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Effectiveness and Feasibility of In-office versus Smartphone Text-delivered Nutrition Education in the College Setting: A Mixed-methods Pilot Study

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Effectiveness and Feasibility of In-office versus Smartphone Text-delivered Nutrition Education
in the College Setting: A Mixed-methods Pilot Study

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California State University, Northern Consortium

Doctor of Nursing Practice

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Doctor of Nursing Practice:

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Abstract

Often, being away from home for the first time, coupled with limited knowledge regarding healthy eating behaviors, leads to poor food choices and an increased risk of obesity among college-aged young adults. These college students are prone to high-calorie diets and limited physical activity, putting them at risk for obesity, a physiologically, psychologically, and financially costly epidemic in the United States. College students use their cellular phones over eight and a half hours a day and cell phones are their primary means of information consumption outside of the classroom, suggesting that the phones would be a useful tool to provide nutrition education to this at-risk population.

This mixed-methods randomized-controlled trial took place over eight weeks, between 9/15/15 and 12/2/15. The primary aims of this study were to assess the effectiveness and feasibility between an educational nutrition intervention delivered via smartphone texts and a traditional in-office setting for 18-22-year-old, overweight college students at the Sonoma State University Student Health Center. Using simple randomization, participants were assigned to one of two groups: text, or in-office.

Participants in the in-office group received one-on-one nutrition counseling framed within the social cognitive theory by a registered nurse at the study onset, week two, and week four. Participants in the text group received the same information, broken up into weekly text messages with links to websites, YouTube, and explanations of content. Participant characteristics, including weight, height, and health behaviors (hours of sleep a night, number of fruits and vegetables per day), were assessed at the study onset (T1) and again at week two (T2), week four (T3), and week eight (T4). All participants were invited to take part in an in-depth, qualitative, face-to-face interview at the end of the study (T4).

Nine participants completed both the trial and interviews. Two-thirds (66.7%, n=6) were in the text group, 66.7% (n=6) were female, 33.3% (n=3) were minorities, 66.7% lived on-campus, and 44.4% (n=4) took part in the university's on-campus meal plan. No statistically significant differences were noted in participant characteristics, or health behaviors between the two groups throughout the study. Although no statistical significance was noted between the two groups with regard to weight change, the text group's mean weight decreased from 188.25(sd=25.03) pounds to 184.58(sd=24.67) pounds while the in-office group's mean weight increased from 254.00(sd=90.15) to 257.00(sd=94.14) pounds. Weight loss in the text group should be further evaluated as it may hold clinical significance for effectiveness of the intervention.

Through qualitative interviews exploring participants' experiences, four major themes emerged. All participants in the text group (n=6) stated that they felt there was a need for their method of education, they felt their method was effective, they would recommend their method, and their health behaviors changed positively. For the in-office group, all participants (n=3) said there was a need for their method of education, 67% (n=2) said it was effective, all would recommend it, and 67% stated that they changed their behaviors.

Both the quantitative and qualitative findings of this study hold clinical significance as to the effectiveness and feasibility of text messages as a means of providing nutrition education in the college setting. Future research with larger sample sizes and a longer-term study are recommended for more statistical power and to determine the long-term benefits of these methods of nutrition education.

**Effectiveness and Feasibility of Traditional In-office versus Smartphone Text-delivered
Nutrition Education in the College Setting: A Mixed-methods Pilot Study**

Overweight and Obesity Epidemic

Obesity, defined by the Centers for Disease Control and Prevention (CDC) as a body mass index (BMI) of greater than 30 kg/m^2 in people 18 years or older, affects over one-third of the adult population in the United States (CDC, 2014a). Per the Healthy California 2010 report, the overweight percentage of males aged 12 to 19 years in 2007 increased to 23.6%, while the percentage of overweight females was lower at 13.6% (California Department of Public Health, 2009).

Obesity is associated with a higher risk for elevated blood pressure, cholesterol, and cardiovascular disease in adulthood (CDC, 2014b). Obesity can also lead to impaired glucose tolerance, sleep apnea and asthma, fatty liver disease, and esophageal reflux (CDC, 2014b). Persons with more chronic conditions will see functional impairment sooner than those without and those individuals with chronic conditions are estimated to account for 75% of the 2.5 trillion dollars in annual health care expenditures (CDC, 2009). Between 2008 and 2010, Medicare Part B spending increased by 9.2 billion dollars to cover the cost of care for people with at least two chronic conditions. (Erdem, Prada, & Haffer, 2013).

Medical costs in the United States pertaining to obesity, specifically, were estimated to be \$147 billion in 2008 (Finkelstein, Trogon, Cohen, & Dietz, 2009) and the lifetime medical costs for people who are obese is 47%-50% higher than those with a normal BMI (Hammond & Levine, 2010). The costs due to loss of productivity from absenteeism of people who are obese is estimated to be nearly four billion dollars a year. Even when showing up for work, the lost productivity time due to fatigue, loss of concentration, and the need to repeat a job in people who are obese costs companies almost eight billion dollars a year (Ricci & Chee, 2005). The overall

estimated economic cost of obesity in the United States is \$215 billion dollars each year (Hammond & Levine, 2010).

Overweight and obese individuals face social discrimination in the form of negative comments and not being included in social groups and as a result, due to repeated offenses, may become more sensitive to discrimination over time (Hartung & Renner, 2013). This discrimination has negative economic effects, pervading the professional career of obese individuals through difficulty getting hiring interviews (Agerstrom & Rooth, 2011). Negative health care outcomes are more likely due to less careful medical treatment of overweight patients. DiGiancinto, Gildon, Stamile, and Aubrey (2014) state that medical providers often do not properly address patient weight and hold a negative bias toward overweight patients, feeling that the patients' weight issues are, in part, due to laziness and their medical problems are somehow their fault. Patients feel embarrassed to discuss needs with the provider and are further stigmatized by ill-fitting medical equipment. Overweight individuals are at greater risk for low self-esteem (Nestler & Egloff, 2012), especially in ethnic minority populations (Rivera & Paredez, 2014). Zhao and colleagues (2011) showed a significant link between overweight and depression, indicating that there are both physiological and psychological risks associated with the disorder.

The Young Adult College Population

It is well documented that consumption of excess calories without sufficient physical activity leads to weight gain (CDC, 2014a). Factors associated with increased caloric intake include cafeterias and vending machines offering sugary drinks and unhealthy snacks as well as off-campus eating options, which include increased portion sizes and limited access to affordable healthy foods (CDC, 2014a). In addition, decreased exercise due to lack of quality physical activity, more screen time, including television, computers, and media, as well as lack of time for

sports participation contribute to weight gain in this population (CDC, 2014a). Though unwanted weight gain can take place at any age, the greatest incidence typically occurs around ages 18-34, with an average increase of 15 kilograms over a 15-year period (Gokey LaRose, Tate, Gorin, & Wing, 2010). The significant weight increase in this age group makes the need for education and intervention, especially of college-aged students, all the more crucial.

College students are at a critical point in their lives where they are transitioning from a stage greatly influenced by parental control to one where they assume the responsibility for their own lifestyle and health choices (Udo et al., 2013). Deshpande and Basil (2009) suggest that college students have very limited knowledge of nutritional requirements or healthy eating behaviors. Even with the obvious benefit of healthy eating practices, college students commonly participate in problematic behaviors, such as unhealthy dieting, skipping meals, minimal fruit, vegetable, and dairy intake, and a large consumption of fast food. Students have a limited knowledge of nutrients, ability to read a food label, and knowledge of groups within the food pyramid (Wahlich, Gardner, & McGowan, 2013). This is of great concern as food label use and improved health literacy directly lead to healthier diets and improved health outcomes (Cha et al., 2014).

Because of the increasing rates of overweight and obese young adults, as well as the related risks to present and future health, nutrition education has become a crucial health promotion priority for all age groups (Taft, Muñoz, Lenihan, & Gantan, 2014). Even so, topics such as alcohol and drug use are traditionally the areas of focus in college policy due to the more acute nature of the consequences of these behaviors (Garey, Prince, & Carey, 2011). College health centers are the most likely resource for nutrition education on a college campus. In a study by Kessler, Jonas, and Gilham (1992), 79% of the college health centers surveyed offer some

form of nutrition education for students and one-on-one counseling is the most common, albeit labor-intensive approach at 96%.

Registered dietitians, doctors, nurses, and health educators are the most common providers of nutrition education in this setting and, while there is typically little cost to students, there is a large drain on time and energy of the providers. These health care providers face significant challenges in working to determine the best approach to educating and motivating this at-risk college population. Utilization of technology could prove to be a solution to the challenge of nutrition education delivery (Poddar et al., 2012).

The Viability of Smartphones

In 2010, 94% of college-aged students reported owning a cell phone (Pew Research Center, 2010), and in 2013, college students used a smartphone an average of over eight and a half hours a day (Roberts, Yaya, & Manolis, 2014). College students are constantly receiving information through their smartphones, via the internet, YouTube, Facebook, and other news sources throughout the entire day. As smartphone use consumes the majority of college students' waking hours, smartphones could be the ideal medium for transmission of nutrition education.

Smartphones and, more specifically, text messages have already proven effective tools for improved patient outcomes, including lower low-density lipoprotein cholesterol, lower blood pressure, and lower BMI in patients with high cardiovascular risks (Chow et al., 2015). Text reminders are effective in stimulating greater compliance with vaccine schedules (Stockwell et al., 2015). They can also decrease emergency room utilization in patients with diabetes by increasing medication adherence and improving diabetes-specific knowledge, resulting in decreased hemoglobin A1C levels (Arora et al., 2014). Compared with traditional in-person breast cancer education classes, text message education was equally effective in teaching

working nurses about breast cancer concepts due to the convenience of cell phone access (Alipour, Jannat, & Hosseini, 2014). The improved patient outcomes in multiple areas of medicine, as well as the evidence showing that text messages are an effective and viable method of information transmission, suggest that they could be used to effectively and efficiently provide nutrition education.

The Social Cognitive Theory in Nutrition Education

The social cognitive theory (SCT), developed by Albert Bandura in 1986 from his own social learning theory (Bandura, 1986), provides a comprehensive framework for technology-based nutrition education intervention for the college-aged population (Mohamadi, Asadzadeh, Ahadi, & Jomehri, 2011). Assuming that humans are social by nature, the SCT frames the interaction between behavior, environmental influences, and personal factors into a reciprocal, dynamic, three-way relationship (Glanz, Burke, & Rimer, 2015). It is ideal for nutritional behavior change because the SCT blends emotional, behavioristic, and cognitive models. Glanz and colleagues assert that the setting of goals and self-monitoring are especially beneficial in changing habitual eating patterns by countering the ingrained responses to emotional queues, environmental influences, and cognitive justifications of habitual behaviors.

Nutrition education researchers frequently address four main concepts of the SCT: cognitive constructs, social constructs, environmental constructs, and self-efficacy (Ball et al., 2009; Dennis, Potter, Estabrooks, & Davy, 2012; Dewar, Lubans, Plotnikoff, & Morgan, 2012; Gero, Nickerson, Tompkins, & Callas, 2012). Cognitive constructs include intentions, behavioral strategies, and outcome expectations. With nutrition, this includes intentions to start eating healthily, frequency of reinforcement of setting goals and self-monitoring, and expectations with regard to benefits of eating healthily. Social constructs include aspects of nutrition role-

modeling, family reinforcement, encouragement, and socioeconomic status. Environmental constructs involve mental representation of the physical environment, and location of, and access to, healthy sources of food. Self-efficacy deals more with an individual's ability to overcome barriers and adopt healthy behaviors. Behavior change is instigated by reciprocal determinism. All of the constructs work in conjunction to influence the behavior outcome.

Depending on the population studied and the desired behavior change, some elements have greater predictive value than others. Dewar and colleagues (2012) studied the validity of the SCT in relation to adolescent dietary behaviors and determined that all of the elements had reliability and factorial validity, with social support, intentions, and behavioral strategies having the greatest influence. The validity of the four main concepts of the SCT suggests that while addressing a behavioral intervention with even one concept might yield a change, addressing all four concepts in the behavioral intervention could yield greater results. As such, nutrition educators should not only cover environmental factors, such as access to healthy food, but should also discuss nutrition labels, family and friend eating habits, and setting small, frequent, and attainable goals.

Social Cognitive Theory In-Depth

Self-regulatory systems drive the causal process and behavior is steered by forethought (Bandura, 1991). Individuals hold beliefs about their own abilities, can anticipate consequences of their actions, set personal goals, and can plan actions in the hopes that they will lead to the desired outcome. Individuals with nutrition knowledge can anticipate what will happen with eating carbohydrates or fat-rich foods, can set a goal of calorie intake, and create a meal plan to accommodate. SCT considers how individuals attain and maintain behavior, while also taking the social environment of that individual into account. If the environment makes fast food and

processed snacks convenient, while limiting access to healthy choices, individuals are more prone to making poor diet choices.

The theory factors in an individual's past experiences and beliefs as well, which can guide future behaviors through expectation and reinforcement. Those who grow up in environments focused on fresh fruits and vegetables could be more likely to select those foods in their future diets. SCT assumes that future events are not the drivers of current motivation, but if the future events can somehow be represented cognitively in the present, they are converted into present motivators with cognized goals (Bandura, 1991). The promise of achieving a healthy weight, alone, is not enough for an individual to adhere to a diet, but frequently assessed short-term goals, such as losing a pound a week, can allow for maintained motivation.

Self-regulatory mechanisms weigh the costs of actions with the internal and external incentives to guide decisions and behavior. While the environment does influence knowledge, goals, and motivation, individuals can still maintain some control over thoughts, emotions, motivation, and behavior due to their self-reflective and self-reactive abilities. Even if the environment limits access to healthy food choices, with sufficient knowledge and motivation, individuals can still work to achieve a healthy diet.

Individuals modeling behavior also influence the health choices of others by conveying example and importance. Behavioral interventions are less effective if the information conveyed is thought to be unimportant (Ko, Campbell, Lewis, Earp, & DeVellis, 2011). Individuals learn from both personal experience and by observing the actions of others and the outcomes of those actions (Glanz, Burke, & Rimer, 2015).

Applicability to Young Adult College Students

While SCT is useful for behavior intervention in general, it also informs college-aged student behavior-change interventions as well. Poddar and colleagues (2012) addressed self-efficacy and self-regulation interventions in relation to dairy intake in college students, showing great improvement of both efficacy and regulation after a web-based education intervention. Brown and colleagues (2014) showed that repeated MyPlate© education that taught students how to balance a meal and diet monitoring helped the majority of the college-student participants stay focused on their portion sizes. Dennis and colleagues (2012) studied the effectiveness of one-unit college nutrition courses based on SCT in preventing weight gain, though the study showed that the courses were not statistically significant in preventing a gain in weight during the brief intervention. Over half of the participants reported that the online diet tracking took too long. These studies indicate that the SCT can be an applicable framework for nutrition behavior interventions in the college realm.

College students are often living away from home for the first time. They are establishing a new social group and are reliant on the buffet-style school cafeteria for their meals. As study time increases, the students become more sedentary, and convenience of food tends to take precedent over healthy contents (Deshpande & Basil, 2009). These students are at high risk for unplanned weight gain (Gokee LaRose et al., 2010) and future health disorders. This health threat warrants further research of nutrition education grounded in the framework of SCT. One type of SCT-driven intervention in the college population that has yet to be thoroughly studied is that of technology-based nutrition education.

Although existing studies of technology and SCT-driven nutrition education are limited, a few have shown very promising results. Poddar and colleagues (2012) determined that a web-

based education program resulted in improved scores of SCT constructs and greater knowledge of healthy food choices in the college population. Ko, Turner-McGrievy, and Campbell (2014), in their study of the effectiveness of Podcasts based on behavior theories such as SCT, concluded that the elaboration likelihood model was associated with weight loss in the college population. While the SCT mediators did appear to lead to a decrease in weight, the change was not statistically significant.

Over one-third of the United States adult population is currently obese, placing them at risk for glucose intolerance, cardiovascular disease, sleep apnea, and asthma (CDC, 2014c). An overabundance of easily accessible high-fat and carbohydrate-rich foods, lack of venues for exercise, and limited nutrition knowledge further threatens these young adults' health. Immediate intervention is necessary. There is over 20 years of research that supports the validity of the SCT concepts, which include cognitive constructs, social constructs, environmental constructs, and self-efficacy. The previous studies of SCT and technology-based nutrition interventions in the college population have shown potential, warranting further research. Since college students have very limited time to devote to nutrition and they are fast to ignore information that is deemed unimportant, quick and convenient interventions could be very useful in transmission of information. By implementing nutrition education interventions that combine SCT constructs and smartphone technology, researchers can help develop new nutrition health care interventions. As smartphone use consumes the majority of college students' waking hours, smartphones appear to be an ideal medium for transmission of nutrition education, grounded in the framework of the SCT.

A Comparison of Methods of Nutrition Education

This pilot study aims to assess the feasibility and effectiveness of smartphone text-delivered nutrition education compared with traditional in-office nutrition education in the young-adult college population over a two-month period. Both methods of nutrition intervention will be driven by the SCT and will attempt to provide the young adults with basic knowledge of food contents, food labels, dietary recommendations, bodily needs, meal planning, safe weight loss, and the importance of fruits, vegetables, and exercise. Effectiveness will be measured quantitatively with indicators, such as amount of weight loss, amount of exercise, as well as amount of fruit and vegetable consumption. Feasibility will be measured qualitatively via participant responses regarding their respective method of nutrition education transmission.

The following chapters will discuss the literature regarding the influence of technology in nutrition education in the college setting and the research methods for this study. Findings and recommendations will follow.

Literature Review of Technology Utilization in Nutrition Education

As college students have expressed a need for smartphone-based health information applications (Miller, Chandler, & Mouttapa, 2015), recent studies have begun to assess the effectiveness of modern technology involvement in nutrition and weight loss education in the college population. While some have made use of applications available online (Gow, Trace, & Mazzeo, 2010; LaChausse, 2012; Mackey et al., 2015; Pellegrini et al., 2012; Polzien, Jakicic, Tate, & Otto, 2007), others have targeted smartphone capabilities, specifically (Allen et al., 2013; Brown, O'Connor, & Savaiano, 2014; Shaw et al., 2013; Sterner, 2012). Of the smartphone studies, at least three have looked at texting as the vehicle of information transmission (Brown et al., 2014; Shaw et al., 2013; Napolitano et al., 2013). These studies have focused on using technology to support nutrition education with the goal of improving nutrition knowledge and eating habits, managing weight, and preventing chronic illness.

Internet-Based Education

Polzien, Jakicic, Tate, & Otto (2007) completed one of the first studies to assess the appeal and effectiveness of an internet-based behavioral weight loss program. Using a randomized controlled trial (RCT) design, 57 adults were placed into a standard in-person weight loss program, an intermittent, or continuous technology-based program. All participants received seven weight loss sessions that focused on diet and exercise. The tech groups also used an electronic armband and an internet-based monitoring program. Weight, activity, and dietary intake were tracked at weeks one, five, and nine in the intermittent group and weekly for 12 weeks in the continuous group. The goal of the study was to see if adding technology-based interventions and monitoring to an in-person weight loss program would improve weight loss,

decrease dietary intake, and increase physical activity. The authors also wanted to see if intermittent or continuous technology support made a difference in efficacy.

Using repeated measures analysis, both relative and absolute weight loss was greater in the groups that incorporated technology ($p \leq 0.05$). Activity increased and calorie intake decreased in all three groups without statistically significant differences among groups. Study findings suggested utilization of electronic tracking tools and armbands for monitoring and feedback could be effective supplements for the standard in-office nutrition education.

The author suggested that future research should attempt longer-term studies that incorporate different forms of technology interventions as well as compare effectiveness of technology with standard interventions. A strength of the study was that it was one of the first to examine the use of a technology system in a behavioral weight loss program, while also looking at the effectiveness of different frequencies of technology use. A large weakness was that the study did not directly compare the effectiveness of the technology, alone, with the standard program, alone.

Pellegrini and colleagues (2012) expanded upon the research of Polzien and colleagues (2007) by comparing traditional behavioral interventions with technology interventions for weight loss. Using a RCT design, 51 adults between the ages of 21 and 55 were placed into three groups: standard behavioral weight loss, technology-based weight loss, or a combination of the two over a 6-month period. The standard group received weekly nutrition meetings focused on eating and activity. The technology group received the same weekly information via mail and were encouraged to use technology (Body Media Fit) for support. The third group had the meetings and were encouraged to use Body Media Fit. Weight, dietary intake, and activity were measured upon enrollment into the study and at six months.

ANOVA and t-test analysis noted combination group lost the most weight ($P < 0.001$), 8.8(SD = 5.0) kg compared with the standard group who lost 3.7(SD=5.7) kg. The technology-only group saw a mean loss of 5.8(SD = 6.6) kg. The sample size and length of the study strongly supported short-term effectiveness. However, the authors did not directly compare methods of information transmission, instead providing the education either in-office, or through the mail. The technology solution was merely a supplement.

In 2010, Gow, Trace, and Mazzeo conducted a three-month RCT in which 170 first-semester college students, aged 22 or younger, were randomized into four groups that either received weight and caloric feedback and a six-week internet program, weight and caloric feedback only, the internet program, alone, or no intervention. BMI and eating attitudes were measured at study onset and at three months. The authors hypothesized that those in the combined group would lose the most weight and that all groups would lose more weight than the control, which received no intervention.

ANOVAs and ANCOVAs were used to compare outcomes of the various groups at post-testing and at three months. Lowest retention rates were seen in the internet-only and the feedback-only groups. The combined intervention group ended up with significantly lower BMI scores than the control group, but the other groups did not show statistically significant differences. Those who participated in the intervention had higher body dissatisfaction at baseline, possibly indicating that this intervention was appealing to those who wanted to lose weight and were not satisfied with their bodies.

Study strengths included the objective measurement of BMI and the direct comparison to a control group. The study greatly relied on self-reporting for diet and exercise, instead of using accelerometer, possibly limiting reliability of the results. The limited sample size and small

effect size limited accurate assessment of differences between the treatment groups. The authors suggested that future studies should include more objective measurement, including the use of an accelerometer for activity measurement. They also recommend a larger sample size and possibly extending the study beyond the college setting to the general population.

LaChausse (2012) conducted a longitudinal, quantitative, randomized study of 320 undergraduate students of a California state university who were either given an online nutrition course, and on-campus nutrition course, or who were in a comparison group. Over 73% of the participants were female, 39% were Hispanic, and over 17% were African American. The 12-week study strove to test the effectiveness of the online MSB-Nutrition program by looking at fruit and vegetable consumption, positive attitudes toward exercise, and weight loss.

Using repeated measures ANOVA, no significant changes of BMI, exercise self-efficacy, or exercise attitudes were noted among the three groups. Vegetable consumption increased in the online group only. A strength of the study is that it was a randomized, longitudinal trial that looked at both psychosocial elements along with actual behaviors. A weakness of the trial is that it used self-reporting of height and weight and some self-selection may have occurred.

Most recently, Mackey and colleagues (2015) performed a 24-week, double-blind, RCT of 47 enrolled college students, ages 18-20, with regular access to email, who were randomized into intervention or control groups at a two to one ratio. The control group received general health education via email and the intervention group received diet and exercise education, based on the social cognitive theory, via email in order to assess the feasibility of an e-mail-based program. The author's hypotheses were threefold: African American college students require a weight gain prevention program, e-mail programs are feasible, and African American students will feel the program is useful.

The authors measured feasibility by qualitative, descriptive statistics, including program satisfaction, willingness to recommend the program, and favorite parts of the program. Over 90% of both study groups reported high levels of engagement. 87% of the control group said that they changed a health behavior, while 100% of the intervention group reported changing a health behavior. The intervention group also reported higher levels of learning, greater levels of discussing health behaviors with friends, and overall higher program satisfaction than the control group. Weekly reminders were appreciated by 56% of the intervention group.

The study's greatest strength was the large sample size, which was more than sufficient for solid qualitative research. Due to the participants being almost entirely African American and 76% being female, the lack of diversity, both culturally and in terms of gender, limited generalization of the results. Also, there was no comparison with traditional forms of health education since both groups received emails.

All of the aforementioned clinical trials indicated that the involvement of technology, whether it was via online programs, emails, or fitness wearables, provided statistically significant improvements in health behaviors. These changes included increases in daily exercise, fruits and vegetables consumed, or self-efficacy. Some of the studies even showed a significant improvement in weight loss through the use of a health behavior intervention that incorporated technology. Because electronic interventions can be convenient, anonymous, and approached at one's own pace, they could be an ideal way to reach a multitude of patients with only minimal effort on the part of the provider once the content is established. Since 94% of college-aged students reported owning a cellular phone and 93% of them reported texting daily (Pew Research Center, 2010), research focused on smartphones and texting is warranted.

Smartphone App Studies

Using a cross-sectional, quantitative design, Allen and colleagues (2013) assessed the efficacy of smartphone technology versus traditional counseling in increasing physical activity and decreasing caloric intake in a convenience sample of 68 obese adults in Baltimore University in Maryland. Weight, height, waist circumference, and physical activity per the Stanford 7-Day Physical Activity Recall (Blair et al., 1985) were recorded at the time of randomization and again at six months. Participants were randomized into one of four groups that received either (1) physical activity and diet counseling only, (2) diet and exercise counseling plus smartphone self-monitoring, (3) smartphone monitoring and less intensive diet and exercise counseling, (4) or smartphone monitoring only.

Statistical analysis showed that 78% of participants were female, average age was 45 ± 11 years, average BMI was $34.3 \pm 3.9 \text{kg/m}^2$. While participants in groups (2) and (3) lost more weight than the other groups, the differences were not statistically significant among any of the groups, possibly due to the pilot nature and small sample size of the study. Sixty-four % of participants in group (2) and 40% of participants in group (3) achieved the goal weight loss of a 5% decrease in body weight. In group (1), only 25% achieved the 5% decrease, and in group (4), only 20% saw the decrease. Self-reported exercise decreased in all groups except for the smartphone only group. Thus, the combination of counseling and smartphone monitoring proved most efficient.

Study strengths include a randomized trial and interventions grounded in social cognitive theory. Limitations to the study include a small sample size, limited participants from low socioeconomic status, and few participants with limited access to healthy foods.

Sterner (2012) qualitatively examined consumer response to smartphone application and traditional pen and paper tracking of dietary intake and exercise. Inclusion criteria consisted of smartphone-owning students, ages 18 to 65 with a BMI of 25 to 40. After being stratified by age, BMI, and gender, the 16 participants were semi-randomized into three focus groups. Group 1 used the “LoseIt” app, while Group 2 used their smartphone notepads to type memos of daily food records. Group 3 handwrote their daily food and exercise in a paper journal. The focus groups were asked ten questions regarding their smartphone or paper use. Open coding of the transcripts was completed by two undergraduate honor students and results were organized into Excel spreadsheets. Grounded theory (McCann, 2003) was used to analyze the data.

Of the 16 participants, 69% were female, 31% were male, and the mean age was 45 years, though standard deviation was not reported. App users reported liking the improved dietary awareness (56%) and calorie control without food restrictions. They disliked the exercise portion of the app and wanted more nutrition advice. Of the app participants, 67% stated that controlling calories was an effective approach to weight loss and 56% stated that recording on the phone complimented their lifestyle. Every member of the paper journal group stated that the journal was ineffective due to size, inconvenience, and tedium. They all wanted a more organized format, exercise template, and calorie calculator.

A strength of the study was the 10 questions asked and methods of theme extraction. Limitations of the study include loss of data due to participant error and lack of diversity of the participants in areas such as education, race, and socioeconomic status.

These studies addressed the viability of smartphones as a means for supporting nutrition education and health behavior changes. Due to an inconsistency of available smartphone applications among the different smartphone operating systems, more universally available

smartphone solutions could be key in consistently, efficiently, and effectively reaching larger populations in a cost-effective manner. As such, research on text message-based nutrition interventions is crucial.

Texting Interventions

Napolitano and colleagues (2012) completed a RCT of 52 college students placed into one of three groups: The Facebook group (n=17) joined a private Facebook group that provided content such as handouts and podcasts. Participants were notified of new content with group postings and Facebook mail. The Facebook Plus group (n=18), too, had access to a private Facebook group that provided the same content, but with a focus on theory-driven targets, such as goal setting, self-monitoring, and social support. The Facebook Plus group also received daily text messages. The final group was the Waiting List (n=17) group that received no intervention and served as the control.

Weight loss, activity, self-efficacy, engagement, and satisfaction were measured. The primarily female samples (n=45, 86.5%) were a mean age of 20.5(SD=2.2) years. At four and eight weeks, the Facebook Plus group had significantly greater ($P < 0.05$) weight loss than the control group. A greater weight loss was noted in the Facebook group than the control without statistically significant findings. No significant difference was noted in physical activity or self-efficacy among the groups. Of the participants, 97% stated that the program was helpful. 93.3% thought that the text messages were helpful.

A strength of the study was the research regarding psychosocial variables, including self-efficacy as those could help drive long-term compliance. The main weakness of the study was the lack of comparison with standard in-office interventions, or with texting, alone. Also, the

Facebook Plus group had the benefit of both text messages and more focused content grounded in social cognitive theory that the other groups did not have.

In a quantitative randomized trial of 150 Purdue University students, Brown, et al. (2014) studied two groups: those who received text messages with MyPlate icons and U.S. Department of Agriculture dietary guidelines, or those who were sent the same information in the form of paper pamphlets. Of the study participants, 90% were white and 57% were 22 years old. The authors measured recognition of the food groups and fruit and vegetable consumption.

The text group showed statistically significant improved recognition of MyPlate food groups, increased fruit consumption, and a trend toward more vegetable consumption. The majority of the control group said that the texts helped them stay focused. Of the control group, 72% showed either the same or decreased MyPlate recognition. A strength of the study was the randomization and large sample size. Important weaknesses of the study include homogenous samples and the fact that MyPlate awareness might not translate into weight loss in real-life scenarios.

Shaw and colleagues (2013) performed a randomized clinical trial of 120 obese adults at Duke University to assess the difference in weight loss between groups that received either promotion text messages, prevention text messages, or general health text messages. Weights were measured at the onset of the trial and again at one and three months after initiation of the text messages. Using a random coefficients regression model, sustained weight loss was greater than 87% in all three groups. Group differences were not statistically significant at one month, but the prevention-focused group had a significantly greater weight loss than the general health group at three months. Of the study participants, 94% were white, at least 80% were college educated and financially stable, and 59% were female.

A strength of the trial was that it was randomized and each sample had at least 39 participants. This trial also had a very homogenous group of participants, which was a weakness, along with the short trial period and the fact that weights were self-reported.

These text message-based nutrition behavior modification studies echo themes of speed, cost-effectiveness, and convenience. They showed a positive response from the consumers as well as improved health behavior outcomes. While the studies have looked at text messages supplementing the education process, none have directly compared effectiveness of and response to methods of nutrition education. None have compared traditional method of in-office nutrition behavioral interventions with the method of text-based nutrition behavioral interventions.

Summary of Literature

The review of the literature demonstrates varying degrees of effectiveness of the involvement of technology in nutrition education and weight loss. In two studies, the web and smartphone interventions led to increased fruit and vegetable consumption compared to traditional interventions (La Chausse, 2012; Brown et al., 2014). One study showed that complimenting traditional in-office nutrition counseling with smartphone apps led to improved weight loss (Allen et al., 2013), while another showed that text messages via smartphone led to sustained weight loss in all study groups and especially in the group with the prevention focus (Shaw et al., 2013). Various studies have shown a positive response to the convenience of technology-based interventions, both in terms of flexibility, but also cost (Brown et al., 2014; La Chausse, 2012; Napolitano et al., 2012; Shaw et al., 2013; Sterner, 2012).

Studies focused on smartphone nutrition and weight loss interventions in college students, specifically, are scarce. Sample sizes are often limited, and study groups are very ethnically homogenous. No studies have yet to focus in on just the early adult population in the

18 to 22-year-old range. Few studies directly compare the effectiveness of smartphone interventions, alone, versus in-office interventions, alone, with regard to weight loss, dietary intake, or exercise. Also, there is little information available about consumer response to text message-based education that could inform the viability of these interventions. Further studies that focus on young-adult college students and the weight loss effectiveness of smartphone texting interventions versus in-office counseling are indicated.

Method

This mixed-methods pilot study included a RCT of young adult SSU students, in which the participants received nutrition education over an eight-week period, followed by a semi-structured interview. The purpose of the smartphone trial was to assess the viability and effectiveness of two methods of nutrition education transmission by recording participants' responses to the methods of information transmission as well as measurable health behaviors, such as fruits and vegetables consumed each day, hours slept each night, and hours of exercise performed in a week. All of the participants' weights were also measured to determine the two methods' influence on weight loss in the overweight population. One method of nutrition education was the traditional, in-office, primary care-based nutrition counseling, while the other method conveyed the same information via smartphone texts with nutrition tips and links to videos and websites. Upon completion of the eight-week trial, participants were invited to participate in a semi-structured interview to assess their opinion regarding their respective method of nutrition education.

The study employed convenience sampling and inclusion criteria were smartphone-owning Sonoma State University (SSU) students ages 18-22 years old, with a BMI of 25 kg/m^2 or greater. Students currently under psychiatric care, with a current eating disorder diagnosis, or those taking medication for weight loss were excluded. A sample size of 20 was anticipated for this pilot study. The small sample size relative to the larger student population of over 9,000 students limited concerns of subject interaction. All of the in-office visits, text messages, and interviews were conducted one-on-one to protect participant privacy.

This study took place between 9/15/15 and 12/2/15. Participants were recruited via referral by SSU Student Health Center medical providers, posters at the Health Center, mass

emails, and fliers handed out by Student Health Center staff and the Student Health Advisory Club after Institutional Review Board approval was received from both Sonoma State University and Fresno State University. Study participants were asked to either attend one-on-one in-office nutrition education sessions and weigh-ins (control group), or read weekly nutrition education smartphone texts and show up for in-office for weigh-ins (intervention group).

The participants were simple-randomized into the control or intervention group by the lead nurse practitioner initially flipping a coin with the first subject and then alternating groups thereafter. A single medical assistant handled the subsequent grouping of participants and scheduling for the entire study and also handed out the health behavior questionnaires at each participant visit. Participants were randomized at the time of signing their informed consent form (see Appendix A) once they had initially been deemed eligible for the study, based on reported height and weight. Due to their more sensitive nature, other excluding criteria were not asked until informed consent was obtained. Because some participants did not have enough time to fill out the initial demographics and health behavior documents when they presented to join the study, informed consent was obtained and the participant was randomized at that time and an appointment was made for their first official visit at their earliest convenience.

The control group received traditional, in-office, primary care, nutrition education at enrollment, or at participant's earliest convenience (T1), and again at week two (T2) and week four (T3). The intervention group received that same general content via weekly text messages that contained links to informational videos, websites, and meal plans (see Appendix G for text message manuscript). The nurse practitioner sent the entirety of the weekly text messages on Wednesday evenings to each participant, separately. Because text messages over 160 characters that are sent between cellular phone carriers are automatically broken into separate texts every

160 characters, the nurse practitioner broke the large weekly message into smaller messages at each internet link to prevent the links from being split. A trained registered nurse weighed all participants upon enrollment into the study, or at earliest convenience (T1), and then again in two weeks (T2), four weeks (T3), and at eight weeks (T4) (see Appendix B for timing of information collected). The designated medical assistant or lead nurse practitioner contacted participants who did not appear for scheduled appointments in order to reschedule.

The health center's nutrition education registered nurse (RN) performed all of the weigh-ins by instructing the participants to remove shoes and wear only light clothing. She then measured the participants' weights and heights and calculated BMI (kg/m^2) using weight, in kilograms and height, in meters. The RN also collected the questionnaire responses and provided the in-office nutrition counseling for the entire study to limit the threat of influences on internal validity. Because the RN already performed the health center's standard nutrition counseling sessions, no extra training was necessary, other than to familiarize her with the study's health behavior questionnaire, which was a slightly modified version of the one she already used.

For the height and weight measurements, the RN used a Weigh Beam Eye-Level physician's scale for the entire study. The scale was medical-grade and was calibrated every six months per the manufacturer's recommendations, with most recent calibration on 8/7/15. Participants completed a health behavior questionnaire, based on the SSU Student Health Center's standard questionnaire that included fruit and vegetable consumption, hours exercised each week, meals eaten out each week, and alcohol consumption (see Appendices C and D). Participants also completed demographic data, including age, gender, race-ethnicity, and work status upon enrollment into the study, or at the earliest available appointment (see Appendix E). All data collection took place at the SSU Student Health Center. At T4, with the participants who

had agreed to take part, the lead nurse practitioner conducted a 30 - 60-minute semi-structured, audiotaped interview that contained 10 prompts (see Appendix F). These interviews also took place on a one-on-one basis at the health center and all were conducted by the lead nurse practitioner. The lead nurse practitioner notified all participants that the interviews would be recorded and that they could pass on any question that they did not feel comfortable answering.

No cash remuneration was offered to participants, though all nutrition education interventions, handouts, and medical care were provided free of charge for the full study period. Participants who completed the entire trial and follow-up interview were eligible for a drawing to win one of three \$20 Wolf Bucks cards for use at the SSU campus bookstore and dining facilities.

Nutrition Education Content

The educational sessions, per the standard SSU health center procedures, were based on recommendations from the United States Department of Health, the Centers for Disease Control and Prevention, MyPlate®, and Let's Move®. In-office participants were asked health goals and were given verbal counseling and handouts regarding caloric and nutritional needs, exercise needs, food contents, nutrition labels, calorie counting and monitoring, goal setting, and meal planning. The nurse provided helpful tips based on the participant's needs that addressed topics including alcohol and high-calorie food and juice consumption, eating out, and meal preparation. Participants were encouraged to use a free diet and exercise-tracking smartphone application, such as MyFitnessPal®, or LoseIt®. At subsequent visits, the nurse assessed the participants' progress and provided encouragement, redirection, and more focused nutrition education.

The text message group received the same general content in a text message format. The first week was broader, with content about calories, exercise, and monitoring. Each subsequent

week focused on a new theme, such as meal preparation, incorporating exercise into daily routines, or daily nutrient recommendations (see Appendix G for the text message manuscript). There were many links to YouTube videos that provided simple tips to incorporate health behavior changes into daily life. The text messages encouraged participants to state weekly goals and ask questions via text for clarification when necessary. The text group did not receive any nutrition counseling during the in-person visits in which they filled out health behavior forms and weighed in.

Participant Safety

Participant confidentiality and privacy was of the utmost importance during this study. All subjects were protected under the California Privacy Law, which is more stringent than FERPA or HIPAA, and is standard in all California college health centers. All registered nurses, healthcare providers, and staff were held to the SSU Student Health Center's standards of privacy. All participants were provided with literature regarding California Privacy Law and signed a statement of understanding before beginning the study. All participants' charts were stored and protected per Health Center procedures.

Participants were notified that text messages would be sent via standard SMS through U.S. cell phone carriers and that the student was responsible for any text overages. No identifying patient information was sent via text messages and participants could opt out of the text messages by texting "STOP" at any time. Students considering joining the study received a written informed consent document and were given an opportunity to ask questions. Participation was not allowed if the informed consent document was not signed. All consents were kept in a binder by the lead nurse practitioner researcher and, when not in use, stored in a locked cabinet at the Student Health Center. Participation had no impact on the student's regular access to the

health center, or status at Sonoma State University and the student could withdraw from the study at any time.

While, for both study groups, there was a risk of psychological stress during the trial, this was mitigated with support and counseling from the nurse practitioner performing the data collection and check-ins. If further emotional counseling sessions had been needed, they would have been free of charge and the subject would have been allowed to withdraw from the study if desired. The SSU Health Center's nurse practitioners or physicians would be the ones to perform the emotional counseling and refer to the campus's psychological services or the Health Center's psychiatrist as indicated. Fortunately, no participants required such interventions.

Students who participated in unsafe eating habits such as fasting, laxatives, or fad diets were not allowed to continue participation in the study and were offered focused counseling from the Health Center medical provider and psychological services. Students taking diet medications were not allowed into the study as well. Only evidence-based, healthy eating and exercise habits were encouraged by the provider to limit physical harm.

Results

Of the initial 11 people who signed up to participate in this mixed-methods RCT, nine participants completed all study measures. One participant was excluded as her weight at the first study visit fell within the normal BMI range. Another participant was excluded due to early withdrawal (family health issue) and therefore was not able to complete all study measures. These two participants had been randomized into the in-office control group.

Quantitative Results

Of the nine participants who completed the study, six were in the intervention text group and three were in the in-office control group (See Table 1). Three were male and six were female. Six participants were Caucasian, two were Hispanic, and one was Native American. Six were living in the dormitories while three were living off-campus. Four of the participants used a meal plan and five did not. Five did not have any employment, while three worked part-time and one worked full-time. Two of the participants did not have English as the primary language spoken in the home when younger.

Table 1.

Study Group and Demographics

Study Group:				Meal Plan:			
	Text	N=6	66.7%		No	N=5	55.6%
	In-office	N=3	33.3%		Yes	N=4	44.4%
Gender:				English in Home:			
	Male	N=3	33.3%		No	N=2	22.2%
	Female	N=6	66.7%		Yes	N=7	77.8%
Ethnicity:				Work Status:			
	Caucasian	N=6	66.7%		No Work	N=5	55.6%
	Hispanic	N=2	22.2%		Part-time	N=3	33.3%
	Native American	N=1	11.1%		Full-time	N=1	11.1%
Age:				Year in School:			
	18 years	N=3	33.3%		Freshman	N=2	22.2%
	19 years	N=1	11.1%		Sophomore	N=2	22.2%
	20 years	N=2	22.2%		Junior	N=1	11.1%
	21 years	N=2	22.2%		Senior	N=3	33.3%
	22 years	N=1	11.1%		Fifth Year	N=1	11.1%
Living Area							
	Off Campus	N=3	33.3%				
	Dorm	N=6	66.7%				

This RCT measured weight and BMI at four points in time: onset, week two, week four, and week eight. Other items recorded at those times included hours of exercise in a week, fruits and vegetables consumed in a day, snacks in a day, alcoholic beverages consumed per week, and hours of sleep in a night. A mix analysis of variance was deemed appropriate for one or more recordings within subject variables. For the purpose of the study, the weights and BMIs of the text and in-office groups, along with the measured health behaviors, were compared to determine effectiveness of the text versus in-office interventions.

For inferential results, repeated measures ANOVA was conducted to determine whether there was a significant difference in weight over time between the text group ($n = 6$) and the in-office group ($n = 3$). To correct for any violations of the repeated measures ANOVA's assumption of

sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 21) = 1.036, p = 0.397, \text{power} = 0.241$. There was no significant interaction between time and study group: $F(3, 21) = 2.518, p = 0.086, \text{power} = 0.539$. There was no significant difference in weight between the text and in-office groups: $F(1, 7) = 3.350, p = 0.110, \text{power} = 0.353$. Table 2 presents the weight at each point in time between study groups.

Table 2.

Participant Weight (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	188.25	25.03	6
Week 2	186.17	24.44	6
Week 4	184.25	24.37	6
Week 8	184.58	24.67	6
In-office			
Onset	254.00	90.15	3
Week 2	252.75	89.88	3
Week 4	254.00	91.15	3
Week 8	257.00	94.14	3

Differences in BMI over time between the text group ($n = 6$) and the in-office group ($n = 3$) were also tested with a repeated measures ANOVA. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 21) = 0.986, p = 0.416$,

power = 0.223. There was no significant interaction between time and study group: $F(3, 21) = 2.423, p = 0.099$, power = 0.503. There was no significant difference in BMI between the text and in-office groups: $F(1, 7) = 2.080, p = 0.192$, power = 0.239. Table 3 presents the BMI at each point in time between study groups.

Table 3.

Participant BMI (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	29.98	2.89	6
Week 2	29.65	2.79	6
Week 4	29.33	2.88	6
Week 8	29.38	2.86	6
In-office			
Onset	34.70	8.22	3
Week 2	34.57	8.28	3
Week 4	34.70	8.32	3
Week 8	35.10	8.71	3

Repeated measures ANOVA was again conducted to determine whether there was a significant difference regarding servings of water consumed per day between the text group ($n = 5$) and the in-office group ($n = 2$) over time. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 15) = 1.913, p = 0.187$, power

= 0.341. There was a significant interaction between time and study group: $F(3, 15) = 4.090, p = 0.039$, power = 0.648. There was no significant difference in water consumption between the text and in-office groups: $F(1, 5) = 1.360, p = 0.296$, power = 0.159. Table 4 presents the water servings per day at each point in time between study groups.

Table 4.

Participant Water Servings Consumed per Day (N = 7)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	4.60	.89	5
Week 2	4.50	1.00	5
Week 4	3.20	.84	5
Week 8	3.20	.84	5
In-office			
Onset	3.50	2.12	2
Week 2	7.75	6.72	2
Week 4	7.75	8.13	2
Week 8	7.00	7.07	2

Differences in high-calorie drinks consumed per day over time between the text group ($n = 5$) and the in-office group ($n = 3$) were also tested with a repeated measures ANOVA. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 18) = 1.363, p = 0.290$, power = 0.274. There was no significant interaction

between time and study group: $F(3, 18) = 0.423, p = 0.710$, power = 0.112. There was no significant difference in high-calorie drink consumption between the text and in-office groups: $F(1, 6) = 3.578, p = 0.107$, power = 0.357. Table 5 presents the high-calorie drinks per day at each point in time between study groups.

Table 5.

Participant High-calorie Drinks Consumed per Day (N = 8)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	1.40	.89	5
Week 2	1.00	.71	5
Week 4	.80	.84	5
Week 8	1.20	.76	5
In-office			
Onset	.67	1.16	3
Week 2	.33	.58	3
Week 4	.17	.29	3
Week 8	.00	.00	3

Repeated measures ANOVA was conducted to determine whether there was a significant difference in servings of alcohol consumed in a week over time between the text group ($n = 6$) and the in-office group ($n = 3$). To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 21) = 0.433, p = 0.670$, power = 0.109.

There was no significant interaction between time and study group: $F(3, 21) = 0.415, p = 0.681, \text{power} = 0.106$. There was no significant difference in alcohol consumption between the text and in-office groups: $F(1, 7) = 0.042, p = 0.843, \text{power} = 0.054$. Table 6 presents the servings of alcohol per week at each point in time between study groups.

Table 6.

Participant Servings of Alcohol per Week (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	.92	1.11	6
Week 2	.17	.41	6
Week 4	.75	1.84	6
Week 8	.58	1.43	6
In-office			
Onset	.50	.87	3
Week 2	.50	.87	3
Week 4	.50	.87	3
Week 8	.33	.58	3

Repeated measures ANOVA was once again conducted to determine whether there was a significant difference in hours slept per night between the text group ($n = 6$) and the in-office group ($n = 3$) over time. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 21) = 0.947, p = 0.436, \text{power} = 0.222$. There was no

significant interaction between time and study group: $F(3, 21) = 2.563, p = 0.082, \text{power} = 0.547$. There was no significant difference in hours of sleep per night between the text and in-office groups: $F(1, 7) = 0.049, p = 0.831, \text{power} = 0.054$. Table 7 presents the number of hours slept per night at each point in time between study groups.

Table 7.

Participant Hours Slept per Night (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	7.58	1.02	6
Week 2	7.08	1.11	6
Week 4	6.92	1.46	6
Week 8	7.50	.84	6
In-office			
Onset	7.67	.29	3
Week 2	7.50	1.32	3
Week 4	7.83	1.26	3
Week 8	6.67	.58	3

Differences in hours of exercise performed in a week over time between the text group ($n = 6$) and the in-office group ($n = 3$) were also tested with a repeated measures ANOVA. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated no significant difference in the within-subjects test for time: $F(3, 21) = 1.710, p = 0.196, \text{power} = 0.381$. There was no significant interaction

between time and study group: $F(3, 21) = 0.841, p = 0.487$, power = 0.201. There was no significant difference in hours of exercise per week between the text and in-office groups: $F(1, 7) = 0.872, p = 0.381$, power = 0.128. Table 8 presents the hours of exercise performed in a week at each point in time between study groups.

Table 8.

Participant Hours of Exercise per Week (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	4.25	3.00	6
Week 2	3.67	1.37	6
Week 4	2.67	.82	6
Week 8	3.58	1.46	6
In-office			
Onset	5.17	1.44	3
Week 2	5.83	3.82	3
Week 4	4.33	1.61	3
Week 8	3.50	3.78	3

Repeated measures ANOVA was conducted to determine whether there was a significant difference in the number of meals eaten out in a week over time between the text group ($n = 6$) and the in-office group ($n = 3$). To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results indicated a significant difference in the within-subjects test for time, showing that meals eaten out decreased overall

over time: $F(3, 21) = 5.031, p = 0.025, \text{power} = 0.699$. There was no significant interaction between time and study group: $F(3, 21) = 1.637, p = 0.232, \text{power} = 0.277$. There was no significant difference in meals eaten out per week between the text and in-office groups: $F(1, 7) = 0.837, p = 0.391, \text{power} = 0.125$. Table 9 presents the number of meals eaten out per week at each point in time between study groups.

Table 9.

Participant Meals Eaten Out per Week (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	3.17	2.46	6
Week 2	2.58	2.15	6
Week 4	1.83	1.13	6
Week 8	1.92	1.72	6
In-office			
Onset	6.67	5.35	3
Week 2	3.33	2.08	3
Week 4	2.17	1.61	3
Week 8	2.00	2.18	3

Repeated measures ANOVA was once again conducted to determine whether there was a significant difference in fruits and vegetables consumed per day between the text group ($n = 6$) and the in-office group ($n = 3$) over time. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. The ANOVA results

indicated no significant difference in the within-subjects test for time, $F(3, 21) = 2.397, p = 0.117$, power = 0.440. There was no significant interaction between time and study group: $F(3, 21) = 2.000, p = 0.163$, power = 0.374. There was no significant difference in fruit and vegetable consumption between the text and in-office groups: $F(1, 7) = 0.249, p = 0.633$, power = 0.072. Table 10 presents the number of fruits and vegetables eaten per day at each point in time between study groups.

Table 10.

Participant Fruits and Vegetables Consumed per Day (N = 9)

Study Group	<i>M</i>	<i>SD</i>	N
Text			
Onset	3.58	2.42	6
Week 2	3.25	1.41	6
Week 4	4.25	.88	6
Week 8	4.33	1.03	6
In-office			
Onset	2.33	1.53	3
Week 2	5.17	.29	3
Week 4	4.67	.58	3
Week 8	4.50	1.32	3

The repeated measures ANOVA analyses above all suggest that there were minimal differences in effectiveness with regard to weight or BMI between the text and in-office groups. This could be due to the small sample sizes and a larger sample could have yielded statistically significant differences. Though the mean weight of the text group decreased while the mean

weight of the in-office group increased, the overall difference between the two groups was not statistically significant ($p=0.110$). Even so, these data suggest that the two methods of intervention were, at the very least, equally effective. Only meals eaten out had a statistically significant within-subjects effect ($p=0.025$), showing that both groups had a significant drop in how often they ate out, though there was not statistically significant difference between the two groups ($p=0.391$).

Qualitative Results

Of the nine participants, all nine consented to in-depth interviews. The interviews were completed on a one-on-one basis upon completion of the RCT, with the goal of determining feasibility of text message-delivered nutrition education to overweight, college students. See Appendix H, Table 1 for detailed responses. An overview of qualitative themes, with examples of participant responses, is provided here.

To determine viability of the method of education transmission, four criteria were used: perceived need, perceived efficacy, willingness to recommend, and change in nutrition behaviors. The audio-recorded interviews were transcribed into Microsoft Word and responses to questions pertaining to those four criteria were isolated. The participant responses, with participant initials attached, showed good support for both the in-office and text methods (See Appendix H, Table 7).

All participants, in both the control and intervention groups, perceived a need for nutrition and behavior change prior to starting the study. Motivations for joining the study ranged from a desire for basic weight loss, a wish to return to a previous level of fitness, the desire to learn more about nutrition, and the hope to avoid medical disorders in the future. This could indicate that weight and nutrition are on the minds of many college students. Nutrition

education interventions could fit these students' needs, especially if these interventions fit into the students' busy schedules.

In regard to perceived efficacy, all six members of the text group found elements of effectiveness with texting as a method of nutrition education transmission. Two participants greatly appreciated the videos and other nutrition resources that showed up as messages on their phones. One participant, who greatly values human interaction, thought that the in-office approach might be more powerful, but he still thought that always having the information available on his phone was helpful. One participant related that everyone is always on their phone, so text messages could be quite helpful. Another participant in the text group felt that the text method was better than the in-office nutrition education for developing life-long skills.

Unlike the text group, there was not a consensus regarding the efficacy of the in-office nutrition education transmission. One participant thought there was real efficacy, especially in terms of weight maintenance, while another thought the social support and guidance from a professional was very effective. One participant did not feel the in-office education was effective. This individual had very little motivation during the clinical trial and wanted handouts that had much more specific instructions on what foods to buy and what meals to cook each day. The information provided in the education sessions was focused more on concepts for skill-building.

All six of the text group participants recommended the smartphone-based form of nutrition education. Reasons for recommending this method included lack of nutrition knowledge in the college population, the convenience of receiving the information while on the go, and the fact that the reminders kept the participants on track. One participant pointed out that because the messages came to the smartphone, the owner could look at the messages anytime

there was a spare moment. For people with very busy schedules, that could be a great solution. Another participant noted that for students who are not very outgoing, the text messages could be an easier way to receive the information. An echoed reason for recommendation was that the information would always be available on the phone for future reference.

When asked if they would recommend the in-office form of nutrition education, all three participants responded affirmatively, some more enthusiastically than others. One noted that he would recommend it only if the future recipient had motivation to change behaviors. The other two participants specifically noted that support from another person was greatly beneficial and one participant pointed out that receiving the information from a professional as opposed to random online sources was reassuring. Every member of the text group as well as the in-office group stated that they would endorse their respective methods of education, bolstering the feasibility of each option as a useful way to reach college students.

One of the best indications as to whether or not a method of education is viable is achievement of the desired outcome. All six members of the text group stated that they were able to make healthy changes in their behaviors. These changes included awareness of their food decisions, watching what they were eating, shopping differently, exercising more consistently and finding enjoyable activities, avoiding fast food, and limiting high-calorie snacks. The participants were able to appreciate improvements in their health behaviors, regardless of whether or not they lost weight. The fact that every participant showed improvements speaks greatly to the viability of the text-delivered method.

With regard to nutritious behavioral changes, the in-office group was fairly successful as well. Only one participant did not make any significant changes. One cut out high-calorie liquids in order to reduce the total daily calories consumed. The final participant made healthy changes

in her shopping choices and nutritious snacks. The text group, by having equal, if not better, outcomes in terms of reported behavior changes than the in-office group, supports the notion that text-delivered nutrition education is a truly feasible method of teaching college students.

Additional Feedback

The study participants provided excellent feedback about their likes, dislikes, and recommendations for change of their respective methods as well (See Appendix I, Table 8). This information could be useful for informing future studies or proposed nutrition education interventions.

The text group's likes had very common themes. Almost all participants took note of the fact that they could go back at any time and review covered content. One participant called the information accessible, while another pointed out that he did not have to act on the information right away and could review it when his schedule allowed for it. Another participant also stated that this format was helpful for someone with a busy schedule. Yet another participant pointed out that having all of the information in written format is a benefit over verbalized information because information learned in a discussion can be easily forgotten and lost. At least two of the participants made mention of their appreciation for the YouTube videos that were specific to this method of nutrition education.

All three members of the in-office group stated their appreciation for the support they received from the nutrition registered nurse. They liked the human interaction and the support that provided. One participant also noted that the face-to-face interactions also increase accountability. Another participant mentioned that he would much prefer the human interaction to a generic newsletter, which could be an argument against certain types of text interactions.

The largest concern for the text group was the length of the messages. Even though the intent was for the participants to have enough content to last a week, they voiced concerns that there was too much information to receive all at once. Two reported that the amount of information that came in at one time was overwhelming, while another said that it was fine if she tackled it little by little. One participant pointed out that if she just ignored the text messages, there was nobody around to hold her accountable. Another participant mentioned that, due to the sterile nature of technology, it was difficult for her to know who was on the other end of the text messages and that deterred her from asking questions, or stating personal goals for the week.

The in-office group found very little to dislike about that method of nutrition education. One participant stated that she had no dislikes whatsoever, while another initially stated the same, but eventually mentioned that halfway between the sessions, he would start to lose focus and begin eating larger portions of food. The third participant also took note of the fact that there were not any reminders in between the office appointments, so it was easy to lose track of what to do. The participants had glowing reviews for the nutrition registered nurse and liked the human interaction of the office visits.

Most changes recommended by the text group pertained to the length and frequency of the messages. Many felt that the texts were too long to receive all at once, so splitting that information up into more bite-sized pieces and delivering them twice a week, or even more frequently per one participant, would be better. Another participant felt that the amount of content was fine, but should be sent daily with specific themes. A participant who prefers human interaction to technological stated that adding some kind of face-to-face interaction would have held her more accountable.

For the in-office group, suggestions pertained to the frequency of the visits. One participant wanted visits at least every two weeks. The others mentioned that even with an appointment every two weeks, they would like more specific reminders, possibly in electronic format. A participant also wished to have a very specific meal plan and shopping list so that he had no choice in what to purchase or cook. He found that general suggestions made it too difficult to make those decisions.

Discussion and Recommendations

In 2013, the American Medical Association designated obesity as a disease (Beal, 2013), calling greater attention to the disorder as a progressive public health crisis. Because obesity already impacts over a third of the adult population (CDC, 2014a), affects cardiovascular, digestive, and endocrine health (CDC, 2014B), and incurs medical costs of trillions of dollars a year (CDC, 2009), new, creative, and immediate interventions are needed to combat this expanding health problem and public health issue.

The young-adult college population, which has minimal knowledge of healthy eating behaviors (Deshpande & Basil, 2009) and gains an average of three to 4.3 kilograms during their first year of school (Crombie et al., 2009; Lloyd-Richardson, Bailey, Fava, & Wind, 2009) is an ideal population for new preventive interventions focused on healthy eating and weight management. Since over 94% of college-aged students report having a cell phone (Pew Research Center, 2010) and college students use their cell phones over 527 minutes a day (Roberts, Yaya, & Manolis, 2014), an intervention that incorporates cell phones could be idea.

This mixed-methods pilot study, which included a randomized control trial (RCT) and follow-up interview, assessed both the effectiveness and feasibility of a smartphone-driven nutrition education intervention for college-aged students as well as in-office nutrition education counseling. Nine participants successfully completed the RCT and follow-up interview. Six participants were in the experimental text group and three were in the control in-office group. Their interview responses were used to determine viability of the methods of nutrition education transmission based on four criteria: perceived need, perceived efficacy, willingness to recommend, and a reported change in nutrition behaviors.

Quantitative Discussion of Effectiveness

With only nine participants, and just three in the in-office group, the strength of the inferential statistics was limited. There was no statistically significant difference between the two groups with regard to nutrition behaviors throughout the study. Only one health behavior, meals eaten out per week, saw a statistically significant decrease in both groups over time ($p=0.025$). Even though there was no statistically significant difference in weight loss between the two groups, the text group saw the mean weight decrease from 188.25(sd=25.03) pounds to 184.58(sd=24.67) pounds while the in-office group saw an increase from 254.00(sd=90.15) pounds to 257(sd=94.14) pounds. These data, by suggesting that the texting caused at least as much benefit as the office sessions, help to support the text-based method as an effective way to transmit nutrition education in this age group.

While these findings are not statistically significant, they are clinically significant in that the very efficient method of texting nutrition education was shown to lead to an outcome of weight loss. Because sending weekly text messages to six participants took less time than seeing just one participant in the office, the text method appears to be useful for both clinicians and patients in the college setting.

Qualitative Discussion of Feasibility

One hundred percent of the text group responded positively for each of the four criteria determining feasibility. Every participant in the text group ($n=6$) felt that there was a need for the education, the texting was effective, they would recommend text message-based nutrition education, and they changed their nutrition behaviors because of the education that they received via text messages. While all three of the in-office participants felt that there was a need for nutrition education, only 67% ($n=2$) felt that the traditional method was effective. All three

participants said that they would recommend the in-office method of education, but only 67% (n=2) said that they made behavioral changes based on the nutrition education that they received.

Based on the four criteria, the smartphone-based method of nutrition education was deemed, not only feasible for college students, but possibly an even better-received form of nutrition education than the traditional in-office method. The text group loved the videos and being able to access the information at any time while the in-office group enjoyed the face-to-face interaction and customized information. Neither method was determined to be perfect. The text group would have preferred shorter and more frequent texts and some reported missing the human interaction as well as increased accountability associated with in-office appointments. The in-office group wished for more frequent reminders and to have access to information on the go. There were echoes from each group, suggesting a mix of the two methods for greatest effectiveness.

Comparison with Previous Research

These results align with those of previous studies that determined weight loss was as good, if not better, with interventions that incorporated technology (Gow, Trace, & Mazzeo, 2010; Polzien, Jakicic, Tate, & Otto, 2007; Pellegrini et al., 2012). The relative, but not statistically significant weight loss also matches results from Allen et al.'s (2013) study that looked specifically at the benefit of smartphone applications for diet monitoring. Like this study, one of the few previous studies that looked at nutrition education through text messages (Shaw et al., 2013), found that texts that focused on prevention were beneficial.

The determination of legitimate feasibility of technology-based nutrition education methods echoes previous studies as well (Mackey et al. 2015; Sterner, 2012). Descriptions of efficacy, such as texts helping to stay focused, matched Brown et al.'s results (2014). Much like

Sterner's (2012) results, the text group reported that the smartphone-based solution fit their lifestyle. As this is the first known study to directly compare efficacy and viability of texting, alone, with in-office education, alone, there are no existing results for direct comparison. As such, further research that directly compares the two methods of nutrition education transmission is recommended.

Study Strengths

A great strength of the study is that it was the first known to attempt to directly compare the effectiveness and feasibility of, traditional in-office versus smartphone-based nutrition education. Previous studies have only looked at either online methods, smartphone applications, or methods that combine texting and other forms of education. This pilot study also attempted to determine consumer response as well as participant benefit. If the solution provided benefit, but were not viable in the real world, the results would not have been as clinically significant. This study showed that the students saw true potential in text-based nutrition education and also saw real weight loss due to participation.

Other strengths included a randomized trial that used the same scheduler, registered nurse, and nurse practitioner in their respective roles for the entirety of the study. The study did not rely on reported weights and all weights were recorded on the same scale that was calibrated per manufacturer's standards just prior to the randomized controlled trial.

Study Weaknesses

A great limitation of this study, especially with regard to the quantitative results, was the small sample size. With only three participants in the in-office group, inferential statistics were difficult. Because of the small sample sizes, the results obtained by the two groups could have been greatly influenced by only one or two participants that may have been especially motivated.

Since the participants began the study when they had time to set their first appointment, some finished the study two weeks or more later than the others. These late finishers had to contend with the Thanksgiving holiday and all three of these participants happened to be in the text group. Also, because the study was only two months long, the long-term effectiveness of these interventions is unknown.

While the study attempted to compare the text method with the in-office method, the text group still had to show up at the health center to fill in the nutrition behavior follow-up forms and weigh in. Even though no nutrition education took place at these check-ins, the fact that the participants of the text group needed to show up could have influenced their feeling of accountability and given the text group an advantage that they might not have had if they had just reported their weights via text instead. Another weakness was the fact that while the text messages were identical for each participant, the in-office education focus could have varied depending on the participant's specific needs. The content would have still been based on government recommendations, but emphasis may have varied.

The in-office group, meeting only three times total for nutrition education, may have been at a disadvantage compared to the text group that received weekly texts. The study was attempting to propose a real-life scenario and because six participants could be sent text messages in the time it took to complete one in-office session, the nurse practitioner felt that with regard to clinician time, text messages once a week was reasonable. Even with sending the weekly texts to six participants, more clinician time was spent on the in-office sessions for the three participants. While a weakness, this also speaks to the viability of the text method with regard to convenience.

Even though the demographic background of the participants, with two Hispanic and one Native American student, was even more diverse than the actual Sonoma State University population (Sonoma State University, 2015), the participants did not accurately represent the composition of the population of California, which hindered the ability to generalize the results of this study.

Two of the study participants were roommates and each was in a different study group. While they did discuss how their respective experiences were going, they denied sharing the actual content with each other. As such, their data were included in the results. Their perception of their own methods could have been influenced by their roommate's reported experiences.

Recommendations

While this mixed-methods study served its purpose as a pilot study, by showing signs of both feasibility and effectiveness of text-based nutrition education, more research is needed. Future research should attempt to include a greater number of diverse participants and the study should be attempted for a longer period of time. This could provide results that are more applicable to the entire young-adult population and also help to determine if the benefits of these methods of nutrition education persist long-term. The researchers should weigh the pros and cons of measuring the weights of the participants in the office, or having the text group report their weights. Scales that automatically track and transmit weights to the healthcare provider could also be used.

Future researchers should also consider shortening the text messages to retain attention and send them more frequently as texting requires much less time than an in-office session and that format would be reasonable in a real medical setting. Alternatively, the texts could be sent with the same intervals as the in-office visits to limit the influence of more frequent reminders.

Because the ultimate goal is to find a solution that works in real-life settings, the more frequent text messages would be recommended.

Closing

This mixed-methods pilot study was the first of its kind, directly comparing text-based nutrition education with the more traditional in-office education. The texting was determined to be both viable, in terms of participant response to the method, and as equally effective as the in-office education, with regard to weight loss and changes in nutrition behaviors. Based on these data, the authors can recommend text messaging as a means for nutrition education in the college population that is so smartphone-centric. The authors also recommend further research to determine the ultimate extent of the effectiveness of this method.

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Appendix A

INFORMED CONSENT

You are invited to participate in a study of nutrition education interventions for weight and nutrition conscientious college students, being conducted by Jordan Rose, FNP, at the Sonoma State University Student Health Center (SHC). The goal of the study is to compare the effectiveness of traditional nutrition education versus smartphone text-delivered nutrition education, as well as to explore the participants' experiences. The educational sessions will be based on CDC, USDA, American Heart Association, and the Academy of Nutrition and Dietetics guidelines and recommendations as well as behavior change interventions grounded in the social cognitive theory, with the goal of promoting safe and effective weight loss, and a sustained healthy body mass index (BMI). I cannot guarantee that you will receive any benefits from this study.

If you decide to participate, you will be randomized into one of two groups. One group will receive three 20-minute nutrition counseling sessions. The other will receive that same nutrition information in weekly smartphone texts. The study will occur over a two-month period. Your weight, regardless of group, will be recorded when you sign this consent form and again at week two, at week four, and at week eight of the study. Upon completion of the study, you will be asked to participate in a 30 to 60-minute face-to-face interview for you to provide feedback.

Any information that is obtained in connection with this study and that may be used to identify you will remain confidential and will be disclosed only with your permission, or as required by law. The privacy of your medical records will remain protected at all times, per the California Privacy Law. The data collected will include your demographic information and height at study onset, and weight at each visit, health habits, as well as your opinions voiced in the final interview. The final interview will be recorded via a digital audiotape. All information will be coded to protect your identity. Your identity will not be disclosed in the study results. If you give your permission by signing this document, we plan to disclose to medical journals only aggregate demographics, health behaviors, and weight and height data, along with anonymous voiced opinions in order to improve evidence-based nutrition education.

Participants who complete the eight weeks of nutrition education sessions, as well as the final interview, will be entered into a raffle to receive one of three **\$20 Wolf Bucks cards**. There will be no charge for the education sessions. There will be no reimbursement of travel costs to the clinic or for personal cell phone text plans.

Your decision of whether or not to participate will not prejudice your future relations with Sonoma State University. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without prejudice. The Committee on the Protection of Human Subjects at Sonoma State University and Fresno State University have reviewed and approved the present research. If you have any questions, please ask.

Thank you,

Jordan Rose, FNP, (707) 664-2921, rosejo@sonoma.edu

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE HAVING READ THE INFORMATION PROVIDED ABOVE.

Please print, and then sign your name with today's date below:

Student Participant (print name)

Signature

today's date

Signature of Witness (if any)

Signature of Investigator

Appendix B

Outcome Measures and Timeline Table

Table 1: Outcome Measures and Timeline	Enrollment (T1)	2 Weeks (T2)	4 Weeks (T3)	8 Weeks (T4)
Subject characteristics (age, gender, race/ethnicity, school status, years of college, work status, primary language)	X	Identify any changes		
Nutrition and health behaviors (alcohol consumption, number of daily fruits and vegetables consumed, number of daily meals eaten, weekly hours of exercise)	X	X	X	X
Weight and height	X	X	X	X
Semi-structured interviews to explore participants' experiences. Responses recorded via audiotape				X

Appendix C

Sonoma State University
Student Health Center
Nutrition Consultation Intake Form

Participant ID number _____ Today's Date _____

Nutrition concerns you would like to discuss _____

Recent weight change? (circle) Gain Loss How much and how fast? _____

Which meals do you most often skip? _____ (circle) never seldom often

Number of snacks eaten per day _____ Type of snacks _____

Number of calories consumed per day (if known) _____

List servings of each beverage consumed per day: water _____ milk _____ coffee _____ tea _____

Caffeine drinks (i.e. Rockstar, Red Bull, etc.) _____ soda/punch/sport drinks _____

100% fruit juice _____ other (type and amount) _____

Food Allergies _____ Symptoms _____

List all medications taken _____

List all supplements and herbs taken _____

Hours spent: sleeping/night _____ Hours of exercise/week _____ Types of exercise _____

Housing situation _____ Who prepares your meals? _____

Number of meals eaten out/week _____ Where? _____

Number of fruits eaten per day _____ Number of vegetables eaten per day _____

Do you have difficulty with? (circle) diarrhea constipation low energy other

If yes, please specify _____

List any special diet you are currently following _____

Family history: (circle) heart disease high cholesterol high blood pressure diabetes

Osteoporosis Please specify relationship & age at diagnosis _____

Previous cholesterol test? If yes, what was the result and when? _____

Previous blood pressure check? If yes, what was the reading? _____

Do you smoke cigarettes? If yes, how many/day? _____

(over)

How many servings of alcohol do you consume per week? _____

If weight is a concern, at what age did it become an issue? _____

What diets and diet programs have you tried? What were the results? _____

What was the most you've weighed as an adult? _____ When? _____

What was the least you've weighed as an adult? _____ When? _____

Are any immediate family members overweight? (circle) yes no

If yes, please elaborate _____

What do you see as possible obstacles to getting to your desired weight? _____

For women only:

Has your menstrual cycle ever been irregular? (circle) yes no

If yes, please specify (i.e. weeks between periods) _____

Are you currently on oral contraceptives? (circle) yes no

If yes, name of med? _____

Appendix D

Sonoma State University
Student Health Center
Nutrition Consultation Follow-up Form

Participant ID number _____ Today's Date _____
Which meals do you most often skip? _____ (circle) never seldom often
Number of snacks eaten per day _____ Type of snacks _____
Number of calories consumed per day (includes food, drinks, alcohol) _____
List servings of each beverage consumed per day: water ____ milk ____ coffee ____ tea ____
Caffeine drinks (i.e. Rockstar, Red Bull, etc.) ____ soda/punch/sport drinks ____
100% fruit juice ____ other (type and amount) _____
Hours spent: sleeping/night ____ Hours of exercise/week ____ Types of exercise _____
Number of meals eaten out/week _____ Where? _____
Number of fruits eaten per day _____ Number of vegetables eaten per day _____
Do you smoke cigarettes? If yes, how many/day? _____
How many servings of alcohol do you consume per week? _____

Appendix E

Demographic Data Sheet

Participant ID number: _____

1. Please state your age (in years): _____ years.

2. Please circle your gender:

Female	Male	Transitioning to Female	Transitioning to Male
--------	------	-------------------------	-----------------------

3. Please circle your race/ethnicity:

African American	Asian	Caucasian	Hispanic	Native American
------------------	-------	-----------	----------	-----------------

4. Please circle your school status:

Part-time Student	Full-Time Student
-------------------	-------------------

5. Please circle your living situation:

Dormitory	Off-campus	With Parents/Family	Other:
-----------	------------	---------------------	--------

6. Do you have a meal plan?

Yes	No
-----	----

7. How many years of college have you completed? _____ years.

8. Please circle your current work status:

No work	Part-time	Full-time
---------	-----------	-----------

9. Was English the primary language spoken in your household growing up?

Yes	No
-----	----

Appendix F

Semi-structured interview prompts:

1. Please tell me about yourself and your reason for participating in this study.
2. What does nutrition and healthy eating mean to you?
3. What did you like least about your method of nutrition education?
4. What did you like most about your method of nutrition education?
5. What would you change about the method?
6. How would you describe the effectiveness of this method?
7. Would you recommend this nutrition education method to someone trying to lose weight?
Why or why not?
8. Did this study help you change any nutrition behaviors? If yes, how?
9. While in the study, did you speak with any of the other participants?
10. Please tell me about your experience. What was your overall impression of the study and are there any questions that you would add?

Appendix G

Master Text Message Manuscript

Week 1

Hello and welcome! Thank you for participating in this exciting study. I am looking forward to the next 8 weeks of learning about nutrition and health. The first week will be focused on basics, such as calories and food choices.

I know that many of you are interested in losing weight. We will work toward your specific goals with healthy and safe weight loss choices.

First things first. What are calories? Check out this great video by Emma Bryce:

<https://www.youtube.com/watch?v=VEQaH4LruUo>

Some fun weight loss tips from AsapScience:

<https://www.youtube.com/watch?v=HA00ZctGz50>

So, how to apply calorie knowledge to weight loss? Joanna Soh made this useful video to calculate how many (or how few) calories you need to eat a day for safe weight loss:

<https://www.youtube.com/watch?v=a0SoSMN4TOM>

So, weight loss is math? To a certain extent, yes. Before you say, “Ugh, math...”, there are some great apps that can help you track and calculate these calories. Two free and useful apps that I have found are MyFitnessPal and LoseIt and I highly recommend that you use one of them over the next two months. Part of weight loss and nutrition awareness is tracking what you eat.

Check out this MyPlate video to see what the proportions of a standard meal should look like:

<https://www.youtube.com/watch?v=-J1hmmY1OB4>

See how the fruits and vegetables take up half of the plate? For more MyPlate info, check out their website at: <http://www.choosemyplate.gov/about>

We'll get more into food contents next week, but to get a start on things, have a look at Emeroy's video about drinks. He makes some good points (though I would still encourage the milk):

<https://www.youtube.com/watch?v=-x5VFtVhEFs>

For this week, try to calculate your BMR and your daily calorie requirements. If you think you want to lose a pound a week, you'll need to consume 500 less calories per day than your daily requirements. Also, try to focus on water and avoid other types of drinks. Alcohol is one of the greatest calorie culprits. Goodbye, Cotati Crawl.

This site has a 5-day meal plan you can try:

http://www.eatingwell.com/nutrition_health/weight_loss_diet_plans/diet_meal_plans/5_day_1500_calorie_diet_meal_plan?page=2

Please feel free to send me a goal that you set for yourself this week. Share the info you have learned with a friend. We maintain our momentum better with social support. If you feel comfortable, post something healthy you plan to do this week on Facebook or Twitter.

Feel free to send me any questions. Remember that text messages are not a totally secure way to communicate, so please don't include any of your personal information.

Until next week!

Week 2

Hi and welcome to week 2. How did your first week go? Were you able to achieve the goal you set? Did you make any adjustments to your routine or your meals? Did you share your goal with your friends? This week, we will focus more closely on the calorie contents of foods.

What foods have what calories? This AsapScience video helps review a little from last week and delves more into the calorie content of foods:

<https://www.youtube.com/watch?v=KMGUmcveQeg>

Did you notice how fat has over double the calories of carbohydrates? Alcohol has almost double as well. While fats are important to absorb useful vitamins, we typically get way too much fat in our diet. Healthier fats from nuts and avocados will provide great benefit and have more nutrients than fried foods, certain meats, and chips. This buzzfeed video is a good intro as well:

<https://www.youtube.com/watch?v=RSUtXePw7Aw>

Now do you see why MyPlate says that half of your plate should be fruits and vegetables? See how much you can eat for just a few calories? Here are a couple of suggestions for meals/snacks with less than 100 calories:

<http://www.livestrong.com/article/316912-list-of-foods-or-lunches-100-calories-or-under/>

So, how do you know the calories of the foods you eat? Food labels can be very helpful, if you take the time to read them. If we are looking at calories alone, we just need the top information on the label:

Nutrition Facts		
Serving Size 3/4 Cup (32 g)		
Servings Per Container about 12		
Amount Per Serving		
	Cereal Alone	With 1/2 Cup of Vit. A & D fortified skim milk
Calories	120	160
Calories from Fat	15	15
% Daily Value**		
Total Fat 1.5g*	2%	2%
Saturated Fat 0g	0%	2%
Trans Fat 0g		
Polyunsaturated Fat 0.5g		
Monounsaturated Fat 0.5g		
Cholesterol 0mg	0%	1%
Sodium 160mg	7%	9%
Potassium 90mg	3%	8%
Total Carbohydrate 25g	8%	10%
Dietary Fiber 2g	8%	8%
Soluble Fiber 1g		
Sugars 6g		
Other Carbohydrate 17g		
Protein 3g		

See how the label has a spot that says calories? In the label above, there are 120 calories. But, how much cereal equals 120 calories? The 120 is the amount of calories per serving. In the label above, the serving size is written at the top. It says 3/4 cup. When was the last time you measured

your cereal with a measuring cup? You might be surprised how many servings you are actually eating.



Some foods have less calories than others. Veggies are some of the best low calorie foods. These baby carrots are a yummy snack. How many calories in a serving? 35. How large is one serving? 2/3 of a cup. You can eat almost three cups of baby carrots for the same amount of calories as 3/4 cup of cereal with milk. And how about something oily?



This vegetable oil has the same number of calories per serving as the cereal did. But look how much oil you get for those calories. Just 1 tablespoon. Part of eating healthy is prioritizing what you eat. If your goal is to be full, but still keep calories low, focus on the fruits and veggies. Let's make it an initial goal to eat at least 5 servings of fruits and vegetables a day.

So, now that you know more about what foods contain greater or fewer calories, do you think you will be making any adjustments to your meals? Here is a possible meal plan that you can try this week. Feel free to substitute or adjust based on your needs and food preferences:

<http://nolimitbootcamp.com/downloads/1300CalorieMealPlan.pdf>

Here's a video to help you prep healthy lunches for a busy week. Making eating healthy convenient, you can be more likely to follow your diet.

https://www.youtube.com/watch?v=2_PZU2r_-0k

That's it for this week. Please send me a text with your goal for the week. It can be anything from getting 15 minutes of exercise a day to eat one salad a day. Also, feel free to post your goal online for some good social support. Have a great week.

Week 3

Up this week...Exercise! The word everyone loves to hate (or hates to love).

As previously mentioned, the best way to stay healthy and fit is to make choices that fit your lifestyle. Some of the best diets and exercises are those that are so easy to do that they become a natural part of your daily routine. Here are some exercises that you can try without even leaving the house, or putting on exercise clothes:

<https://www.youtube.com/watch?v=3zbANDVv-Kk>

Do you remember how if you eat 500 calories less than what your body burns in a day, you'll lose a pound in a week? Let's say that you are too hungry when you cut that many calories. Well, you can aim for 400 calories a day and then add 100 calories worth of exercise to your routine.

That way you are still at the 500 calorie a day deficit. You don't have enough time to exercise?!?! Here is a video that shows how to burn 100 calories in 5 minutes:

https://www.youtube.com/watch?v=4_KhMBLVX1I

Not a fan of workouts? Have a listen to Rawn here:

<https://www.youtube.com/watch?v=08g7wcfXRxE>

For a more official look at exercise, check out WebMD (make sure to click on their link for 7 most effective exercises):

<http://www.webmd.com/fitness-exercise/guide/fitness-beginners-guide?page=1>

The President's Challenge also has some suggestions for staying fit (check out the tabs on the left for other ideas):

<https://www.presidentschallenge.org/motivated/ten-ideas.shtml>

See how a lot of these can be done without ever hitting up the gym? I always try to park at the end of the parking lot so that I am forced to get in some extra steps. The most effective exercise, by far, is one that you enjoy. If you can't stand pushups, maybe try something else. If you don't mind walking, but find it boring, think of a fun place to do it. Have you visited the duck pond on campus? A few laps around that can be very relaxing. Check out the family of turtles while you are out there. Even if you can't get out and exercise, just don't spend too much time sitting. Did you know too much sitting can be bad for you?

<https://www.youtube.com/watch?v=uiKg6JfS658>

How to remedy the sitting problem?

https://www.youtube.com/watch?v=4K_ENbRgywY&feature=youtu.be

Need some inspiration for different types of activities. This link will take you to a list of activities that shows you how many calories you will burn in one hour of performing that activity:

<http://www.nutristrategy.com/activitylist4.htm>

So, give it a try. You have an incredible fitness center available on campus. Please send me a text with one exercise that you will try to incorporate every day this week. It can be as simple as power walking to class. Start to build a daily plan. Get a friend to join in. We stick to our exercise plans way better when someone is doing it with us. And, if you don't notice immediate results on the scale, try not to worry. Often times, if you have not been exercising much and then start, you will build muscle as you are losing fat. So, even though the fat in the body is decreasing, the weight will remain the same.

For a final bit of fun, here are some weird ways to burn 200 calories per AsapScience:

https://www.youtube.com/watch?v=eml6f9g_Yhw

Week 4

Welcome to week 4. We're almost half-way there! I hope you are keeping up with your weekly goals. We are going to be checking in this coming week in the office. Can't wait to see you. Up this week is meal and snack preparation. Nutrition requires planning! Prepping meals or snacks for the week ahead of time makes it so much easier to choose healthy foods when life gets busy. First things first. Shopping is very important. Finding healthy fruits and veggies is very important, but the fresh ones can go bad quickly and are sometimes hard to prep and cook. Well, then try the frozen varieties. These are great for people on the go because all you need to do is thaw and add seasoning as you would like.

<https://www.youtube.com/watch?v=zjsOOT347cA>

Buy a bag of frozen fruits and you can have an easy smoothie every morning. Here are some examples of frozen fruits that you can buy in the supermarket. If you don't like smoothies, you can just throw a handful of these in Tupperware containers on Sunday and have a sweet snack ready for every day of the week:



Remember how we talked about the importance of well-balanced meals? MyPlate is a great guide. Here is a Pinterest page devoted entirely to MyPlate for some good meal ideas. If you want, you can make extra of these recipes over the weekend and store the rest for meals during the week:

<https://www.pinterest.com/MyPlateRecipes>

If you want more explicit, step-by-step instructions, here is a video from Tiffany. This video is a little longer, but she will get into detail about a lot of different planning tips and easy foods (though I think plastic Tupperware is fine, too).

<https://www.youtube.com/watch?v=oHFB5ss5Pvc>

Want some more ideas? Search YouTube for weekly meal prep.

Remember how we talked about the importance of getting multiple colors of fruits and vegetables into your daily diet? Want to try to incorporate more salads, but don't have the time to make every day? Introducing salads in a jar! You can prep a few of these over the weekend to eat during the week. Try to use a low-calorie dressing (that's where most of the salad calories come from):

<https://www.youtube.com/watch?v=jhbWz3CpdfA>

So, you've been doing a good job of focusing on healthy meals, but you get hungry in between. Ideally, you want to eat around 5 times a day to keep your body well fueled. That way you are not super-hungry when you get to one of your meals and over-eat. Again, here come some mason jars, but you can use Tupperware as well. You can do these without dips, too, as dips tend to have the most calories in these snacks:

<https://www.youtube.com/watch?v=Rz6PruHEsdM>

Some people love the smoothies to take with them in the morning. Here is a cool way to prepare you smoothies in advance. She also has some good ideas for prepping the weekly veggies.

<https://www.youtube.com/watch?v=yki3uG8L6CU>

Here is Rawn again, this time about temptation:

https://www.youtube.com/watch?v=VABN_mUBdHk

What he says about not surrounding yourself with temptation is so true. If you have crackers, cookies, chips, etc. in the house, you will be so much more likely to eat it. The best thing you can do is get that stuff out of there. This can be difficult if you are not the only one in the house buying groceries. Try to coordinate with your roommates so that everyone can eat healthier. This is a team effort and you are more likely to stick with goals if those around you are doing the same.

So, that's it for the week. I'm a big fan of practice-what-you-preach, so here is a pic of my snacks today.



Have a great week. See you next week for the check-in. As always, please send me one goal for the week. How about one snack that you plan to prep for the week?

Week 5

Congratulations! We're half-way there. Keep up the great work. The first few weeks were very information-dense to get the basics down. Now we are going to get a little more focused.

We've talked about portions already, but how much is a portion of a certain type of food. You may be surprised to see that we normally eat way more than a serving of most foods:

<https://www.youtube.com/watch?v=7yQmXWuH10g>

Portion sizes have skyrocketed over the years and what restaurants are putting on our plates now is up to four times as much as what a regular meal should contain in terms of calories.

Interestingly, if a large amount of food is sitting in front of us, we are likely to eat more than we would have if a smaller amount of food were in front of us. And it doesn't matter how hungry we are. Weird, huh? So, if you eat out, put half of your meal in a separate bag and you will be less likely to overeat. Here is a video showing how we are victims of portion distortion:

<https://www.youtube.com/watch?v=A6QnCdc6LkY>

Joanna has some good suggestions about serving sizes and how much food to eat in a day to achieve a healthy diet:

https://www.youtube.com/watch?v=yIcn_9WWe7Q

Think it is hard to measure a serving? Try this video for simple ways to measure:

<https://www.youtube.com/watch?v=CA-wyKqKjpl>

If you would like a picture of common food portions, you can save this pic from the Manitoba Dairy Farmers to your phone:

<https://www.milk.mb.ca/wp-content/uploads/2013/01/FoodGuideServings-poster.jpg>

So, the key for this week is training ourselves to see food in proper portion sizes. Use smaller plates. You will dish up less and likely eat less as well. If you eat out, take away half of the meal for later. When cooking for yourself, make sure to check those food labels for serving sizes. I really like the following video's suggestions:

<https://www.youtube.com/watch?v=0doFbF3zK-g>

Her suggestion about the chip bag is soooooo true. Have you ever sat down to watch tv or study with a bag of snacks next to you? It is amazing how much we eat without even paying attention. I know that I have mentioned this before, but if you struggle (like I do) to not eat the snacks that are lying around the house, don't let them into the house. If you don't even have the option to eat higher calorie foods, it makes keeping up with your health goals so much easier.

The CDC even feels the same way about limiting portion sizes. Here is a quick document of theirs to check out:

http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/portion_size_pitfalls.pdf

That's all for this week. Please keep the weekly goals coming. Our check-in next month will be the final one, so set a goal for this month. Each weekly goal should help you get closer to the monthly goal. My goals this week will be to not buy any chips or crackers at the grocery store and to have at least one vegetable with each meal.

As always, please feel free to tell me your goal for the week. Get your roommates involved with the healthy eating. The more support we have, the easier it will be. And, since eating healthily should be fun, here is one last video to keep things lighthearted:

https://www.youtube.com/watch?v=LBko_3wT44Q

Week 6

Hello and welcome to week 6. I hope that you have been keeping up with your goals. So far, I have been sending information about calories and how to create a healthy plate. But, why are some of these things important? First off..... Water! You know how I keep recommending that you stop drinking sweet coffee, alcohol, and soda? Not only do those drinks have a ton of calories that would be better used to fill you up with food, but water is crucial to keeping us alive. AsapScience again to the rescue:

<https://www.youtube.com/watch?v=zCheAcpFkL8>

Another important element of nutrition is protein. It helps you build muscle, helps you burn fat, and helps you stay full longer. Remember, it's not just in meat, but also in things like nuts and milk. I'm not the only one who likes to emphasize protein:

<https://www.youtube.com/watch?v=xsXmX7inUew>

For more info, check out WebMD:

<http://www.webmd.com/men/features/benefits-protein>

You know how I am always pushing more vegetables? There is a reason for that, too. They tend to be lower calorie than any of the other foods, have a ton of vitamins, and the fiber can help you poop (all good things)! Vegetables, along with protein, are the key to losing weight. If you combine a bunch of vegetables with lean protein, you can get full and stay full, and keep your daily calories low. I always include vegetables with my daily snacks. Experts also love veggies:

<https://www.youtube.com/watch?v=Kak6RmKkUZc>

Even fats are good as they are crucial in our body and help us absorb vitamins. But, make sure that you are getting the proper kinds of fats. Here is a video with suggestions of foods with healthier fats:

<https://www.youtube.com/watch?v=U620eqjv84>

So, is there anything that should just be avoided? Yes! Added sugars are actually killing us. We are the first generation not expected to live longer than our parents and sugar is a major culprit. Check this video out for more:

<https://www.youtube.com/watch?v=Yda8RtOcVFU>

That's about it for this week. Just wanted to provide you with a little information behind the suggested servings of food in the previous week. Food is good. Not only is it fun to eat, but it helps us grow and thrive. The key is a proper balance. That's why MyPlate and recommended servings are so important. If all of this is too confusing, just remember, you can't go wrong with veggies, lean proteins, and some nuts and fruits for good measure. Here is a meal plan that breaks things down into both servings and also specific foods:

<http://www.discovergoodnutrition.com/2013/10/1500-calorie-diet-plan/>

Keep working on setting and achieving your daily food and exercise goals. Try posting a healthy meal you eat this week on Facebook. Be proud of the knowledge you have gained and the progress that you have hopefully made. Please send me your weekly goal. We have a ton to choose from, including exercise, meal prep, making a meal plan, or avoiding fast food. I'll leave it up to you. Have a great week.

Week 7

Hi again. I hope you are doing well and keeping up with your goals. This week we will talk about influences on health and weight and ways to fight back.

Sleep is so important to your health and nutrition. Lack of sleep can lead to cardiovascular issues, obesity, and trouble with blood sugar. It also leads to more impulsive behavior and that can lead to eating foods that are not part of our daily goals:

<https://www.youtube.com/watch?v=nNhDkKAvxFk>

So, how much sleep should a person be getting?

<https://www.youtube.com/watch?v=SVQlCxiQlZI>

Get those 8 hours of sleep a night. Your brain and body will thank you.

Another important element in our lives can be very harmful to our weight and health: stress.

When our body is constantly stressed out, we are more likely to reach for foods that might not be good for us. We also have more cortisol in our system. This can lead to a slower metabolism and increased weight gain, especially around our mid-section. This video is very informative and gives some good tips on ways to calm the stress:

https://www.youtube.com/watch?v=gH_idwRLKIM

Like Faith Hill once said, "Just Breathe." Deep, controlled breathing can be very calming. Also, try to plan fun items throughout the day to break up the constant treadmill routine. Some people think that exercise helps them lose stress. Here are some more activities to help you relieve stress:

<https://www.youtube.com/watch?v=0fL-pn80s-c>

I especially like the hot baths and vacuuming. And dark chocolate....yum (in moderation).

So, aside from stress relief, is there something to help us keep up with our nutrition and exercise goals? We've already been trying the cell phone diet tracking apps. How about a fitness tracker to keep us more active? While these little buggers might not directly translate into improved fitness, they can be good reminders to get up and move. Some come with apps that connect us socially so that you can see how you do compared with friends. Nothing like a little competition to get us motivated, right? Not sure which one to buy? You might have a friend or two that have one you could borrow to see if it works with your lifestyle. This video does a quick review of some of the more common trackers:

<https://www.youtube.com/watch?v=u6UZFIEOSqQ>

Finally, I have mentioned this before, but I just want to reiterate. Making diet changes or keeping up with exercise is so much easier if you do it with a friend. That social support and accountability can be soooo helpful. Here are some of the reasons why:

<http://www.fitday.com/fitness-articles/fitness/weight-loss/5-reasons-why-having-a-workout-partner-can-help-you-achieve-your-goals.html>

So grab your best bud, family member, or someone you know who is wanting to work on a healthy lifestyle and sign them up to be your partner. You are so much more likely to bring a salad for lunch if you know your friend will be doing the same thing. And, if someone is waiting for you at the gym, you will be more likely to get out of the house. WebMD thinks so, too:

<http://www.webmd.com/diet/obesity/choosing-weight-loss-buddy>

We are just two weeks away from our final check-in. You are now armed with knowledge about calories, food labels, bodily needs, how to plan your meals, and recommendations for fruits, veggies, and exercise. Time to really buckle down and set some goals for the home stretch. Try to maintain your daily calorie limit and incorporate some extra activity into your daily routine. Please send me one goal for the week. Talk to you next week for the final text!

Week 8

You've made it! Welcome to the final week. This has been a long journey and I've probably sent you more information than you wanted. The goal was to give you all the basic tools to make healthy nutrition choices for yourself. Here is a quick review of some key elements of nutrition and weight loss from AsapScience (check out their follow-up video on beating overeating):

<https://www.youtube.com/watch?v=HA00ZctGz50>

Remember to try to track the foods you eat with a journal or app, get plenty of sleep, and use smaller plates. Some might say that it is impossible to lose weight, or that they are just not interested in exercise. There could actually be some science behind that:

<https://www.youtube.com/watch?v=gd7wAithl7I>

Remember to keep at it! Nutrition and exercise are lifelong challenges. It can be easy to fall into a rut. Remember to set goals. Make a plan that you write down. Losing weight can seem daunting, but sometimes just getting started can be enough:

<https://www.youtube.com/watch?v=IHfjvYzr-3g>

So, let's go over what we have learned so far. Your body needs a certain number of calories a day to function. If you eat more calories than your body needs each day, those calories will be stored as fat. If you eat less calories than your body needs, you will lose weight. A calorie deficit of 500 calories a day for a week equals 1 pound of weight loss. Make sure to read the food labels to know how many calories you are eating with each serving.

<https://www.youtube.com/watch?v=X-8BIWYR0zs>

An easy way to quickly cut calories is to get rid of the juice, soda, and alcohol. Focus on the water instead. Temptation is difficult for many to overcome. If we have high-calorie options in our house, we are much more likely to eat them. Plan your grocery list before shopping and

coordinate with roommates to keep the less healthy choices out of the house. Teamwork is so crucial for healthy lifestyles. If we have a partner for cooking, shopping, and exercise, we are so much more likely to maintain our goals.

<https://www.youtube.com/watch?v=HU0WAGeahdY>

Remember that the buddy system works for more than exercise. We can team up with friends to prep meals for the week, alternating weeks. If we have some delicious meals ready to go when we get busy during the week, we are way more likely to avoid fast food and make healthy choices:

https://www.youtube.com/watch?v=NLRfomk0Inw&list=PLt2c0hX1aB8pDTXK_Vk10cDza8nx05fp4&feature=iv&src_vid=Rz6PruHEsdM&annotation_id=annotation_990413609

We tend to overeat and make poor food choices when we are especially hungry, so don't skip meals. Ideally, we should eat three meals a day and have a small snack between each meal (that's 5 times a day!). We want to make sure that we get a well-balanced diet. For a guide on how to build your plate, MyPlate is one of the best available resources:

<https://www.youtube.com/watch?v=-J1hmmy1OB4>

I'm proud of you for sticking with this program. Give yourself a pat on the back. Keep in mind that health is a life-long journey. A diet is just temporary. Really work to make the things we've covered over the past two months a part of your everyday life. It is much easier to maintain these behaviors once they become muscle memory. Staying active can be fun. Be creative with ways to incorporate exercise. Here is a pic of me getting ready to be active last week:



We have covered all the basics that you will need to maintain a healthy life. Good luck and keep it up! See you next week for the final check-in and feedback interview. Your feedback will be essential in determining what future services will be offered at the health center. I look forward to seeing you. Have a great week.

Appendix H

Table 7.

Question	Participant Quotes
Perceived Need (text)	<p>(FC) “I had a physical, um, right before I signed up for this, everything was great, but she just told me that, um, the weight was kind of an issue. Like it can be an issue, so that’s when she told me about the program. So, yeah. That was the main motivation because just the number’s a bit high.”</p> <p>(HF) “Well, I felt like I was gaining weight and being in college, I thought I was gonna gain more weight and I didn’t want to do that. And, I really like food and it’s a problem.”</p> <p>(LM) “I thought it would help just learn some really valuable skills that I can apply to the rest of my life and it’s also a way to keep me, in a sense, to, like, keep me on track and, like, have someone kind of help me. Just make sure that I’m on top of nutrition.”</p> <p>(EC) “My family, they’re, um, they, um, have like diabetes and cancer and I just don’t want to get that, so I just decided to participate in this so I can, like, lose weight and feel good about myself and know that I could actually lose weight and know, just watch what I eat and exercise.”</p> <p>(ME) “I originally wanted to lose weight and learn more about nutrition, but I wasn’t necessarily ready to lose weight, or learn about nutrition. So, I just kind of wanted to have the information readily available so that when the time came, I would be able to access it.”</p> <p>(CA) “I am going into law enforcement. So, I decided to do this study because I knew I had to change my eating habits. And, I needed some hints and some tips to do that.”</p>
Perceived Need (in-office)	<p>(GS) “I definitely want to lose weight, but I also don’t feel incredibly motivated at this time. Most of my motivation is drained into schoolwork, which is annoying.</p> <p>(WB) “Getting to college, I went strictly academic. No more sports and I cut out the activity in my life. So, that’s when I started just to keep gaining and gaining and gaining. Um, I, as of this summer, I told myself I was going to come in and see the nutritionist.”</p> <p>(AP) “I wanted to lose weight and try to get in better shape, because I used to be in better shape because I played a sport. But, then I, like, stopped the sport, so I kind of lost it.</p>
Perceived Efficacy (text)	<p>(FC) “I think it’s effective for my, for some motivation, for me to keep reminding myself that, like, there’s somebody there, there’s resources there, like I can do this. But, as far as, like, really effective, I didn’t lose any weight.”</p> <p>(HF) “I think with nowadays, like, it would probably be easier. If it was, like, my parents, to come in here...(laughs). But, um, now is, like, it was really effective because everyone is always on their phones.”</p> <p>(LM) “I feel it’s effective. In the beginning, I was really into it. Like, I was, like, watching the videos and reading everything and I was, like, ‘Cool this is, this is something that’s, like, really valuable. It’s a new part in, like, my life. And, I have it accessible, just like on my phone.’”</p>

	<p>(EC) “I had no problems with it. And, so, it was good.”</p> <p>(ME) “I don’t think it’s as powerful as it would be seeing someone in person, but, you know, like I said, having that information available to you is also very helpful because you can always reference it. So, I would say, ask the person, maybe.”</p> <p>(CA) “I can’t rely on, like, seeing someone once a week for the rest of my life. So, it gave me those good tips because if I were in the other group, I think that I would have been more, like, relying on that, ‘Oh, I have a meeting next week. Oh, I have a meeting next week,’ to, uh, um, be eating healthy. In this style, maybe like, oh, I’m pretty much, like, you do it, like, ‘I’ll give you some tips, but you do it by yourself.’ So, I think that gave me that push that I needed to, um, do it by myself.”</p>
<p>Perceived Efficacy (in-office)</p>	<p>(GS) “It wasn’t effective because it didn’t, at least I didn’t feel like it gave me a specific plan that I could follow easily and there wasn’t, I didn’t, wasn’t motivated to do anything in particular. Like, it didn’t, it didn’t give me something to do. Or, at least it didn’t give me something I felt I wanted to follow.”</p> <p>(WB) “It was, like, that accountability, Um, coming to see someone face-to-face that, um, has the, the numbers that are showing kind of like, what I’ve been doing, how I’ve been changing. Um, it’s, it’s nice to be able to come in to someone who knows what they’re talking about and kind of guides you in what you should be doing.”</p> <p>(AP) “I think it’s helped me a lot because I feel like I would have gained weight. Like, I kind of maintained my weight. But, I feel like I would have gained weight if it wasn’t for, like, these sessions because I wouldn’t have really realized, like, what I was eating was, like, that bad.”</p>
<p>Willingness to Recommend (text)</p>	<p>(FC) “Yeah. Well, I think that there’s a lot of people who just don’t know a lot of this stuff.”</p> <p>(HF) “Yeah. Because I know a lot of people are, like, worried about their weight and they want to lose weight. And, I know a lot of people are busy and on the go in college, so if it was something they could just, you know, look at on their phone, it would be easy for them.”</p> <p>(LM) “Yeah. Like, I feel that if they know that they will follow it, then yes. And, also, I would recommend it to anyone just in general. Like, they should just have it just in case they want to read it. It’s really... it’s nice to have the resources just in case you want to see it.”</p> <p>(EC) “Yeah. It’s just very good. Like, it just helps you and keeps you on track and it’s just, like, a watch out kind of deal. Like, makes sure that you eat the right kind of food and not, like, the bad, like, fast food.”</p> <p>(ME) “Yeah. I think if they, uh, um, you know, didn’t really want to talk to someone, because I know some people who aren’t as, you know, outgoing per say about getting help for nutritional needs. I think the text message, you know, being sent, like, once or twice a week would be good for them. Like, that would...they could check it on their own time and do what they want about it.”</p> <p>(CA) “I think a lot of people nowadays are busy and they don’t have the time to, there are excuses, ‘I don’t have time to go see someone,’ or whatever. ‘Well, hol, okay, let me, like, text this to you and you could check it out.’ And then, you don’t really have an excuse to be, like, I don’t have the time to read that because, you know what I mean? Everyone has a little bit of time.”</p>
<p>Willingness to</p>	<p>(GS) “I think it depends. It’s, depend on, um, how much motivation, or like, it’s kind</p>

Recommend (in-office)	<p>of specific circumstance. If they don't know how they would do it, like theoretically, I feel like it would be much more useful.”</p> <p>(WB) “Definitely I, I would recommend it solely on the fact that people need to know what they're eating, how much they should eat. Um, and, I mean, you never, you can't really get...you don't know if it's true or not if you get it from, you know, another source, or online kind of thing. You don't know what to believe and so it's, it's that reliability from someone who's gone to school for that.”</p> <p>(AP) “Like I said, the supporter, like, on your team, like, I feel like for myself it's hard to just, like, go out and, like, get motivated and, like, try to lose weight. Or, like, try to, like, eat healthier. So, like, having someone, like, there to, like, help you is a lot easier.”</p>
Change in Nutrition Behaviors (text)	<p>(FC) “But, I think that what this did the most was, like, the exercise. ‘Okay, have fun. Like, here's a picture of me scuba diving.’ Like, ‘Go have fun.’ And it's kind of like that, I think more than the food, that it's more like, ‘Go do something fun. Go exercise.’ Yeah.”</p> <p>(HF) “Yeah. I'm eating a lot better now and I'm exercising more. I mean, I've always exercised, but it'd be like, ‘Oh, I'm not going to exercise for four days and then I'm gonna go again and then...’ So, it's just kind of like, hit and miss, but I've been, like, exercising often and I've been eating a lot better.”</p> <p>(LM) “It did in some things. Like, I, when I went grocery shopping with a few of, like, my coworkers, I would be, like, in the vegetable section, or, like, more, like, the fresh produce section. So, it kind of like, it rubbed off on them, actually.”</p> <p>(EC) “Yeah. Well, fast food, for instance. I used to eat fast food, like, I just felt lazy to cook, or just went to The Kitchen, the cafeteria at school, and just ate whatever was there. Now I'm just watching what I eat and small portions.”</p> <p>(ME) “Yeah. I think it makes me more aware. It gives me, um, more choices for what I can eat and what I know about what I am doing. Makes you more conscious about your decisions.”</p> <p>(CA) “I'm just more cautious and aware of what I'm putting in my body. And, um exercising is obviously important, but nutrition comes fir...that was always my problem was, I could exercise for days, but I didn't eat right, nothing was happening. So, um, uh, just changing my little, like, the snacks and the fruits and not snacking all the time and not eating at the candy jar in the office and stuff like that.”</p>
Change in Nutrition Behaviors (in-office)	<p>(GS) “Nah. I'm pretty much the same as I was before.”</p> <p>(WB) “Definitely. I mean, um, I, uh, the focus on the whole, ‘What am I drinking?’ Um, a lot of water. Um, more coffee in the morning, less alcohol at night. Um, that was, that was probably huge for me. Um, just, you know, the alcohol consumption is way down. Um, and a lot of that was, you know, the focus on it's just a lot of calories I don't need.”</p> <p>(AP) “Uh, yes. I added a lot more fruit. Like, I, my mom came down and visited and we, like, bought a lot of fruit that I could eat. And, like, healthier snacks, because I used to, like, always go for, like, chips, or like, you know... And, now, like, I have, like, mandarin oranges, or like that type of stuff.”</p>

Appendix I

Table 8.

Participant Feedback	Quotes
Likes (text)	<p>(FC) “Well, I liked it because since I have all the resources on my phone and I still do have them, I can always look at them. And so, that’s one advantage to getting, you know, like when somebody’s telling you about a health plan, sure you have, like, maybe a few papers telling you whatever. But, what they’re telling you, you’re going to forget eventually. This is something where I can always look and think, ‘Okay, this is a site that my doctor recommends.’”</p> <p>(HF) “That you can go back and, like, reference something again. I thought it was very helpful. Especially, like, the MyPlate stuff. That was really helpful.”</p> <p>(LM) “I really liked the videos, so I don’t know if the other group got that, but I’m a very visual person, so I enjoy the videos a lot because I can go back to it anytime. Like, it was accessible. It was on my phone, so if, for whatever reason I wanted to reflect on it, I could go back and go on that.”</p> <p>(EC) “I just liked it because, like, you sent out, like, YouTube videos and expla, explained in the text messages. And, I just felt it was just accurate. It was just there and I could answer back to you, you know, with questions and concerns. It was overall a good experience.”</p> <p>(ME) “It was nice not having to come in as frequently. I mean, don’t get me wrong. It’s nice to come in every now and again. What’s cool about the text message is that you get the information, but you don’t have to immediately act upon it.”</p> <p>(CA) “The videos. That, because, like, all the links to the videos that I actually watch, they were really informative. Um, I think it was a blessing in disguise because I didn’t really want to be in the text group at first, but then I found that I probably would like it more, um, just because with my schedule and everything like that.”</p>
Likes (in-office)	<p>(GS) “It was nice having just like another person to interact with instead of, um, like, a newsletter. I don’t know what your other program was, but I’m imagining, like, those Kaiser ‘Seven Ways to Stay Healthy’ newsletters, or whatever, which no one ever reads, so it was, it was nice having, like, an appointment and you knew you needed to come in and there wasn’t really any way to avoid it, or anything like that.”</p> <p>(WB) “It was, like, that accountability, Um, coming to see someone face-to-face that, um, has the, the numbers that are showing kind of like, what I’ve been doing, how I’ve been changing. Um, it’s, it’s nice to be able to come in to someone who knows what they’re talking about and kind of guides you in what you should be doing.”</p> <p>(AP) “She was very supportive throughout it, so, like, having, like, that little support system, like, when you’re trying to, like, exercise more and</p>

	that type of stuff.”
Dislikes (text)	<p>(FC) “Probably the personal stuff, just because like I said, I, throughout it, I just wasn’t sure if, you know, you knew for sure that you were talking to me or something and so it was, I don’t know, it was kind of like awkward to reply or something.”</p> <p>(HF) “It was just, like, a lot at once, so like, if you’re doing something, you’re not, like, as likely to read all of them. Like, you’ll read a few of them and then you’ll, like, continue what you’re doing.”</p> <p>(LM) “It was very easy to just open the messages to get that little red thing off of my phone and then think about coming back to it later and then just forgetting about it.”</p> <p>(EC) “I’m not going to lie. I’d, like, skim through it. I’m like, ‘Oh, this is too long.’ Oh, I read some. You know? The videos, at first, I was like, ‘Okay.’ And then I was just like, ‘Ahhhh.’ And then, I was just like, ‘Okay. I guess I’ll just read the whole thing.’ You know? It doesn’t hurt.”</p> <p>(ME) “It felt like there was a lot of information coming out each week. And, it was like, “Oh, so many videos. So much information.” So, maybe a little bit, like, either spread out the program, or maybe, um, maybe not make it so information-dense.”</p> <p>(CA) “My phone was just, like, vibrating constantly when they came in. Instead of sending just one message, it was just, like, I’v, I’d like look at my phone and I’d have, like, twenty-three.”</p>
Dislikes (in-office)	<p>(GS) “Once you talk to, uh, Toni, it’s like then you don’t have to see her again for, like, two weeks, so there isn’t any reminder, or like, ‘This is what you should be doing,’ or anything like that.”</p> <p>(WB) “I know, um, coming into the office every two weeks, um, usually by, like, the end of week one, or the middle of week two, you start to, like, see a lack of focus on like the portion control.”</p> <p>(AP) “Um, no.”</p>
Suggested Changes (text)	<p>(FC) “I mean even once, like, every other day.”</p> <p>(HF) “Maybe, like, separate on different days. So, like, Monday, you get, like, this information. Tuesday, you get more, like, that kind of stuff maybe.”</p> <p>(LM) “Maybe like twice a week, just to give me that reminder, like, that mental, like, “Remember you’re still doing this.” Not just like all at once in one week. [] I really like interaction, like, face-to-face interaction. It keeps me more accountable.</p> <p>(EC) “I guess saying what you need to say and then just like adding additional links, like YouTube, for instance, add YouTube videos at the end.”</p> <p>(ME) “Same content, but twice a week.”</p> <p>(CA) “I don’t think there’s anything that I would change because, like I said, it was once a week, it was... the only thing I would change is the [length].”</p>

Suggested Changes (in-office)	<p>(GS) “I think more specific, like, plan-type things. Um, it’s so easy to say, well, I mean, you could eat less of that, but perhaps more of a, like, ‘Here is several example days,’ or whatever. So, just something to, like when you go to the grocery store, you can just, like, buy these things, or whatever.”</p> <p>(WB) “Every other week doing kind of like a, like a reminder like, “Hey are you logging your food? Are you reminding yourself, like, no alcoholic drinks, or, or like, portion your, um, your snacks?’ And things like that.”</p> <p>(AP) “Um, no. Not really. [] The one-month jump was kind of hard, I think, because I kind of, like, lost track of stuff.”</p>
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