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

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Abstract

Objective: To examine the feasibility and efficacy of using smartphones to provide nutrition education to college students.

Participants: 9 randomized, overweight students between 18-22 years old, attending a small California public university from 9/15/15 to 12/2/15.

Methods: Mixed-method study comparing face-to-face and smartphone-based methods of delivering nutrition information.

Results: No statistically significant difference was noted in weight, or improvement in health behaviors, including number of fruits and vegetables consumed daily, hours of sleep per day, and high-calorie drinks consumed daily between the two groups. Qualitative interview data revealed participants in the text group expressed a need for using texting, that it led to them changing their health behaviors, and that they would recommend it to others.

Conclusions: Although further research is recommended to assess efficacy, initial study findings indicate delivery of nutrition information via text format is a feasible.

Keywords: Education; Health; Nutrition; Obese; Smartphone; Text Message; Weight Loss

Introduction

The American Medical Association designated obesity, defined in the adult population as a Body Mass Index (BMI) of greater than 30 kg/m^2, [1] as a disease in 2013 [2]. Obesity, affects over 33% of the United States adult population [1] and individuals who are obese are at higher risk for secondary chronic medical disorders, including hypertension, hyperlipidemia, impaired glucose tolerance, asthma, and sleep apnea [3]. Between 2008 and 2010, individuals with two or more chronic conditions accounted for a 9.2-billion-dollar increase in Medicare Part B spending [4]. Obesity accounted for $147 billion in medical costs in the United States in 2008 [5] and the estimated overall economic cost of obesity in the United States is $215 billion each year [6]. Along with significant physical and financial risks, overweight (BMI > 25 kg/m^2) and obese individuals also face social risks in the form of exclusion from social groups [7], lack of access to job interviews [8], discrimination from medical providers [9], and low self-esteem [10].

Young-Adult College Population

Young-adult college students gain an average of 4.3 kilograms of weight during their first year of school [11,12] and the average weight gain over a 15-year period in early adulthood is 15 kilograms [13]. College students, moving from a parent-dominated environment to one of more autonomy, are in a

transitional stage in which they are beginning to make their own lifestyle and health choices [14]. Limited knowledge of healthy eating behaviors, nutritional requirements, or food groups, along with their unhealthy dieting, meal skipping, consumption of fast food, and inability to read nutrition labels places college students at higher risk for weight gain and obesity [15,16].

As the rates of overweight and obese young adults have risen, nutrition education and health promotion have become a medical priority [17]. On a college campus, college health centers are the most common source of nutrition education and at least 79% of these health centers offer some form of nutrition education, with one-on-one counseling being the most frequently used method [18]. Due to the challenge of reaching at-risk college students and the significant time associated with one-on-one visits, utilization of technology could be an effective solution to the problem of nutrition education delivery [19].

Smartphone Technology

As of 2010, 94% of college-aged students own a cell phone [20]. College students are using the internet, YouTube, and Facebook for information consumption and, on average, are on their smartphones over eight and a half hours each day [21]. Since smartphone use takes up the time equivalent to a full-time job in college students' lives, these phones could be a useful tool in the transmission of nutrition education. Smartphone text messages have already been shown to be effective in improving specific patient outcomes. In patients with high cardiovascular risks, smartphone texts helped lead to lower BMI, decreased cholesterol, and lower blood pressure [22]. In patients with diabetes, texts helped lead to decreased utilization of the emergency room by improving diabetes knowledge and increasing medication adherence [23]. Text message reminders were even a useful tool for improving vaccine schedule compliance [24]. These improved health outcomes suggest that smartphone text messages could be used to efficiently and effectively provide nutrition education to college students.

Existing Interventions

Due to the rise in overweight and obesity in the technologically savvy adolescent and young-adult population, recent studies have begun to look at the feasibility and effectiveness of the involvement of technology in weight loss and nutrition education in the college setting. Studies assessing internet-based programs are more common, [25-29] with only a few addressing smartphones specifically [30-33]. At least three have looked at the effectiveness of the method of texting nutrition education [31,32,34]. Internet-based programs showed promising benefits. Supplementing traditional in-office college nutrition education with a diet tracking armband and online monitoring program resulted in improved weight loss over the in-office education alone ($p \leq 0.05$), though there was no statistically significant difference in calorie intake [29]. Another study of college students showed that combining in-office education with emails and monitoring technology resulted in greater weight loss ($p < 0.001$) than traditional methods, alone [28]. Internet programs were shown to be useful in the college population when used in conjunction with traditional feedback methods, resulting in lower BMIs than the feedback method, alone [25].

One study that compared an online nutrition course to an on-campus nutrition course had mixed results, showing no significant changes in BMI or exercise attitudes, though vegetable consumption increased in the online group [26]. Email-based nutrition education programs were deemed feasible based on the positive experiences expressed by the participants [27]. Whether it was via online programs, fitness wearables, or emails, these internet-based programs resulted in statistically significant improvements in health behaviors. Studies that focused on smartphone technology mostly assessed the benefits of diet tracking applications. A study that compared a traditional in-office method, with varying degrees of tracking application involvement found no significant differences in the weights of the groups, though the smartphone-only group was the only one to not see a decrease in reported exercise [30]. Smartphone diet tracking was much more positively received than traditional paper-based diet journaling [33]. Due to the inconsistent quality and availability of smartphone tracking applications among the different smartphone operating systems, more universally compatible forms of smartphone technology, such as text messages, could be key in consistently and effectively reaching larger populations.

Few studies have looked at smartphone texting effectiveness or feasibility. One study combined a Facebook group with text messages and found that this sample lost more weight than the control group that received no education ($p < 0.05$), though there was no difference in physical activity or self-efficacy [34]. This study also assessed feasibility and found that 93.3% of the participants stated that the text messages were helpful. Other studies have found text messages to be more effective than paper pamphlets in awareness of healthy meal composition [31] and that text messages which focus on prevention instead of general health result in better weight loss outcomes [32]. The technology-influenced nutrition education studies have shown a positive response to the convenience of technology-based interventions, both in terms of flexibility, but also cost [26,31-34]. Studies looking at the college population, specifically, are scarce and sample sizes are often limited. No studies have yet to directly compare the effectiveness of smartphone text-delivered nutrition interventions, alone, with the traditional in-office education, alone. There is also limited available data covering consumer experiences regarding text message-based education that could inform the feasibility of the texting method.

Current Study

The current pilot study aimed to address deficiencies in the existing literature by assessing feasibility and effectiveness of smartphone text-delivered nutrition education compared with traditional in-office nutrition education in the young-adult college population over an eight-week period. The text and in-office methods were framed within the social cognitive theory [35] with the goal of providing the young adults basic knowledge of dietary recommendations, meal planning and tracking, food labels, exercise, and the importance of fruits and vegetables. Effectiveness was measured quantitatively with indicators including amount of weight loss, amount of fruit and vegetable consumption, and amount of exercise each week. Feasibility was measured qualitatively via participant responses regarding their experiences with their respective nutrition education transmission method. The current study hypothesized that weight and behavior outcomes for the text group would be similar to the in-office group and that the text-based method would be feasible.

Material and Methods

The goal of this mixed-methods pilot study was to assess the feasibility and effectiveness of a smartphone text-delivered method of nutrition education in relation to traditional in-office method of nutrition education in the young-adult college population over an eight-week period. Both methods of nutrition education transmission used the social cognitive theory and attempted to provide the young adults with basic knowledge of food contents, food labels, dietary recommendations, meal planning, safe weight loss, the dangers of calorie-dense food and drinks, and the importance of fruits, vegetables, and exercise.

Sample

The mixed-methods study took place at a northern California university between 9/15/15 and 12/2/15 and included a Randomized Controlled Trial (RCT) of young adult students 18-22 years of age, followed by a semi-structured interview. The control group during the trial received the traditional, in-office, one-on-one, primary care-based nutrition counseling. The intervention group received the same general information via smartphone texts that contained nutrition tips and links to websites and useful videos. Quantitative data, such as weight, fruits and vegetables consumed each, day, hours of sleep each night, and hours of exercise completed in a week were recorded to assess effectiveness, while feasibility was assessed upon the completion of the trial via semi-structured interviews that probed participant experiences. Inclusion criteria for the trial were smartphone-owning, 18-22-year-old, university students, with a BMI of 25 kg/m^2 or higher. Exclusion criteria were current psychiatric care, current diagnosis of an eating disorder, or weight-loss medication use.

Procedure

Upon Institutional Review Board approval from the university, convenience sampling recruitment took place by referral from university's Student Health Center (SHC) medical providers, mass emails and fliers sent out by SHC staff and the Student Health Advisory Club, and posters at the SCH. Participants were simple-randomized into the two study groups at the time of signing their informed consent form, once they fulfilled initial screening criteria of reported height and weight. The other excluding criteria, due to the more sensitive nature, were asked at the first visit after informed consent was obtained. Participants who did not have enough time to fill out the initial demographics and health behavior documents on the day that they signed the informed consent were scheduled an appointment at their earliest convenience to do the paperwork and perform the initial measurements of height and weight.

All data collection took place at the campus SHC. To ensure reliability, a trained Registered Nurse (RN) used a calibrated physician's scale to measure heights and weights of all participants at their first appointment in light clothing, with shoes removed. She also collected a demographics form that was completed by each participant as well as an initial health behaviors form, which assessed items such as fruit and vegetable consumption, weekly hours of exercise, weekly meals eaten out, and weekly alcoholic and high-calorie beverages consumed. For the follow-up check-ins, the same RN used the same scale to recheck weight and then asked the participants to fill out follow-up health behavior forms. Upon completion of the study, participants were invited to participate in 30- to 60-minute one-on-one, semi-structured, audiotaped interviews performed by the nurse practitioner. See (Table 1) for the data collection timeline. Participants received no cash remuneration, though those who completed the trial and follow-up interview were entered into a drawing to receive one of three $20 gift cards to be used at campus dining facilities or the bookstore.

Measurement	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, weekly meals eaten out, weekly hours of exercise, amount daily water consumed, nightly hours of sleep, high-calorie beverage consumption)	X	X	X	X
Height	X	Identify any changes		
Weight	X	X	X	X
Semi-structured interviews to explore participants' experiences. Responses recorded via audiotape				X

Table 1: Outcome Measures and Timeline.

Intervention

The control group received three traditional, 20-minute, in-office nutrition education sessions at enrollment or the participant's earliest convenience (T1), again at week two (T2), and at week four (T3). The text group received the same topics and content via weekly text messages that contained links to suggested meal plans, websites, and informational videos. The nurse practitioner sent the weekly batch of text messages to the text group on Wednesday evening to each participant, individually, to ensure confidentiality. The nutrition education sessions were based on the United States Department of Health, MyPlate©, the Centers for Disease Control and Prevention, and Let's Move© recommendations [36-39], per standard SHC procedures. The RN assessed patient health goals and provided handouts along with verbal counseling regarding optimal nutritional intake, exercise, monitoring calorie intake, reading nutrition labels, meal planning, and goal setting. An individualized plan was then developed for each participant that included meal preparation, eating out, and high-calorie drink consumption. Participants were also encouraged to use smartphone diet and exercise-tracking applications for self-monitoring, including MyFitnessPal©, or LoseIt©.

The same general content was provided via weekly text messages, addressing exercise, calories, and self-monitoring in the first week. Subsequent weeks each had a theme, such as nutrient and serving recommendations, meal preparation, or how to make exercise a part of daily life. Although the nurse practitioner encouraged participants to reply via text with weekly goals and to ask questions when participants needed clarification, no in-person nutrition counseling was provided during the in-person check-ins for weight measurements and completion of health behavior forms. All text messages were sent via standard SMS through U.S. cell phone carriers and the participant was responsible for any text overages. Participants could opt out of the study by texting "STOP" at any time.

Quantitative Results

Demographic Information

Eleven participants enrolled in the study, with 9 completing all study measures. Participants completed a demographic questionnaire created by the research team. See (Table 2) for the participant demographics.

	Total Sample n = 9	Text n = 6	In-office n = 3
Gender			
Male	3 (33.3%)	1 (16.7%)	2 (66.7%)
Female	6 (66.7%)	5 (83.3%)	1 (33.3%)
Age			
Range	18 - 22 years		
Ethnicity			
White, not Hispanic	6 (66.7%)	3 (50.0%)	3 (100.0%)
Hispanic	2 (22.2%)	2 (33.3%)	0 (0.0%)
Native American	1 (11.1%)	1 (16.7%)	0 (0.0%)

Living Area			
Off Campus	3 (33.3%)	2 (33.3%)	1 (33.3%)
College Dorm	6 (66.7%)	4 (66.7%)	2 (66.7%)
Meal Plan			
No	5 (55.6%)	3 (50.0%)	2 (66.7%)
Yes	4 (44.4%)	3 (50.0%)	1 (33.3%)
English in Childhood Home			
No	2 (22.2%)	2 (33.3%)	0 (0.0%)
Yes	7 (77.8%)	4 (66.7%)	3 (0.0%)
Work Status			
No Work	5 (55.6%)	4 (66.7%)	1 (33.3%)
Part-time	3 (33.3%)	2 (33.3%)	1 (33.3%)
Full-time	1 (11.1%)	0 (0.0%)	1 (33.3%)
Year in School			
Freshman	2 (22.2%)	1 (16.7%)	1 (33.3%)
Sophomore	2 (22.2%)	2 (33.3%)	0 (0.0%)
Junior	1 (11.1%)	0 (0.0%)	1 (33.3%)
Senior	3 (33.3%)	2 (33.3%)	1 (33.3%)
Fifth Year	1 (11.1%)	1 (16.7%)	0 (0.0%)

Table 2: Study Group and Demographics.

Weight Status

Weight and health behaviors were recorded upon enrollment into the study (T1), week two (T2), week four (T3), and week eight (T4). Over the 8-week study period, weight of participants in the text group decreased from 188.25(sd = 25.03) pounds to 184.58(sd = 24.67) pounds while weight of participants in the in-office group increased from 254.00(sd = 90.15) to 257.00(sd = 94.14) pounds (Table 3).

	Total Sample	Text	In-office
	n = 9	n = 6	n = 3
Weight (in pounds)			
Enrollment	210.17(sd = 59.20)	188.25(sd = 25.03)	254.00(sd = 90.15)
Week 8	208.72(sd = 62.51)	184.58(sd = 24.67)	257.00(sd = 94.14)
BMI			
Enrollment	31.56(sd = 5.26)	29.98(sd = 2.89)	34.70(sd = 8.22)
Week 8	31.29(sd = 5.68)	29.38(sd = 2.86)	35.10(sd = 8.71)

Table 3: Participant Weight.

Because of the multiple measurements within subject variables, for inferential results, repeated measures ANOVA was used to determine the effectiveness of the text versus in-office methods of nutrition education. To correct for any violations of the repeated measures ANOVA's assumption of sphericity, Huynh-Feldt corrected p-value was used. Regarding participants' weights, there was no significant difference in the within-subjects test for time: F (3, 21) = 1.036, p = 0.397, power = 0.241. There was no significant interaction between time and study group: F (3, 21) = 2.518, p = 0.086, power = 0.539. Finally, there was no significant difference in weight between the text and in-office groups: F (1, 7) = 3.350, p = 0.110, power = 0.353. There was no statistically significant difference between the text and in-office group for BMI (p = 0.192).

Health Behavior Status

Health behaviors were assessed via a SHC form that participants completed at enrollment and at the two-week, four-week, and eight-week visit. All of the health behavior findings were based on participant-reported figures. There were no statistically

significant differences between the text and in-office group for high-calorie drinks consumed per day ($p = 0.107$), servings of alcohol consumed per week ($p = 0.843$), hours of sleep per night ($p = 0.831$), hours of exercise per week ($p = 0.381$), and fruits and vegetables consumed per day ($p = 0.633$). One health behavior item of statistical significance was the interaction between time and study group for servings of water consumed per day ($p = 0.039$), indicating that the two groups trended in different directions over time. The in-office group began to drink more water while the text group drank less, though the overall difference between groups was not statistically significant ($p = 0.296$). The only other item of statistical significance was the within-subjects test of meals eaten out per week ($p = 0.025$), indicating that both groups began to eat fewer meals out of the home over time. The difference between the two groups, however, was not statistically significant ($p = 0.391$).

Qualitative Results

Feasibility

All nine of the participants consented to the semi-structured in-depth interviews upon completion of the RCT. The interviews were transcribed into Word documents and responses to questions were then copied into Excel for easy comparison. Four criteria addressing feasibility of the methods of nutrition education emerged: perceived need, perceived efficacy, willingness to recommend, and change in nutrition behaviors. An overview of the four criteria and salient participant responses is provided here.

Perceived Need

In both the control and intervention groups, all participants reported a perceived need for nutrition and behavior change prior to the onset of the study. Participant motivation included a desire to lose weight, return to a previous level of fitness, learn more about nutrition, as well as the hope to avoid future medical disorders. A participant in the text group stated, "My family, they're, um, they, um, have like diabetes and cancer and I just don't want to get that." An in-office group participant reported a need for the in-office education because, "I wanted to lose weight and try to get in better shape." The unanimity of the participant responses suggests that weight and nutrition are of concern for many college students.

Perceived Effectiveness

While all six members of the text group reported perceived effectiveness of nutrition education transmission via text messages, only two of the three in-office participants found their method effective. The text group appreciated the links to the websites and videos and felt that having the information readily available on their phones was helpful. One participant stated, "It was really effective because everyone is always on their phones." A different text participant thought the text method was better because it encouraged the development of life-long skills.

The in-office group did not have a consensus regarding the efficacy of their method of nutrition education. One participant reported efficacy pertaining to weight maintenance, while another thought that the social support and guidance from an RN was useful. This participant stated, "You don't know what to believe and so it's, it's that reliability from someone who's gone to school for that." One individual reported lacking motivation throughout the clinical trial and felt that handouts with more explicit instructions regarding food to buy and meals to cook would have been helpful.

Willingness to Recommend

When discussing whether or not they would recommend the smartphone text-based form of nutrition education, all six participants of the text group responded positively. Their reasoning included convenience of information while on the go, the frequent reminders kept them on track, and an overall lack of knowledge about nutrition in general. One participant mentioned that she could look at the messages any time she had a spare moment. She suggested that this could be an excellent option for people with busy schedules, stating, "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." Multiple participants reported recommending the method because it was nice to always have reliable information available on their phone for reference in the future.

The in-office group also unanimously recommended the in-office method of nutrition education, though some were more enthusiastic than others. One stated that he would only recommend the method if the future recipients had motivation to actually change their health behaviors. The two other participants recommended the method due to the fact that they felt they benefitted from the support of the RN and thought that getting the information from a professional was preferable to random online resources. They also felt that the information they received was important for the entire college population, stating, "Definitely. I, I would recommend it solely on the fact that people need to know what they're eating."

Change in Health Behaviors

The final of the four emergent criteria from the interviews was reported changes in health behaviors. In the text group, all members stated that they made healthy behavior changes, including improved awareness of food decisions, shopping differently, avoiding fast food, exercising more frequently, and cutting down on high-calories snacks. One participant stated, "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." Even those who did not lose weight appreciated the improvements in their health behaviors. While two participants in the in-office group reported positive changes in behaviors, one participant reported making no significant changes. One reduced daily calories by cutting out high-

calorie drinks. He stated, "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. Another improved her shopping choices and focused on healthier snacks.

Discussion

No statistically significant differences were noted between the text and in-office groups in weight or health behaviors. 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 suggest that the text-based method of nutrition education transmission is at least equally effective as the in-office method in achieving weight loss and improved health behaviors in this age group.

Although the findings were not statistically significant, they do hold clinical significance. The time-efficient and cost-effective method of texting the nutrition education resulted in patient weight loss. And, since sending weekly text messages to all six study participants required less time from the clinician than seeing only one in-office participant, the text method appears beneficial to both patients and clinicians in the college setting. Due to the shorter duration of the study, long-term effectiveness of the two methods is unknown. Because three participants' schedules caused a delay in setting their first appointment, they finished the trial over two weeks later than the other participants. The three who finished later were all in the text group and, unlike those who finished before, they all had to attempt to maintain their weight over the Thanksgiving holiday.

All of the qualitative responses from the text group were positive for the four criteria that informed feasibility. Each text group participant (n = 6) felt that there was a need for the education, that the text method was effective, that they would recommend the text-based education, and that the text messages helped them make positive changes in their health behaviors. Although all three of the participants from the in-office group felt that there was a need for the education and that they would recommend the in-office method, only two out of the three felt that the method was effective and that it resulted in improved health behaviors.

Based on these participant responses, the text method of nutrition education was determined to be feasible for the college population and was even better-received than the traditional in-office method. Highlights for the text group included the videos and the ability to access the information at any time. The face-to-face interaction and customized information pleased the in-office group the most. Although the majority of participants liked their respective methods, the text group mentioned a desire for shorter and more frequent texts as well as more human interaction for increased accountability. The in-office group wanted more frequent reminders and the ability to have the information on the go. Members of both groups suggested mixing both methods for greatest effectiveness.

While previous studies have looked at methods that combine texting with other forms of more traditional nutrition education, this pilot study is the first known to directly compare the effectiveness and feasibility of text-based nutrition education, alone, with in-office education, alone. This study showed that the students not only found legitimate potential in text-based nutrition education, but some also saw real weight loss during the trial.

Limitations

Results of this pilot RCT should be interpreted with caution given the small sample size and the relatively short duration of the trial. A larger sample and longer trial will be necessary to determine effects on weight loss and long-term effectiveness. Although the study aimed to directly compare the two separate methods of nutrition education, the text group was still required to present to the health center in order to be weighed and to fill out the nutrition behavior forms. This was done to avoid inaccuracies that could arise from self-reported weights. Attending these in-office weigh-ins could have influenced the text group's accountability, affording them an advantage that they might not have had if they had merely texted in their weights.

The difference in education intervals could have affected outcomes as well. While the in-office group only met three times for their education sessions, the text group received eight separate text threads, each a week apart. This was done to better reflect a real-life scenario as a clinician can send text messages to six patients in the same amount of time it takes to see one patient in-office. Although a weakness, this also speaks to the convenience and feasibility of the text method. With one Native American and two Hispanic students, the ethnicities of the participants were more diverse than the population of the university [40]. Even so, the demographics did not accurately reflect the entire US college population.

Conclusions

This first-of-its-kind, mixed-methods pilot study directly compared traditional in-office and text-based methods of nutrition education. The texting was determined to be as effective as the in-office counseling regarding nutrition behaviors and weight loss as well as equally feasible in terms of participant responses to the method. Based on these results, the authors can recommend text messaged-delivered nutrition education in the smartphone-centric college population.

Although this study provided initial data addressing the effectiveness and feasibility of text-based nutrition education, more research with a greater number of diverse participants is needed.

An increased sample size and longer trial could provide results that are more applicable to the young-adult population as a whole as well as determine long-term effectiveness of these methods of nutrition education.

In the future, researches could consider using home scales that could transmit participant weights to the healthcare provider. They should also consider shortening the text messages and increasing the frequency to better retain the participants' attention. An alternative consideration would be to send the texts at the same frequency as the in-office visits in order to limit the influence of more frequent reminders. Since the goal of assessing these methods is to find a real-life solution to nutrition education, the more frequent text messages would be recommended.

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References

1. Centers for Disease Control and Prevention (2015) Overweight and obesity: adult obesity facts 2015.
2. Beal E (2013) The pros and cons of designating obesity a disease: the new AMA designation stirs debate. Am J Nurs 113 :18-19.
3. Centers for Disease Control and Prevention (2015) Overweight and obesity: causes and consequences.
4. Erdem E, Prada SI, Haffer SC (2013) Medicare payments: how much do chronic conditions matter? Medicare and Medicaid Res Rev 3: E1-E15.
5. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W (2009) Annual medical spending attributable to obesity: payer- and service-specific estimates. Health Aff 28: W822-W831.
6. Hammond RA, Levine R (2010) The economic impact of obesity in the United States. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy 3: 285-295.
7. Hartung FM, Renner B (2013) Perceived and actual social discrimination: the case of overweight and social inclusion. Front Psychol 4: 147-151.
8. Agerstrom J, Rooth DO (2011) The role of automatic obesity stereotypes in real hiring discrimination. J Appl Psychol 96: 790-805.
9. DiGiacinto D, Gildon B, Stamile E, Aubrey J (2015) Weight-biased health professionals and the effects on overweight patients. J Diagn Med Sonog 31: 132-135.
10. Nestler S, Egloff B (2013) The stigma of being overweight: When do attributions to discrimination protect self-esteem? Soc Psychol 44: 26-32.
11. Crombie AP, Ilich JZ, Dutton GR, Panton LB, Abood DA (2009) The freshman weight gain phenomenon revisited. Nutr Rev 67: 83-94.
12. Lloyd-Richardson EE, Bailey S, Fava JL, Wind R (2009) A prospective study of weight gain during the college freshman and sophomore years. Prev Med 48: 256-261.
13. LaRose JG, Tate DF, Gorin AA, Wing RR (2010) Preventing weight gain in young adults a randomized controlled pilot study. Am J Prev Med 39: 63-68.
14. Udo T, Mun E, Buckman JF, Vaschillo EG, Vaschillo B, et al. (2013) Potential side effects of unhealthy lifestyle choices and health risks on basal and reactive heart rate variability in college drinkers. J Stud Alcohol Drugs 74: 787-796.
15. Deshpande S, Basil MD, Basil DZ (2009) Factors influencing healthy eating habits among college students: an application of the health belief model. Health Market Q 26: 145-164.
16. Wahlich C, Gardner B, McGowan L (2013) How, when and why do young women use nutrition information on food labels? a qualitative analysis. Psychol Health 28: 202-216.
17. Taft N, Muñoz C, Lenihan A, Gantan J (2014) Prevention of pediatric obesity: recommendations, priorities, and tools for change. Infant Child Adolescent Nutr 6 :18-23.
18. Kessler L, Jonas JR, Gilham MB (1992) The status of nutrition education in ACHA college and university health centers. J Am Coll Health 41: 31-34.
19. Poddar KH, Hosig KW, Anderson-Bill ES, Nickols-Richardson SM, Duncan SE (2012) Dairy intake and related self-regulation improved in college students using online nutrition education. J Acad Nutr Dietetics 112: 1976.
20. Pew Research Center (2011) Cell phone data set. Washington, DC: Pew Research Center 2011.
21. Roberts JA, Yaya LHP, Manolis C (2014) The invisible addiction: cell-phone activities and addiction among male and female college students. J Behav Addict 3: 254-265.
22. Chow CK, Redfern J, Hillis GS, Thakkar J, Santo K, et al. (2015) Effect of lifestyle-focused text messaging on risk factor modification in patients with coronary heart disease a randomized clinical trial. J Amer Med Assoc 314: 1255-1263.
23. Arora S, Peters AL, Burner E, Lam CN, Menchine M (2014) Trial to examine text message-based mhealth in emergency department patients with diabetes (text-med): a randomized controlled trial. Ann Emerg Med 63: 745-754.
24. Stockwell MS, Hofstetter AM, DuRivage N, Barrett A, Fernandez N, et al. (2015) Text message reminders for second dose of influenza vaccine: a randomized controlled trial. Pediatrics 135: E83-E91.
25. Gow RW, Trace SE, Mazzeo SE (2010) Preventing weight gain in first year college students: an online intervention to prevent the "Freshman Fifteen". Eat Behav 11: 33-39.
26. LaChausse RG (2012) My student body: effects of an internet-based prevention program to decrease obesity among college students. J Am Coll Health 60: 324-330.
27. Mackey E, Schweitzer A, Hurtado ME, Hathway J, DiPietro L, et al. (2015) The feasibility of an e-mail-delivered intervention to improve nutrition and physical activity behaviors in African American college students. J Am Coll Health 63: 109-117.
28. Pellegrini CA, Verba SD, Otto AD, Helsel DL, Davis KK, et al. (2012) The comparison of a technology-based system and an in-person behavioral weight loss intervention. Obesity 20: 356-363.

29. Polzien KM, Jakicic JM, Tate DF, Otto AD (2012) The efficacy of a technology-based system in a short-term behavioral weight loss intervention. Obesity 15: 825-830.

30. Allen JK, Stephens J, Dennison Himmelfarb CR, Stewart KJ, Hauck S (2013) Randomized controlled pilot study testing use of smartphone technology for obesity treatment. J Obesity 2013: 1-7.

31. Brown ON, O'Connor LE, Savaiano D (2014) Mobile MyPlate: a pilot study using text messaging to provide nutrition education and promote better dietary choices in college students. J Am Coll Health 62: 320-327.

32. Shaw RJ, Bosworth HB, Silva SS, Lipkus IM, Davis LL, et al. (2013) Mobile health messages help sustain recent weight loss. Am J Med 126: 1002-1009.

33. Sterner D (2012) Consumers' views regarding the use of smart phones for tracking dietary intake and exercise: a qualitative study. ProQuest, UMI Dissertations Publishing 2012.

34. Napolitano MA, Hayes S, Bennett GG, Ives AK, Foster GD (2013) Using Facebook and text messaging to deliver a weight loss program to college students. Obesity 21: 25-31.

35. Bandura A (1986) Social foundations of thought and action: a social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall, Inc 1986.

36. US Department of Health and Human Services and US Department of Agriculture. 2015 - 2020 dietary guidelines for Americans (8th edition).

37. US Department of Agriculture (2015) College 2015.

38. Centers for Disease Control and Prevention (2015) Healthy weight 2015.

39. Letsmove.gov (2015) Let's move 2015.

40. Sonoma State University (2015) About SSU 2015.