderated the focus

groups worked with the study participants during the 8 week weight-loss trial (prior to focus groups). The interactions included four face to face meetings and communicating via email. The relationship with the subjects could have been an advantage; participants may have willingly joined focus groups to help the researcher or revealed information in a trusted environment. However, the familiarity between the moderator and participants could have influenced the participants to answer the questions dishonestly and give more desirable answers, perhaps what the researcher wanted to hear.

# Chapter 6

# CONCLUSION

Smart phone apps are emerging as novel tools for self-monitoring, assisting with weight loss. Apps have incorporated some effective features of successful weight loss programs. A program including self-monitoring, personalized feedback and interaction with a counselor, opportunities for social support and the ability to individually tailor information are characteristics of technology-assisted weight loss interventions that have produced positive results (Khaylis, 2010). Many self-monitoring apps such as “Lose It” can include friends for social support, provide calorie feedback and allow the individual to customize and track weight loss goals. Exploring benefits and barriers of app self-monitoring and incorporating components of effective weight loss programs can improve these tools readily available through technology.

Benefits of using an app described in our study include the immediate feedback of calorie intake and expenditure, user-friendly features of customizing and entering foods, convenience and affordability (after the purchase of a smart phone). Self-monitoring via an app allows the individual to regulate calories while not restricting foods. Apps for self-monitoring are available to smart phone owners seeking independent methods to lose weight, without a time commitment. For continued self-monitoring, app participants wanted to compliment their current knowledge with personalized feedback and additional nutrition information.

Benefits of recording in a paper journal while monitoring recommended exchanges or food groups included an adequate visual layout of daily food choices and the encouragement of a balanced diet. Participants wanted to take advantage of a technology-based food diary and an auto-calculation of calories. However, all four members of the paper group desired a larger screen to view food entries than their smart phone. Perhaps future research should consider a self-monitoring app available either from a tablet, smart phone or computer.

Perceptions from the ASU Smart Phone Trial revealed that individuals enjoyed self-monitoring through a smart phone app, but needed an additional component of an evidence-based behavior change program. Therefore, the addition of dietary counseling with app self-monitoring technology may result in more effective self-monitoring.

**Future Research**

More research is needed to assess the long-term benefits of and enhancements to app self-monitoring tools. First, the results of this research suggest self-monitoring apps be evaluated with the addition of behavioral counseling or tailored professional feedback for obesity prevention and weight-loss interventions. Tailored feedback may include recommendations for the ideal number of servings from each of the food groups, based on an individual's dietary intake during the day. For example, advising spaghetti squash instead of pasta as a meal idea if the daily recommendations of grains have been met. Also, future research should consider enhancing nutrition information available on apps, including a quick reference to eyeballing portions and a list of nutrient-dense

substitutions (for example; whole wheat vs. white bread). Lastly, tailoring to individual needs and offering self-monitoring programs via smart phone, tablet or computer should be an option for future interventions.

# REFERENCES


Arnold, E., Heddle, N., Lane, S., Sek, J., Almonte, T., & Walker, I. (2005). Handheld computers and paper diaries for documenting the use of factor concentrates used in haemophilia home therapy: A qualitative study. *Haemophilia : The Official Journal of the World Federation of Hemophilia, 11*(3), 216-226.

Arsand, E., Tufano, J. T., Ralston, J. D., & Hjortdahl, P. (2008). Designing mobile dietary management support technologies for people with diabetes. *Journal of Telemedicine and Telecare, 14*(7), 329-332.

Artinian, N. T., Fletcher, G. F., Mozaffarian, D., Kris-Etherton, P., Van Horn, L., Lichtenstein, A. H., . . . American Heart Association Prevention Committee of the Council on Cardiovascular Nursing. (2010). Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults: A scientific statement from the American Heart Association. *Circulation, 122*(4), 406-441.

Auld, G. W., Diker, A., Bock, M. A., Boushey, C. J., Bruhn, C. M., Cluskey, M., Zaghloul, S. (2007). Development of a decision tree to determine appropriateness of NVivo in analyzing qualitative data sets. *Journal of Nutrition Education and Behavior, 39*(1), 37-47.

Baker, R. C., & Kirschenbaum, D. S. (1998). Weight control during the holidays: Highly consistent self-monitoring as a potentially useful coping mechanism. *Health Psychology : Official Journal of the Division of Health Psychology, American Psychological Association, 17*(4), 367-370.

Baker, R. C., & Kirschenbaum, D. S. (1993). Self-monitoring may be necessary for successful weight control. *Behavior Therapy, 24*(3), 377-394.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior : The Official Publication of the Society for Public Health Education, 31*(2), 143-164.

Befort, C. A., Donnelly, J. E., Sullivan, D. K., Ellerbeck, E. F., & Perri, M. G. (2010). Group versus individual phone-based obesity treatment for rural women. *Eating Behaviors, 11*(1), 11-17.

Bennett, G. G., Herring, S. J., Puleo, E., Stein, E. K., Emmons, K. M., & Gillman, M. W. (2010). Web-based weight loss in primary care: A randomized controlled trial. *Obesity (Silver Spring, Md.), 18*(2), 308-313.

Bish, C. L., Blanck, H. M., Maynard, L. M., Serdula, M. K., Thompson, N. J., & Khan, L. K. (2007). Health-related quality of life and weight loss practices among overweight and obese US adults, 2003 behavioral risk factor surveillance system. *MedGenMed : Medscape General Medicine, 9*(2), 35.

Bish, C. L., Blanck, H. M., Serdula, M. K., Marcus, M., Kohl, H. W.,3rd, & Khan, L. K. (2005). Diet and physical activity behaviors among americans trying to lose weight: 2000 behavioral risk factor surveillance system. *Obesity Research, 13*(3), 596-607.

Bish, C. L., Michels Blanck, H., Maynard, L. M., Serdula, M. K., Thompson, N. J., & Kettel Khan, L. (2006). Health-related quality of life and weight loss among overweight and obese U.S. adults, 2001 to 2002. *Obesity (Silver Spring, Md.), 14*(11), 2042-2053.

Boutelle, K. N., Kirschenbaum, D. S., Baker, R. C., & Mitchell, M. E. (1999). How can obese weight controllers minimize weight gain during the high risk holiday season? by self-monitoring very consistently. *Health Psychology : Official Journal of the Division of Health Psychology, American Psychological Association, 18*(4), 364-368.

Burke, L. E., Conroy, M. B., Sereika, S. M., Elci, O. U., Styn, M. A., Acharya, S. D., . . . Glanz, K. (2011). The effect of electronic self-monitoring on weight loss and dietary intake: A randomized behavioral weight loss trial. *Obesity (Silver Spring, Md.), 19*(2), 338-344.

Burke, L. E., Swigart, V., Warziski Turk, M., Derro, N., & Ewing, L. J. (2009). Experiences of self-monitoring: Successes and struggles during treatment for weight loss. *Qualitative Health Research, 19*(6), 815-828.

Burke, L. E., Warziski, M., Styn, M. A., Music, E., Hudson, A. G., & Sereika, S. M. (2008). A randomized clinical trial of a standard versus vegetarian diet for weight loss: The impact of treatment preference. *International Journal of Obesity (2005), 32*(1), 166-176.

Busis, N. (2010). Mobile phones to improve the practice of neurology. *Neurologic Clinics, 28*(2), 395-410.

Catenacci, V. A., Hill, J. O., & Wyatt, H. R. (2009). The obesity epidemic. *Clinics in Chest Medicine, 30*(3), 415-44, vii.

Collins, R. L., Kashdan, T. B., & Gollnisch, G. (2003). The feasibility of using cellular phones to collect ecological momentary assessment data: Application to alcohol consumption. *Experimental and Clinical Psychopharmacology, 11*(1), 73-78.

Dansinger, M. L., Gleason, J. A., Griffith, J. L., Selker, H. P., & Schaefer, E. J. (2005). Comparison of the atkins, ornish, weight watchers, and zone diets for weight loss and heart disease risk reduction: A randomized trial. *JAMA : The Journal of the American Medical Association, 293*(1), 43-53.

Finkelstein, E. A., DiBonaventura, M., Burgess, S. M., & Hale, B. C. (2010). The costs of obesity in the workplace. *Journal of Occupational and Environmental Medicine / American College of Occupational and Environmental Medicine, 52*(10), 971-976.

Flegal, K. M., Carroll, M. D., Kit, B. K., & Ogden, C. L. (2012). Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA : The Journal of the American Medical Association, 307*(5), 491-497.

Franklin, V. L., Waller, A., Pagliari, C., & Greene, S. A. (2006). A randomized controlled trial of sweet talk, a text-messaging system to support young people with diabetes. *Diabetic Medicine : A Journal of the British Diabetic Association, 23*(12), 1332-1338.

Giskes, K., Kamphuis, C. B., van Lenthe, F. J., Kremers, S., Droomers, M., & Brug, J. (2007). A systematic review of associations between environmental factors, energy and fat intakes among adults: Is there evidence for environments that encourage obesogenic dietary intakes? *Public Health Nutrition, 10*(10), 1005-1017.

Glanz, K., Murphy, S., Moylan, J., Evensen, D., & Curb, J. D. (2006). Improving dietary self-monitoring and adherence with hand-held computers: A pilot study. *American Journal of Health Promotion : AJHP, 20*(3), 165-170.

Heetderks-Cox, M. J., Alford, B. B., Bednar, C. M., Heiss, C. J., Tauai, L. A., & Edgren, K. K. (2001). CD-ROM nutrient analysis database assists self-monitoring behavior of active duty air force personnel receiving nutrition counseling for weight loss. *Journal of the American Dietetic Association, 101*(9), 1041-1046.

Hill, J. O., Wyatt, H. R., Reed, G. W., & Peters, J. C. (2003). Obesity and the environment: Where do we go from here? *Science (New York, N.Y.), 299*(5608), 853-855.

Hindle, L., & Carpenter, C. (2011). An exploration of the experiences and perceptions of people who have maintained weight loss. *Journal of Human Nutrition and Dietetics, 24*(4), 342-350.

Hunter, C. M., Peterson, A. L., Alvarez, L. M., Poston, W. C., Brundige, A. R., Haddock, C. K., . . . Foreyt, J. P. (2008). Weight management using the

internet a randomized controlled trial. *American Journal of Preventive Medicine, 34*(2), 119-126.

Khaylis, A., Yiaslas, T., Bergstrom, J., & Gore-Felton, C. (2010). A review of efficacious technology-based weight-loss interventions: Five key components. *Telemedicine Journal and e-Health : The Official Journal of the American Telemedicine Association, 16*(9), 931-938.

Kitzinger, J. (1995). Qualitative research. introducing focus groups. *BMJ (Clinical Research Ed.), 311*(7000), 299-302.

Krishna, S., Boren, S. A., & Balas, E. A. (2009). Healthcare via cell phones: A systematic review. *Telemedicine Journal and e-Health : The Official Journal of the American Telemedicine Association, 15*(3), 231-240.

Lane, S. J., Heddle, N. M., Arnold, E., & Walker, I. (2006). A review of randomized controlled trials comparing the effectiveness of hand held computers with paper methods for data collection. *BMC Medical Informatics and Decision Making, 6*, 23.

McCann, T. V., & Clark, E. (2003). Grounded theory in nursing research: Part 1--methodology. *Nurse Researcher, 11*(2), 7-18.

Mifflin, M. D., St Jeor, S. T., Hill, L. A., Scott, B. J., Daugherty, S. A., & Koh, Y. O. (1990). A new predictive equation for resting energy expenditure in healthy individuals. *The American Journal of Clinical Nutrition, 51*(2), 241-247.

Noar, S. M., Grant Harrington, N., Van Stee, S. K., & Shemanski Aldrich, R. (March/April 2011). Tailored health communication to change lifestyle behaviors. *American Journal of Lifestyle Medicine, 5*(2), 112-122.

Oenema, A., & Brug, J. (2003). Feedback strategies to raise awareness of personal dietary intake: Results of a randomized controlled trial. *Preventive Medicine, 36*(4), 429-439.

Patrick, K., Raab, F., Adams, M. A., Dillon, L., Zabinski, M., Rock, C. L., . . . Norman, G. J. (2009). A text message-based intervention for weight loss: Randomized controlled trial. *Journal of Medical Internet Research, 11*(1), e1.

Pinto-Foltz, M. D., Logsdon, M. C., & Myers, J. A. (2011). Feasibility, acceptability, and initial efficacy of a knowledge-contact program to reduce mental illness stigma and improve mental health literacy in adolescents. *Social Science & Medicine, 72*(12), 2011-2019.

Powell, R. A., & Single, H. M. (1996). Focus groups. *International Journal for Quality in Health Care : Journal of the International Society for Quality in Health Care / ISQua, 8*(5), 499-504.

Redsell, S. A., Atkinson, P., Nathan, D., Siriwardena, A. N., Swift, J. A., & Glazebrook, C. (2010). Parents' beliefs about appropriate infant size, growth and feeding behaviour: Implications for the prevention of childhood obesity. *BMC Public Health, 10*(1), 711.

Rossi, M. C., Perozzi, C., Consorti, C., Almonti, T., Foglini, P., Giostra, N., . . . Vespasiani, G. (2010). An interactive diary for diet management (DAI): A new telemedicine system able to promote body weight reduction, nutritional education, and consumption of fresh local produce. *Diabetes Technology & Therapeutics, 12*(8), 641-647.

Ryan, D., Cobern, W., Wheeler, J., Price, D., & Tarassenko, L. (2005). Mobile phone technology in the management of asthma. *Journal of Telemedicine and Telecare, 11 Suppl 1*, 43-46.

Sherwood, N. E., Morton, N., Jeffery, R. W., French, S. A., Neumark-Sztainer, D., & Falkner, N. H. (1998). Consumer preferences in format and type of community-based weight control programs. *American Journal of Health Promotion : AJHP, 13*(1), 12-18.

Six, B. L., Schap, T. E., Zhu, F. M., Mariappan, A., Bosch, M., Delp, E. J., . . . Boushey, C. J. (2010). Evidence-based development of a mobile telephone food record. *Journal of the American Dietetic Association, 110*(1), 74-79.

Stevens, P. E. (1996). Focus groups: Collecting aggregate-level data to understand community health phenomena. *Public Health Nursing (Boston, Mass.), 13*(3), 170-176.

Stockdale, M. S. (2002). Analyzing focus group data with spreadsheets. *American Journal of Health Studies, 18*(1), 55.

Stone, A. A., Shiffman, S., Schwartz, J. E., Broderick, J. E., & Hufford, M. R. (2003). Patient compliance with paper and electronic diaries. *Controlled Clinical Trials, 24*(2), 182-199.

Strauss, A. L., & Corbin, J. M. (1990). *Basics of qualitative research :Grounded theory procedures and techniques*. Newbury Park, Calif.: Sage Publications.

Tate, D. F., Wing, R. R., & Winett, R. A. (2001). Using internet technology to deliver a behavioral weight loss program. *JAMA : The Journal of the American Medical Association, 285*(9), 1172-1177.

Thomas, S. L., Hyde, J., Karunaratne, A., Kausman, R., & Komesaroff, P. A. (2008). "They all work...when you stick to them": A qualitative investigation of dieting, weight loss, and physical exercise, in obese individuals. *Nutrition Journal, 7*, 34.

Thompson, D., Cullen, K. W., Reed, D. B., Konzelmann, K., & Smalling, A. L. (2011). Formative assessment in the development of an obesity prevention component for the expanded food and nutrition education program in texas. *Family & Community Health, 34*(1), 61-71.

Turner-McGrievy, G., & Tate, D. (2011). Tweets, apps, and pods: Results of the 6-month mobile pounds off digitally (mobile POD) randomized weight-loss intervention among adults. *Journal of Medical Internet Research, 13*(4), e120.

Verheijden, M. W., Bakx, J. C., van Weel, C., Koelen, M. A., & van Staveren, W. A. (2005). Role of social support in lifestyle-focused weight management interventions. *European Journal of Clinical Nutrition, 59 Suppl 1*, S179-86.

Wadden, T. A., & Butryn, M. L. (2003). Behavioral treatment of obesity. *Endocrinology and Metabolism Clinics of North America, 32*(4), 981-1003, x.

Wadden, T. A., Butryn, M. L., & Wilson, C. (2007). Lifestyle modification for the management of obesity. *Gastroenterology, 132*(6), 2226-2238.

Wadden, T. A., West, D. S., Neiberg, R. H., Wing, R. R., Ryan, D. H., Johnson, K. C., . . . Look AHEAD Research Group. (2009). One-year weight losses in the look AHEAD study: Factors associated with success. *Obesity (Silver Spring, Md.), 17*(4), 713-722.

Wang, Y. C., McPherson, K., Marsh, T., Gortmaker, S. L., & Brown, M. (2011). Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet, 378*(9793), 815-825.

Warziski, M. T., Sereika, S. M., Styn, M. A., Music, E., & Burke, L. E. (2008). Changes in self-efficacy and dietary adherence: The impact on weight loss in the PREFER study. *Journal of Behavioral Medicine, 31*(1), 81-92.

Wing, R. R. (2010). Treatment options for obesity: Do commercial weight loss programs have a role? *JAMA : The Journal of the American Medical Association, 304*(16), 1837-1838.

Wing, R. R., & Phelan, S. (2005). Long-term weight loss maintenance. *The American Journal of Clinical Nutrition, 82*(1 Suppl), 222S-225S.

Wing, R. R., Tate, D. F., Gorin, A. A., Raynor, H. A., & Fava, J. L. (2006). A self-regulation program for maintenance of weight loss. *The New England Journal of Medicine, 355*(15), 1563-1571.

Yon, B. A., Johnson, R. K., Harvey-Berino, J., Gold, B. C., & Howard, A. B. (2007). Personal digital assistants are comparable to traditional diaries for dietary self-monitoring during a weight loss program. *Journal of Behavioral Medicine, 30*(2), 165-175.

# APPENDIX A

## IRB APPROVAL SMART PHONE TRIAL

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

| | |
|---|---|
| **To:** | Carol Johnston<br>HSC |
| **From:** | Carol Johnston, Chair<br>Biosci IRB |
| **Date:** | 06/16/2010 |
| **Committee Action:** | **Expedited Approval** |
| **Approval Date:** | 06/16/2010 |
| **Review Type:** | Expedited F4 F7 |
| **IRB Protocol #:** | 1006005238 |
| **Study Title:** | Smart phones and dietary tracking: a feasibility study |
| **Expiration Date:** | 06/15/2011 |

The above-referenced protocol was approved following expedited review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval before the expiration date. You may not continue any research activity beyond the expiration date without approval by the Institutional Review Board.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Biosci IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Biosci IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.

# APPENDIX B

# IRB MODIFICATION FORM FOR FOCUS GROUPS

Arizona State University
Office of Research Integrity and Assurance
IRB
P.O. Box 871103
Tempe, AZ 85287-1103
Phone: 480-965-6788
Fax: (480) 965-7772

*For Office Use Only:*
Date Received:

# Modification Form Institutional Review Board (IRB)

| INVESTIGATOR INFORMATION | |
|---|---|
| **PROTOCOL TITLE:** Smart phones and dietary tracking: a feasibility study | **HS # 1006005238** |
| **PRINCIPAL INVESTIGATOR: Carol Johnston** | **DEPARTMENT/ CENTER: nutrition** |
| **CAMPUS ADDRESS:** 6950 E. Williams Field Road, Mesa, 85212<br>0180 campus mail | **PHONE: 480-727-1713**<br>**EMAIL: carol.johnston@asu.edu** |
| **CO-INVESTIGATORS: Christopher Wharton, Barb Cunningham, Danielle Sterner, Kevin Cowen** | |
| **FUNDING STATUS:**<br>If project is funded or funding is being sought, provide list of all sponsors and grant numbers: | |

**TYPE OF MODIFICATION (CHECK ALL THAT APPLY)**
**Please attach any revised documents (forms, scripts, etc). Attach a brief summary of the proposed changes as well as a justification.**

| | | |
|---|---|---|
| x | New Procedures | Attach a description of the new procedures and a revised consent form. We would like to add a post-trial focus group to the study protocol. The purpose of the focus group is to listen to the experiences and perceptions of the subjects regarding their participation in the 8-wk weight loss trial. We will follow standard focus group protocol. 6-8 subjects will gather in an informal setting at one of the ASU campuses. The room will be set up to both audio tape and video tape the proceeding. These tapes will be used only to allow for accurate transcription of the discussion. The tapes will not be used for presentations, etc. Two facilitators will be in the room during the discussion and will take field notes. At the completion of the proceeding, participants will be offered $10 gift cards as a compensation for their time. |
| ☐ | Study Title Change | What is the new title? |
| ☐ | Change in Study Personnel | ☐ Add (include the name, role, and contact information. Include copies of training certificates: http://researchintegrity.asu.edu/training/humans<br>☐ Delete |
| ☐ | Change of Site | ☐ Add (include the name and location. If this changes the enrollment, that should be noted below.)<br>☐ Modify<br>☐ Delete |
| ☐ | Change in Enrollment | Attach a narrative justifying the change. If this will affect the consent, send a revised consent form as well. |
| x | Consent Change | Attach a copy and describe the change(s). A letter consent for participation in the focus group is attached |
| ☐ | Advertisement | Attach copies of the advertisement or announcement. |
| x | Instruments (surveys, questionnaires, interviews, etc) | Attach copies of the proposed instruments and describe any changes from the approved protocol. If you are adding or deleting any instruments or items to an instrument, describe what the changes are and submit the revised materials. The 10 questions to be used in the focus groups are attached. |
| ☐ | Other | Describe the changes. If this affects the consent process, submit a revised consent form. |

| SIGNATURE | | |
|---|---|---|
| **PRINCIPAL INVESTIGATOR:**<br>**Carol Johnston** | Name (first, middle, last): | |
| | Signature: | Date: 9-14-10 |

# APPENDIX C

# CONSENT FORM

ASU ARIZONA STATE UNIVERSITY
POLYTECHNIC CAMPUS

College of Nursing & Health Innovation
Nutrition Program

6950 E. Williams Field Road
Mesa, AZ 85212

(480) 727-1670
Fax: (480) 727-1064
nutrition@asu.edu

INFORMATION LETTER

**SMART PHONE TRIAL**
Post-Trial Focus Groups

Date: September 2010

Dear Participant:

I, Danielle Sterner, am a graduate student under the direction of Professors Christopher Wharton and Carol Johnston in the Nutrition Program at Arizona State University. I am conducting a research study to explore your perceptions of our recently completed Smart Phone Trial in which you were a research subject.

I am inviting your participation in a post-trial focus group, which will involve about 1 hour of your time at an ASU campus location. Each focus group will encompass 6-8 participants. We will ask the group to reflect about their experiences in the trial and their feelings about the intervention. You have the right not to answer any question, and to stop participation at any time. Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty.

Although there is no direct benefit to you, possible benefits of your participation are that future weight loss trials may be more effective based on your experiences in this trial. There are no foreseeable risks or discomforts to your participation. You will be presented a $10 gift card for your participation in this study.

Although we will take precautions to keep your responses confidential once the discussion is completed, there will be others in the room and we cannot guarantee that complete confidentiality will be maintained. The results of this study may be used in reports, presentations, or publications but your name will not be used.

The session will be videotaped and audiotaped to allow us to transcribe the discussion accurately. You have the right to ask for the recording to be stopped during the discussion If you wish not to be videotaped, we will place you outside of the camera range. These tapes will be transcribed and then stored in a locked cabinet in Dr. Wharton's office (HSC 1331) for 3 years at which time the tapes will be shredded.

If you have any questions concerning the research study, please contact the research team at: 480-727-1821 [Dr. Wharton] or 480-727-1713 [Dr. Johnston]. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

ASU IRB
Approved
Sign
Date 9/14/10 - 6/15/11

By signing below you are agreeing to participate to in the study.

_____ _____
Signature Date

By signing below you are agreeing to be video and/or audio taped in the study.

☐ I agree to both video and audio taping for this study.

☐ I agree only to the audio taping for this study. I will sit out of camera range during the session.

# APPENDIX D
# FOCUS GROUP QUESTIONS

1. Tell us who you are and what your favorite food is.
2. When I say the phrase, “diet success,” what does that mean to you?
3. What was your overall impression of your involvement in our study?
4. What did you like most about the method you used to record the food you ate?
5. What did you like least about the method you used to record the food you ate?
6. What would you change about this method?
7. What was your overall impression of the exercise-tracking method you used in this study?
8. Would you recommend this diet-tracking method to others trying to lose weight? What would your rationale be for that?
9. Did this change your behavior in any way? If so, how?
10. Thinking about this study, what is the one question we forgot to ask during this meeting?

# APPENDIX E

# APP THEME CODE BOOK

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **1. Awareness** | | | | |
| | calorie content of foods | | "Even just for information, I mean my wife was curious, how many calories am I supposed to be having if I want to lose weight? Of course she said, that's too few" | SM |
| | immediacy of net calories | ability to continously self-monitor | "But also learning that right away. I mean, you know, plugging it in. I usually did breakfast, lunch and after to see how well I did on my choices, I know for dinner" | SM |
| | perspective on restaurant foods | calorie content, looking up restaurant menu items prior to eating out | "I never used to look up my restaurant meals. Once in awhile I would look up something. And then this made me look up every restaurant meal I had. And like you, that is when I discovered 500 calories for some burger that I had. That's crazy, so it also helped me be aware of my nutritional choices. And I complain it's time, but I just have to do it. Bring my lunch instead of eat out." | KW |
| | planning | allowing for indulgences, planning meals | "You can strategize, knowing exactly, you can plan it. Like you said, that was perfect." | BS |

| | | | | |
|---|---|---|---|---|
| | portion control | reading labels, being aware of portion sizes | "Yeah, I measure and weigh stuff more now. I have a kitchen scale and I mean, a tablespoon of like peanut butter is a lot less than I used to put on, so, that's - I try to measure stuff like that at least, like butter, peanut butter, jelly, that kind of stuff. The stuff that can really add up if you just overdo it a little bit." | MS |
| Theme/Code | | Definition | Quote | Initials |
| **2. promoted good health** | promoting healthy behavior/ info | exercise, seeking other health related ideas | "Yes, they have a yoga one that I downloaded it. I don't like the strong guy... let's see, where is it... yeah, they have one called fitness I had to pay for. It's | YD |
| Theme/Code | | Definition | Quote | Initials |
| | able to adapt self-monitoring into lifestyle, routine | | "Well, I'm continuing my journaling so yes, it has. It's become a part of my regular routine." | YD |
| | weight loss success | | "A diet success, it worked for me." | SM |
| **3. Simplicity** | User-friendly | App was easy to use, large food database | "Well, I personally was pretty impressed with the lose-it program - the app- because of all the extensive information that was already on there, as far as food items. There were not all that many I had to add, but I did find that I was eating a lot of the same foods over and over again, maybe | RC |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| | no cost | Little or no cost involved with self-monitoring | "I liked it because the Weightwatchers, you had to pay 13 dollars a week and I'd always buy the $100 whatever things and I would go and I'd end up being really mad because the ladies aren't very motivational, I guess, so that was an excuse not to go anymore and this, this is more, this is better for me." | YD |
| **4. Suitable to lifestyle** | | The diet plan was practical; subjects modified intake based on calories, education, awareness | But it was not a diet to deny yourself something. You could treat yourself like however you like or how often you like. I like that too. | SM |
| Theme/Code | | Definition | Quote | Initials |
| | Convenience | Always accessible, portable, already using phone 24/7 and quick entry of saved meals and frequent foods | "It's so convenient. Cause with the Weightwatchers thing I had to carry a bigger purse to put all that stuff in there to go look it up, and here, I just on my phone. It's always with me. So I love the convenience. For my lifestyle, it's wonderful." | YD |
| | tailored to individual preferences | | "I loved that it was pretty well programmed as an app. I mean it had a lot of the foods I already eat in it. I love that I could program it for the foods. I eat on campus a lot; pitchforks on campus. They provide the | SM |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| | not punishing | Did not feel like a "prisoner", on a diet or deprived | "Because with other diets, you feel like a prisoner, yes you are following these but you are really not happy with what you are following. And maybe that is what you said, you go back to old habits, because you stop enjoying what you really were enjoying." | GM |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **5. Tedious** | | time-consuming (manual entry) | "I think one complaint I would have to there was a lot of stuff I had to create a menu for. Uh, there was a lot of supermarket foods, it just seemed I had to do that a lot. Yeah, time | RC |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **6. Disliked exercise component** | exercise calories | App calculated exercise calories too loosely, not enough specific exercises and hard to track certain activities | It, the exercising calc's a little differently. And I like accuracy and this one seemed to be a little loose. Um, some of the exercise, it has walking, it doesn't have the treadmill. But if you go to program it for your own self, somehow they have the symbol for treadmill in there, it was like well, you knew it was coming, why didn't you just… Yoga is only one intensity and my wife, who is a yoga teacher would disagree. | SM |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **7. Prior experience** | Convenience, benefit of SM | knew benefit of self-monitoring, advantage of technology | Yeah, it is a good one. It's free, and they say one of the biggest reasons for success on a diet is journaling. And people don't like to write down, so the next best thing is to, you know, log it. Make your selection and just log it in on your phone. And it's always with you. | SP |
| | | had experience with self-monitoring in weight watchers, already knew benefit of self-monitoring | "Well, my weightwatcher training helped me." | YD |
| Theme/Code | | Definition | Quote | Initials |
| **8. Lost motivation over time** | | got busy or bored with tracking and needed reminder | "You know what would be nice is, with me, I don't think anyone else had this problem, but maybe an email saying like stop being lazy, enter your data. Because sometimes I just forget too. Um, yeah busy, thinking about dissertation stuff, not worried about it. Just a little email says like, it's only going to take you one minute Brett, just do it. And I would just do it. I think that would be all the accountability I would need." | BS |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **9. wanted nutrition education, feedback** | more information | Wanted feedback, coaching on making healthier choices | "yeah, because you could totally lose weight with this and eat junk." | BS |
| | more information | more tips, suggestions | "Thanks for the tips. We need stuff like this on this little Lose-it, like tips of the day or something." | YD |
| | more information | had nutrition information but did not know how to use it | "And it wasn't so much the recording as, we talked about this too, at the follow up, um, it gives you that nutritional information, but I really did not know what to make of it. Is this percentage, it seems like it is a 40-40-20 split of carbohydrates, | SM |
| Theme/Code | | Definition | Quote | Initials |
| | education on portions | was guesstimating portions, wanted to be more accurate | That's one thing about it I don't know if we mentioned it already. Sometimes it's hard to guesstimate your portions. You know, like if you go to a restaurant... I mean, I'd always ask my wife, what do you think this is? Like how many cups or how many whatever, you know. | RC |

| Theme/Code | Definition | Quote | Initials |
|---|---|---|---|
| **10. social support** | support of friends, colleagues and family | "Yes, and actually at my work three of my friends are my friends (on Lose It) and I'll send a text message and say, 'Hey I see that you were not beyond the calories or whatever. I bet you are going to lose weight today.' And then they will get back and say, 'No wait until I enter what I just ate'.We were encouraging each other and I think it really helped keep each other motivated." | GM |

# APPENDIX F

# PAPER THEME CODE BOOK

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **1. Awareness** | | | | |
| | eating patterns | focused on eating patterns | "...logging is of course very good because it's like, there is someone looking over your shoulder like you know you are going to have to put it down if you eat this and is it worth it if you, have to do that. And it does help you look at what you've eaten for the day and your patterns and things. | JL |
| | prevented mindless eating | paid attention to food, not just eating mindlessly | " It forced me to pay attention to what I ate and how much, you know.It forced me to uh, impulsive eating. Because I have to put this down you know and I have to figure out what I'm grabbing." | PH |
| | focused on food groups, portion | planning and eating based on # of servings from each food group and | "I planned my day around what I needed to get off that list or if I was going out for lunch knowing that protein is really hard for me to get because I don't make | DO |
| Theme/Code | | Definition | Quote | Initials |
| | changed shopping habits; fresh produce | increased fruit and veg by changing shopping habits | "...when you were talking about cooking and vegetables, I'm more conscious of trying to stay ahead of keeping good stuff in the refrigerator, the vegetables and the fruits, I go to fresh and easy a lot more than I used too." | JH |
| 2. **Notebook was burdensome** | | time-consuming, tedious | "I thought it was, it was burdensome. This (study) happened during my conference, you know in August. I knew I was going to go to all these parties and I just couldn't drag the thing around. But, it was really tough, you know. Holding a glass of wine and hors d'oeuvre, you know. I needed somehow to you know keep a mental picture. See that was negative about the paper, notetaking." | PH |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| | wanted a user-friendly format, template | burdensome; had to remember notebook | "I would leave it at home or something. And then I'd leave it at work. The other part too, I think I showed you, I was attempting to take that template that was in the front and put it on to every page because a fill in the blank kind of thing is faster for me." | JH |
| | size | notebook was too big to carry around | "For myself, actually what I liked the least was the fact that it was a big notebook. Um, because what I found was I was carrying around big pieces of paper in my purse and then trying to put them into the notebook later." | JH |
| **3. Wanted a user-friendly method** | | using technology, wanted to record easier | "It would have been nice if I'd typed it online, once I figured out what the serving size was, I could have cut and pasted that to use for the next day." | JL |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| | portability, user-friendly | wanted to record easier, something portable | "Smaller size, more fill in the blank, rather than something that is just a list. Something that is has a format to it, where maybe you are filling in what you ate and um, off to the side you are checking off your fruits and vegetables. Something that helps you do a mental tally." | JH |
| | wanted a user-friendly format, template | a template, and more education on portion size | "I'd like to have something on each page, like this thing, where I could just... Like two blanks for fruits and I would just check it off when I fill it in. I'd like to have more detail on different foods, like what the, you know, sometimes there were just things, like I'd go look for something and couldn't figure out what size it really was supposed to be. I just think a little more detail." | JL |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| | calorie info | wanted an auto-calculation of calories | "I didn't like it because, well now I'm doing online recording. I could never figure out how many calories I ultimately consumed. You know, and now I'm doing it online and well now I see well I have to stop here, I've reached my limit." | PH |
| **4. Accountability** | | | | |
| | social support | needed support of friends, colleagues and family | "If we had like a meeting, so like with the other people, like weight watchers [laughter], except weight watchers a lot of it is just someone up there talking, doing the speaking. I think more like, for this, somebody who is going through the same thing and being able to give you some support. ...either way you always gain something from it or get some ideas from some other people and stuff. The peer input." | JL |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| | longer duration of study | longer time recording in study | "Yeah, and I think, continuing (with recording), having it be longer." | JL |
| | submit diet records | needed more accountability, by having to submit diet records | "...if I were held accountable to submit something. I liked the visual aspect of charting how I was doing. If we were weighing ourselves at home or figuring out if it was a longer amount of time, but weighing yourself to kind of see progress. Logging in your exercise, to see, oh you need three more times this week. I'm very much a visual learner. But viewing it helps me. Which is why I didn't write, I typed it as well; because I just needed to see it come on the screen." | DO |

| Theme/Code | | Definition | Quote | Initials |
|---|---|---|---|---|
| **5. More nutrition information** | difficulty estimating portions, eating out | wanted more info on portion sizes | "Sometimes it's hard, like if you get like, uh, you know, processed foods or you're out or something, figuring out how much cheese is this, how much pasta or vegetables this is. Trying to, figuring out what the size is or what the measurement is. Then I get frustrated and it's like, it's too hard to try this day, so we'll start tomorrow." | JL |

# APPENDIX G
# OPEN-CODED TRANSCRIPTS

DS: Yeah. What was your impression of our study?

JH: I thought it was a good idea. I thought it was interesting, um, the idea of looking at the old fashioned paper method vs. all the new technology. Liked the idea of comparing methods to self-monitor

PH: I learned a lot of new tips, even if I was in the control group. It forced me to pay attention to what I ate and how much I ate, you know. Became aware of food and portions I thought it was, it was burdensome. Writing down food entries was a burden But, uh it forced me to uh, impulsive eating. Because I have to put this down you know and I have to figure out what I'm grabbing. Controlled some mindless eating

JH: Yeah, me too.

PH: It made me and obviously your cooking tips, I was telling her earlier that uh, I learned to love vegetables now, especially when they're grilled or roasted. Learned new ways to cook vegetables I always know you need to add more, but I didn't know they taste pretty good. When

they're cooked in a healthy way, because for years I was a bachelor and for me to eat that stuff it had to be in the bags with the cheese in it. Liked vegetables prepared in healthy ways

JH: The sauce

PH: That's right, I can only eat vegetables…But I didn't know you could eat tasty vegetables by grilling it, you know in a healthy manner. Liked vegetables prepared in healthy ways

JH: I realized how hard it is to get 5 fruits and vegetables a day. Hard to eat recommended serving of fruit and vegetables per day

PH: Oh yeah.

JH: I'd get to three and go, wow, I've only gotten 3. I think I'm really conscious of protein though, lean protein. But getting 5 fruits and vegetables was a challenge. But, do you want us to talk more about our impressions or do you have more questions?

DS: I have more questions, but we can open it up to whatever you'd like to share too. Um, what did you like the most about recording in the notebook, even though I know it maybe wasn't your favorite.

JH: What did I like most about it? The fact that you had to do it, basically what he was saying, about you were thinking about what you needed to record, what you were going to eat and so then you thought about what you were eating when you were eating it. Or at least I did. Liked being aware of food intake, having to record it

DS: Uh huh. Awareness.

JH: Uh huh

PH: Well, you had this list of things I should eat, 5 vegetables or you know, so I changed what I ate too. I was trying to follow a guideline, in the notebook. Followed eating plan based on exchange list, changed what she ate

JH: Yeah, I think that is what I liked, being aware, trying to organize my meals around, um, things that were healthy and the guidelines of what we were trying to hit. Being aware of serving sizes, that kind of thing. Awareness of servings, planning meals based on recommendations

DS: So, what did you like the least about recording in the notebook?

JH: For myself, actually what I liked the least was the fact that it was a big notebook. I would have probably been able to carry like a small notebook around with me. Notebook was too big Um, because what I found was I was carrying around big pieces of paper in my purse and then

trying to put them into the notebook later. Wrote food on paper in purse and recorded in notebook at end of day

PH: Yeah.

JH: So I would sit down and literally catch up with all the scraps of paper I had in my purse. If it was smaller, um, you know, 5"x7" or something, that would probably have helped a little bit, at least keep up with it. Needed something more portable

DS: A little more portable

JH: Yeah, something portable.

PH: This happened during my conference, you know in August. I knew I was going to go to all these parties and I just couldn't drag the thing around. Was not realistic to carry around at events But, it was really tough, you know. Holding a glass of wine and hors d'oeuvre, you know. I needed somehow to you know keep a mental picture, you know all these little things keep coming, little appetizers you know

JH: That would be hard.

PH: Really hard to track it, you know hard to keep track of consumption at special events

JH: Yeah, I didn't have that kind of distraction, you know. I would leave it at home or something. And then I'd leave it at work. Forgot the notebook The other part too, I think I showed you, I was attempting to take that template that was in the front and put it on to every page because a fill in the blank kind of thing is faster for me. Wanted a template of servings from food groups to eat daily

PH: Oh. Good idea.

JH: So, when you are looking at the things in the front you were trying to hit, I ended up trying to fill those boxes in because I wanted something to contain me. Ok, this is what I had breakfast, lunch and dinner, um and then up here are your guidelines and so, yup, yup, yup… Even just the manualness of writing it down, I mean with electronic, you still have to type it in. But the idea of being able to somehow quickly calculate that ok, I really better slack off here because I've got a lot here, through lunch, a lot of food, a lot of calories, whatever. And I found myself flipping back and forth at that front page and trying to just use it wanted to check off servings from food groups, a template for each day

PH: I didn't like it because, well now I'm doing online recording. I could never figure out how many calories I ultimately consumed. Wanted calorie information

DS: Yeah

PH: You know, and now I'm doing it online and well now I see well I have to stop here, I've reached my limit. Wanted to see the total calories throughout the day

JH: Yeah

PH: But the paper, the note thing I didn't bring a calculator with me. That was really tough.

JH: Yeah, I started trying to do a calculation or something. Which online thing are you using?

PH: "My fitness pal" started online recording

JH: Ok. I'm using "my food diary". Uh huh. Started online recording

PH: In fact we have uh, we used to read newspapers at the dinner table. Now we have our little, my wife has a little tab and I have a portable there, so I read the New York Times but then I go to the website and I guess I better enter in my food. Yeah, that's what I'm doing. We're kind of weird, uh. Both himself and wife in a routine of recording electronically

DS: No that's great.

JH: I know, I want an iPad because I thought if I had an iPad I'd be

DS: And a bigger screen

PH: Yeah. See that was negative about the paper, notetaking. Didn't like writing everything down

DS: Well that's what we want to know

JH: Part of the research

DS: Yes. Uh, what would you change about the notebook, uh like we talked about smaller size

JH: Smaller size, more fill in the blank, rather than something that is just a list. Something that is has a format to it, where maybe you are filling in what you ate and um, off to the side you are checking off your fruits and vegetables template for daily recording, smaller more portable notebook

PH: Right, right

JH: Something that helps you do a mental tally. Keep a checklist

DS: Would you recommend this particular way of tracking to anybody?

JH: The paper method? Only to somebody who is not computer savvy, at this point. My mom did weight watchers and she did points and she counted up her points. She's like a lifetime member of weight watchers, but uh that was really successful for her because my mom doesn't even do email. Or she barely gets her messages out of her cell phone

DS: Yeah

JH: So for someone that's not very technologically savvy, I think they would need that, but anymore everything is just evolving. Recommend to someone who doesn't use the computer

PH: I think it is better not doing anything, but obviously online or some kind of technology is better. technology can make it easier

DS: Yeah. *(long pause)*

JH: For me, yeah. I think probably if I had brought my journal like a couple of weeks in and someone would have sat and looked at it and said, ok, you know, rough calorie count. Something that was um, kind of like the bootcamp thing, you've paid for it for 4 weeks and you are just kind of committed to that, um, something that is not punitive but something that is sort of a value to it, makes you want to try a little harder, doing better because somebody's going to look at it, you know, help you with it more accountability may have helped, checking in with someone, getting valuable feedback may increase motivation

# APPENDIX H
# DATA SPREADSHEET

| Group Type | Question | Comment | Danielle's codes 1 | Danielle's codes 2 | Danielle's codes 3 | Jessica's codes | ID |
|---|---|---|---|---|---|---|---|
| App | What was your impression of our study? | Yeah, you got an answer right away, you knew where you were at | awareness; Immediacy of net calories | | | immediate calorie feedback helps plan remaining meals | KW |
| App | What was your impression of our study? | But after a few days, you kind of knew what were better choices, that immediacy of | learned calorie content | | | awareness of calorie content of foods | SM |
| App | What was your impression of our study? | I totally agree with what you say, is to be aware. What I learned, because I have been trying to lose weight for one year now and I have been exercising very hard and I was not seeing results, so actually being aware of my food intake | Awareness | learned low cal options | | awareness of calorie content of foods, | GM |

| Group Type | Question | Comment | Danielle's codes 1 | Danielle's codes 2 | Danielle's codes 3 | Jessica's codes | ID |
|---|---|---|---|---|---|---|---|
| App | What was your impression of our study? | You can strategize, knowing exactly, you can plan it. Like you said, that was perfect. | Awareness | planned ahead | | calorie strategizing helps allow indulgences | KW |
| App | What was your impression of our study? | Or if I want a chocolate, because sometimes I cannot avoid it, so I go milkway, 80 calories, funsize, and then at the end of the day if I go to the gym, if I walk for 10 more minutes I can burn it. Maybe it is not the healthier decision, because the sugar levels will still in my body or whatever, but calorie wise, it works. | not depriving, controlled calories by increasing exercise | | | calorie strategizing helps allow indulgences | GM |
| App | What was your impression of our study? | But it was not a diet to deny yourself something. You could treat yourself like however you like or how often you like. I like that too. | Realistic, not punishing | | | calorie strategizing helps allow indulgences | SM |

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| App | What was your impression of our study? | Yeah, I felt like I was cheating, yeah. And then it gave me way too many calories to eat so I had to take away some of the calories. And that's what the weight, like now, I customized it to fit my weight because I'm still using it, I'm still recording, it still keeps me within my perimeters and I fixed it so that I don't have as many calories and I'm actually losing more weight now than I was when I was in the program because it gave me too many calories. | inaccurate exercise calories | tailored to individual needs | | likes recording but program recommended too many calories | C |
| App | What did you like most about this method? | Definitely the simplicity. How quick and easy it is and how comprehensive the database is. I mean, it's pretty rare that something's not listed, and but like you said, it was a little tedious if it's not in there you had to kind of either manually add it from the package or at a restaurant you could look online and try to get a better idea but, I mean, that was probably once a week that something wasn't in there and the | simplicity, user friendly, large food database | ( a little)tedious , manual entry of foods | | database was simple and extensive | D |

| Group Type | Question | Comment | ID | Primary Theme code 1 | Primary Theme code 2 |
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| paper | What was your impression of your involvement in our study? | It made me and obviously your cooking tips, I was telling her earlier that uh, I learned to love vegetables now, especially when they're grilled or roasted. I always know you need to add more, but I didn't know they taste pretty good. When they're cooked in a healthy way, because for years I was a bachelor and for me to eat that stuff it had to be in the bags with the cheese in it. | PH | liked tips and information (received in emails) | eating more vegetables |
| paper | What was your impression of your involvement in our study? | I realized how hard it is to get 5 fruits and vegetables a day. I'd get to three and go, wow, I've only gotten 3. I think I'm really conscious of protein though, lean protein. But getting 5 fruits and vegetables was a challenge. | JH | challenging to eat recommended servings of f&v | followed exchange list |

| Group Type | Question | Comment | ID | Primary Theme code 1 | Primary Theme code 2 |
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| paper | Did your behavior change? | ... the biggest lesson I learned was um to cook vegetables in a tasty manner. Cause I don't cook in my family, or she won't eat my cooking. But then she gave me this sheet on different ways of preparing vegetables, so I could grill and more importantly my wife started eating when I grilled, not just me. So here we bulk up on a lot of vegetables for our meals | PH | liked receiving info, new cooking ideas | social support |
| paper | Did your behavior change? | I measure more than I used to. I have a couple measuring cups and I'll pull them out and just measure when I'm doing my servings now. | JH | awareness; portion control | |
| paper | Did your behavior change? | me too | PH | awareness; portion control | |

| Group Type | Question | Comment | Danielle's codes 1 | Danielle's codes 2 | Danielle's codes 3 | Jessica's codes | ID |
|---|---|---|---|---|---|---|---|
| App | Was there anything you didn't like about the app or recording? | I think one complaint I would have to there was a lot of stuff I had to create a menu for. Uh, there was a lot of supermarket foods, it just seemed I had to do that a lot. Yeah, time consuming. | tedious, manual entry of foods | | | too many foods needed to enter manually | KW |
| App | Was there anything you didn't like about the app or recording? | I, just to give an idea, I have a calorie counter. I wear a heart rate monitor when I exercise which will count my calories and so I program it with my height, weight, age and all that information and it will tell me what is my zone, for fat burning zone, and all that. And every time I am beyond that zone depending on my heart rate or below that zone, the watch will beep. So, when I am exercising that beeping will help me to realize to watch my watch. And to see, oh, I need to keep | inaccurate exercise calories | awareness; energy expenditure | | uses heart rate monitor to estimate calories burned in exercise | GM |

| Group Type | Question | Comment | Danielle's codes 1 | Danielle's codes 2 | Danielle's codes 3 | Jessica's codes |
|---|---|---|---|---|---|---|
| App | Would you recommend this diet tracking method to others? | Well, I think it's, yeah, it's very inexpensive and I think what we all really liked, is the fact that it's not a , wait, how did you say it, like prison, right? You have options. So sure you can eat that chocolate cake, now you just need to go walk for half an hour. Like that's what's really awesome about it, because you can eat as much as you want, you just have to exercise a lot more. That's what's really nice about it. | affordable; no cost | realistic; not punishing | balancing energy intake & expenditure | calorie strategizing helps allow indulgences |
| App | Would you recommend this diet tracking method to others? | Even just for information, I mean my wife was curious, how many calories am I supposed to be having if I want to lose weight? Of course she said, that's too few | learning calorie needs | | | information on calorie needs for weight loss interesting |

| Group Type | Question | Comment | Danielle's codes 1 | Danielle's codes 2 | Danielle's codes 3 | Jessica's codes | ID |
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| App | Did your behavior change? | See I'm also checking labels a lot more. | awareness; reading labels | | | started checking food labels | SM |
| App | Did your behavior change? | It's just the awareness. | awareness | | | awareness of calorie content of foods | BS |
| App | Did your behavior change? | Especially when Halloween rolls around. How many calories in a Hershey kiss? I know now. | awareness, calorie info | | | awareness of calorie content of holiday desserts | SM |
| App | Did your behavior | Now I count them out, the m&m's | awareness; portion | | | started measuring | KW |

| Group Type | Question | Comment | ID | Primary Theme code 1 | Primary Theme code 2 |
|---|---|---|---|---|---|
| paper | Did your behavior change? | ...when you were talking about cooking and vegetables, I'm more conscious of trying to stay ahead of keeping good stuff in the refrigerator, the vegetables and the fruits, I go to fresh and easy a lot more than I used too. | JH | changed shopping habits; fresh produce | |
| paper | Did your behavior change? | We stopped going to Costco, you know there's just two of us. We'd buy all that crap, you know.We just buy smaller portions especially fresh vegetables. Because we can't go through a whole bag of potatoes, or uh | PH | changed shopping habits; fresh produce | |