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Master's Theses, and Doctoral Dissertations, and Graduate Capstone Projects

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Patient adherence to smartphone weight loss applications: A dietitian perception study

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Patient Adherence to Smartphone Weight Loss Applications: A Dietitian Perception Study

by

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Abstract

Background: Dietitians play an important role in weight management. Self-monitoring of food intake is an effective tool for weight management. As smartphones gain popularity, many individuals are using smartphone apps for diet tracking to lose weight.

Objective: To determine the dietitians' perception on whether their involvement with the use of smartphone weight loss apps results in increased patient/client adherence and increased weight loss.

Methods: An online survey was completed by 2,532 weight management dietitians. Paired t-tests were used to determine dietitians' perceptions on patient/client adherence and weight loss using smartphone apps with dietitian intervention compared to without dietitian intervention ($p<.05$).

Results/Conclusion: Eighty-three percent of weight management dietitians recommended smartphone weight loss apps. Dietitians' perceive adherence with smartphone apps to be significantly greater with dietitian feedback than without dietitian feedback ($p=.000$). Dietitians also perceive weight loss with smartphone apps to be significantly greater with dietitian feedback than without dietitian feedback ($p=.000$).

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Chapter 1: Introduction

Background

Weight gain, obesity, and the challenge to lose the excess weight have become major concerns in the United States. Between 2011 and 2012, 69% of adults 20 years and older in the United States were considered overweight or obese.[1,2] Body Mass Index (BMI) is the most common way to estimate overweight and obesity in adults 20 years and older.[2] BMI is a measurement of body fat based on height and weight and is calculated by dividing body weight in kilograms by height in meters squared (kg/m^2).[2,3] BMI reference values for adults as defined by the Weight Control Information Network, an information service of the National Institute of Diabetes and Digestive and Kidney Diseases, define normal weight as a BMI 18.5 to 24.9, overweight 25 to 29.9, obesity greater than 30, and extreme obesity greater than 40.[2] Over 1 in 3 adults in the United States is considered obese and more than 1 in 20 are considered extreme obese.[2] The prevalence of obesity is similar for men and women and has not discriminated for race or ethnicity.[2]

Being overweight or obese increases the risk for type 2 diabetes, coronary heart disease and stroke, metabolic syndrome, certain types of cancer, sleep apnea, osteoarthritis, gallbladder disease, fatty liver disease, and pregnancy complications.[4] To reduce these health risks, experts recommend weight loss, regular physical activity, and following a healthy diet.[4,5] Weight loss of 5–10% of body weight can lower these risks, as well as improve quality of life.[4,5] Guidelines from the Academy of Nutrition and Dietetics (AND) Evidence Analysis Library state that weight loss programs should include a three-part approach of diet, exercise, and behavioral therapy.[6] Dietitians play a key role in weight management with regard to this three-part approach. The AND guidelines further state that medical nutrition therapy provided by a dietitian results in

significant and clinically meaningful weight loss in overweight and obese adults. Self-monitoring through recording of diet and exercise has been shown to be an effective tool in weight management and is considered the cornerstone of behavioral therapy and weight loss.[5,7-11]

Mobile telephones with computer-like capabilities (smartphones) have the ability to access the Internet and run applications (apps).[12] Examples of smartphones include Android®, BlackBerry® and iPhone® devices.[12] Apps are tools which complete various tasks on a smartphone such as self-monitoring food and exercise.[12] As of January 2014, 58% of American adults own a smartphone of some kind with no significant differences between gender and race.[13] As smartphones gain in popularity, many individuals have looked to smartphone apps for diet and weight loss advice and tracking. A key component to these apps is the usage of self-monitoring tools that include food and physical activity logging as well as weight tracking.[5]

While strong evidence exists that the use of mobile technology is effective for weight loss, long-term research on their effectiveness has not been conducted.[14-16] Additional research is also needed to determine the most effective strategies for weight loss using mobile technology.[14] Research has been completed and positive results have shown correlations between the usage of personal digital assistants (PDAs) and weight loss.[7-10,12,17] PDAs and smartphones are both considered mobile technology. For the purposes of this research, PDA and smartphone research results will be considered comparable.

While research confirms that the use of smartphone technology with feedback is effective for weight loss,[7,18,19] limited research exists on the benefit of personalized feedback.[18] Personalized dietitian intervention with smartphone technology has not been studied, nor have the perceptions of dietitians toward smartphone weight loss apps. This study will investigate dietitian perceptions toward smartphone weight loss apps and the impact on patient/client

adherence. Given the lack of published research in regard to dietitian intervention on smartphone weight loss apps, a survey of dietitians practicing in the weight management setting may serve as a viable means of demonstrating the frequency and success of weight management with smartphone apps, dietitian intervention, and the need for further practical human research in this area.

Purpose of the Study

The purpose of this study is to determine dietitian perception on whether dietitian involvement with the use of smartphone weight loss apps results in increased patient/client adherence to self-monitoring and increased weight loss.

Justification and Significance

Overweight and obesity rates are prevalent.[1,2] Recommended treatment options include diet, exercise, and behavioral intervention in the form of self-monitoring.[6] This research will determine whether dietitian perceptions toward patient outcomes and adherence mirror empirical evidence shown in peer-reviewed research studies.[5,7,20] This research may benefit current dietitians as these results may provide support for connecting with patients/clients outside of a formal nutrition counseling session in order to maximize patient/client results until further randomized controlled trials can be conducted. This study may also help to further support the value of the use of technology in weight loss.

Chapter 2: Review of Literature

As obesity rates rise within the United States, continued interventions need to be available for those interested in losing weight or preventing weight gain. Guidelines from the AND Evidence Analysis Library[6] state that weight loss programs should include a three-part approach of diet, exercise, and behavioral therapy. Dietitians play a key role in weight management. Research suggests that PDA or smartphone programs with feedback can result in weight loss.[7,15,19] The effect of dietitian intervention on weight loss in smartphone food journaling programs has not been studied. Nor have the perceptions of dietitians toward smartphone weight loss apps. This section will discuss self-monitoring, weight loss, adherence, technology, and technology with feedback. These concepts will be explained and related literature will be included.

Self-Monitoring

Self-monitoring through the recording of diet and exercise has been shown to be an effective tool in weight management and is considered the cornerstone of behavioral therapy and weight loss.[5,7-11] By recording one's own food intake and activity, individuals can learn from their behavior and make changes to their diet and lifestyle.[8] Although successful self-monitoring is dependent upon the individual to be truthful, consistent, and timely, it allows for the individual to visually see a summary of their food intake on a day-to-day basis.[8] Multiple studies have found significant associations between weight loss and self-monitoring of food intake.[8,12] However, the exact impact is not fully known due to variations of methodology and adherence among studies.[8,12] Self-monitoring of food intake and weight loss are strongly correlated to the increased frequency and completeness of food logs.[8,9]

Historically, self-monitoring has been completed with paper diaries.[8,20,21] The process of a practitioner to review these can be time and cost prohibitive.[20] Improvements to the Internet, PDA devices, and smartphone technology have allowed for individuals to look to these technologies to assist with faster and easier food logging.[9] When comparing weight loss with the use of these technologies, Shay and colleagues[9] found no differences in weight loss between paper diaries, PDA diaries, or web-based diaries. The researchers monitored 39 active duty military members with a BMI greater than or equal to 25 for 12 weeks. Participants selected their preferred method of food and exercise tracking (paper diary, PDA dairy, or web-based diary) and were randomly selected to a diary tracking group. The researchers concluded that participants who were assigned their preferred method of diet and exercise tracking were more adherent to recording food and exercise, but showed no difference in weight loss.

A more recently published study by Wharton and colleagues[21] studied self-monitoring with a smartphone application compared to a memo function on a smartphone and paper diaries. The researchers conducted an 8 week weight loss trial with 57 participants. The smartphone application group used the application LoseIt!®, which included a food database and automatic feedback to the participant regarding their calorie intake. This group did not receive counseling sessions or diet advice from researchers. The smartphone with memo function group and the paper diary group received one-on-one counseling sessions before the study started and weekly e-mails for encouragement. The researchers reported that all groups lost weight and no weight loss difference was noted between groups. The researchers did find that participants in the smartphone application group recorded data more consistently when compared to the paper diary group but not when compared to the smartphone with memo function group.

Weight Loss

Smartphones are an effective tool for weight loss.[14-16,22] A meta-analysis by Tang and colleagues[15] analyzed twenty review articles and concluded that when used in conjunction with standard weight loss programs, self-directed interventions such as smartphone apps, interactive websites, and text messages resulted in an increased weight loss of 1.5 kg over the period that research was conducted. Researchers noted the particular technology features that promoted change and effective weight loss included individualized feedback, e-mail counseling, and online social support. Furthermore, a majority of studies reported weight loss. However, most reviews did not report the percentage of weight loss that was achieved, making it impossible to determine if the weight loss was clinically significant.[14,15]

Baligalupo and colleagues[14] summarized the findings of randomized clinical trials that looked at weight loss with the use of mobile technology and found that clinically significant weight loss is achievable for at least a proportion of overweight or obese participants. The researchers searched databases for articles published between January 1998 and October 2011. Of the 174 articles found, 21 met the criteria for randomized controlled trials on "mobile technology interventions facilitating weight loss in overweight and obese adults with any other comparator." To be included in the review, all interventions included participant education about weight loss through diet and exercise and the need for participants to carry a mobile device. In the same study, researchers identified five key components for effective technology based weight loss: self-monitoring, counselor feedback/communication, social support, use of a structured program, and the use of an individually tailored program. The researchers concluded there is evidence to support short-term and medium-term weight loss through the use of mobile technology although long-term weight loss benefit studies have not yet been conducted. Finally,

the researchers also concluded that research is needed to determine the optimal interventions needed for mobile technology to lead to effective weight loss.

Evidence based practice is essential for weight loss. Breton and colleagues[23] reviewed the content of 204 weight loss apps available for download from the iTunes store and coded the apps adherence to the 13 evidence informed practices for weight control. Table 1 lists the 13 evidence informed practices that are common to the following government agencies: Centers for Disease Control and Prevention, National Institutes of Health, Food and Drug Administration, and US Department of Agriculture. The researchers found that while most of the apps adhered to one or two of the evidence informed practices, only 15% of smartphone apps reviewed had five or more of the 13 evidence informed practices for weight loss. Interestingly, 6% of the apps did not adhere to any of the evidence informed practices and promoted detox or fad diets. Of the apps, 43% recommended or provided a tool for keeping a food diary and 34% of the apps recommended or provided a tool to track weight loss. The researchers discussed that none of the apps reviewed included interactive text messages or proactive alerts to promote behavior change.

Table 1. Thirteen Evidence-Informed Practices for Weight Control[23]

Evidence Informed Practices for Weight Control
1. Assess one's weight
2. Eat a diet rich in fruits and vegetables
3. Perform regular physical activity
4. Drink water instead of juice or soda
5. Keep a food diary
6. Maintain calorie balance of in vs. out
7. Weight loss of 1 to 2 pounds a week
8. Portion control
9. Read nutrition labels
10. Track your weight
11. Keep a physical activity journal
12. Plan meals
13. Seek social support

Most smartphone apps have not been created to include behavioral strategies for evidence based weight loss.[24] While evidence informed strategies may promote weight loss, not all of the strategies may be essential for actual weight loss, such as fruit and vegetable intake and water consumption.[24] Evidence-based behavioral weight loss strategies, see Table 2, are not commonly included in smartphone apps. These strategies can improve motivation, stress reduction, and problem solving leading to increased weight loss.[24-25]

Table 2. Twenty Evidence-based Behavioral Weight Loss Strategies[24]

Evidence-based Behavioral Weight Loss Strategies based on the Diabetes Prevention Program Lifestyle Intervention Protocol

1. Weight loss goal
2. Dietary goal
3. Calorie balance
4. Physical activity goal
5. Exercise safety
6. Benefits of healthy diet and physical activity
7. Food substitutions
8. Food pyramid (healthy eating)
9. Stimulus control
10. Portion control
11. Lifestyle activity (being active as a way of life)
12. Target heart rate
13. Problem solving
14. Stress reduction
15. Relapse prevention
16. Negative thinking
17. Social cues
18. Develop a regular pattern of eating
19. Time management
20. Nutrition label reading

Adapted from Pagoto S, Schneider K, Jojic M, DeBiasse M, Mann D. Evidence-based strategies in weight-loss mobile apps. *Am J Prev Med*. 2013; 45(5):576-582.

Adherence

Increased adherence to self-monitoring is significantly associated with greater weight loss.[7,8,10,16,22] The use of PDA devices has had a direct and indirect effect on weight loss by increased adherence to self-monitoring of diet and exercise.[10,12] With the increase of individuals carrying smartphones,[13] the social stigma associated with being on a diet and recording and carrying around paper diaries may be diminished.[8,12] Unfortunately, the criteria of adherence to self-monitoring is not consistent among studies; it is therefore difficult to determine adherence requirements for weight loss.[7,8]

Adherence has been measured in many different ways from dichotomous codes of "did not self-monitor" or "did self-monitor at least one item"[7] to percentage of days participants recorded an adequate number of calories (greater than 50% of their calorie goal)[11] to a completed day being considered greater than 500 calories[22] or 800 calories[21] recorded. The process of self-monitoring has been studied and these studies found that the detail to which one records their food logs (e.g., amount consumed, brand of food) may not be as crucial as simply listing and recording the food that was consumed.[11] Evidence has shown that timing of meal entry is also related to increased weight loss due to increased accuracy of recording a meal as it is consumed versus recalling what was consumed at a later date or time.[8,12,17]

In a study of online self-monitoring, Krukowski and colleagues[12] studied 161 overweight or obese participants who participated in an online web-based weight loss intervention over six months. The intervention included 24 online group sessions and participants were directed to record diet intake, physical activity, and their weight daily though an online journal. Results showed a mean weight loss of 5.5 kg at six months, which was a loss of 5.8%. The researchers determined that early and more frequent logging at the beginning of the study (self-monitoring greater than or equal to six days) showed greater weight loss and increased compliance. The researchers found that older subjects tended to self-monitor more than younger subjects. They also found that increased self-monitoring during the week of 10% led to an increased 1% weight loss overall. The researchers found that self-monitoring decreases overtime. The researchers concluded that the likelihood of success or failure towards weight loss could be predicted as early as one month into a six-month study.

A study by Carter and colleagues[22], found greater adherence and satisfaction (91.2%) in the smartphone application group compared to the paper food diary group (23.1%). The

researchers studied 128 overweight participants for six months using a self-directed weight loss intervention. Participants were randomized into interventions delivered by a smartphone application, website, or paper diary. At six months, retention was found to be 93% in the smartphone application group compared to 55% in the website group and 53% in the paper diary group. Weight loss at six months was 4.6 kg in the smartphone group, 2.9 kg in the diary group, and 1.3 kg in the website group; however, not all participants complied to their assigned groups and several participants admitted to using more than one intervention to lose weight.

Smartphone Technology

With the use of smartphones gaining in popularity[13], their potential towards weight management increases. Smartphone apps are continuously being developed to assist with chronic disease management.[26] Mobile phones have been used to support developing nations with remote healthcare, assist in medical diagnoses, and provide information for treatments.[26] Other technology with smartphones has been developed to assist in the management of behavior change, health education, and smoking cessation.[26] Smartphone apps such as MyFitnessPal®[27], LoseIt!®[28], and SparkPeople®[29] are widely used to assist in weight management.

Smartphone app technology provides instant feedback to an individual to show comparison with foods consumed and daily calorie or nutrient intake goals.[12] Many smartphone apps include features such as reminder signals to document food and exercise, meal plans, recipes, and health tips. Increased satisfaction is reported by most individuals using smartphone or PDA technologies to monitor diet and exercise. This likely explains the high level of adherence to self-monitoring.

As more smartphone weight loss apps are developed, functionality and capabilities are improved. Some programs allow for self-entry of items not listed in the database and others have

the ability to look up items by scanning the barcode on a particular package.[12,27,28] Once an item is recorded, the food item is added to the app's memory for ease in locating the item again for re-entry on another day or meal.[12,27] As technology improves, date, time, and meal stamps are being added to programs to track when self-monitoring is taking place.[8,17] This allows a clinician who is reviewing patient/client's self-monitoring to look for backfilling, a process of recording several meals and days at one time.[8]

Technology with Feedback

Self-monitoring with technology assisted feedback has been shown to increase weight loss when using a PDA device with feedback versus those with just a PDA.[8,10,12] Burke and colleagues[7], conducted a two-year study examining technology and weight loss. This study tracked 210 overweight or obese adults through the use of a paper diary, PDA, or PDA plus feedback. The PDA plus feedback intervention would provide daily automated feedback to an individual to remind them to log their meals for the day or notify an individual that they were reaching their total fat limit for the day. The researchers found that daily feedback was very influential to individuals for self-monitoring. Results at twenty-four months showed a 2.32% weight loss in the PDA plus feedback group. The researchers found that through all groups adherence greater than 60% led to greater weight loss and overall adherence was more important than a particular method. While this study found that the use of PDA with feedback was effective for weight loss, automated feedback is not personalized.

To date, Chambliss and colleagues[5] and Donaldson and colleagues[20] have published the only available research with a dietitian providing personalized feedback with technology. Chambliss and colleagues[5] provided weekly e-mail feedback with structured pre-created scripts to determine if weight loss was greater with computerized self-monitoring and technology-

assisted feedback. The researchers studied 120 overweight adults for 12 weeks. Participants were randomized to one of three interventions: computerized self-monitoring with basic feedback, enhanced behavioral feedback, or waitlist control. Participants in the basic group met with a dietitian to receive an individualized report of their resting metabolic rate, calorie plan, instructions on how to use the weight management software program, and direction to self-monitor daily food intake and physical activity into the software program. The individuals received weekly e-mail reports with their progress. Participants in the enhanced group received all components of the basic program plus a 2-hour seminar, step counters, monthly e-mail newsletters, and brief monthly telephone consultations. Participants in the enhanced group received expanded behaviorally tailored feedback through weekly e-mails. Individuals in the basic group lost 2.7 kg and individuals in the enhanced group lost 2.5 kg of weight compared to 0.3 kg for controls. Researchers concluded that computerized self-monitoring with technology-assisted feedback is effective for significant weight loss, but an enhanced component may not be necessary. The researchers found that technology-assisted strategies may complement and reduce in-person contact time.

Donaldson and colleagues[20] have published research with a dietitian providing personalized feedback through the format of text messaging. The researchers studied participants who had completed a 12-week weight loss program and were enrolled in an additional 12-week program where they text messaged their progress to a dietitian and received tailored feedback. They followed 17 participants in the intervention (text message group) and 17 participants in the control group (no dietitian intervention). Those in the intervention group were given daily step goals through the use of a pedometer, a daily goal of five fruits or vegetables per day and instruction to consume breakfast. The text message group was instructed to text the outcomes of

their goals twice a week and if they didn't, they were sent reminder text messages. Once the dietitian received the text message from the participant, the dietitian would text back a personalized response of a congratulatory nature if they met their goals or encouragement with suggestions if they missed their goals. The researchers found that this was a cost effective intervention that promoted a mean weight loss of 1.6 kg compared to the control that gained 0.7 kg. In addition, the text message group showed decreased waist circumference and increased quality of life.

The limited research by Donaldson and colleagues[20] begins to support that dietitians can provide effective feedback through smartphone apps that is normally limited to a clinical setting. Dietitians can utilize their training and experience to review individual's food logs and identify areas for improvement while providing intervention that adds a personalized element not found in automated feedback. The addition of personalized feedback from a dietitian, the reinforcement of positive behavioral change, and feedback in a timely fashion may lead to increased adherence resulting in increased weight loss.

Smartphone apps are an effective tool for weight management.[5,14-16,21] However, research has yet to be published evaluating the effect of dietitian intervention on increased adherence and weight loss with smartphone apps. Due to the lack of published research, this study will survey the perceptions of dietitians practicing in a weight management setting to demonstrate the frequency and success of weight management with smartphone apps, dietitian intervention, and the potential need for further practical human research in this area.

Chapter 3: Research Design and Methodology

Pilot Survey

Given that a perception survey in this area has never been conducted to the researcher's best knowledge, validated survey questions on this topic did not exist. Survey questions were developed by the principle investigator. The survey was developed using the SurveyMonkey™ software program (Palo Alto, CA). A sample of twelve dietitians who work in an outpatient weight management setting were surveyed to improve the validity of the survey. Based on the feedback of the dietitians from the pilot survey, dietitian respondent answers allowed the investigator to review the clarity of the survey and improve the question response options before it was sent out to the target population.

Sample Selection

The target population for this study was weight management dietitians currently practicing in the United States. The study sample was obtained through the use of a confidential dietitian e-mail database provided and approved by the Commission on Dietetic Registration (CDR). The CDR is the credentialing body that has the authority to credential dietitians. The CDR was contacted with the purpose of this research, the methodology, and a request for access to the CDR database for credentialed dietitian's e-mail addresses. The CDR reviewed and approved the request for use of dietitian's e-mail addresses (Appendix A).

The principal investigator (PI) kept all information password protected on the PI's personal computer. An e-mail invitation was sent to 85,633 dietitians with a link to the survey (Appendix B). Inclusion criteria were registered dietitians credentialed through the CDR who had been practicing for at least six months and who practiced in the area of weight management at least 25% of the time. Those excluded were dietetics students/interns and dietetic technicians.

Survey Questionnaire

Informed consent was obtained prior to the dietitian completing the survey (Appendix C). The survey consisted of 21 questions that were multiple choice or scaled (Appendix D), with an additional four questions available depending on dietitian response. The time for a dietitian to complete the survey was expected to be less than 15 minutes. The survey was divided into four parts: dietitian demographics, questions about the dietitian's own outpatient practice, the dietitian's recommendations to patient/clients regarding smartphones, and finally, the dietitian's perceptions on patient/client adherence and weight loss. At the conclusion of the survey, participants were given the opportunity to provide their e-mail address for the chance to win a $50 Amazon.com gift card. The e-mail address provided was not linked to any of the participant's survey responses.

The survey was active and available to participants for a period of two weeks. After one week, a follow up e-mail was sent out to dietitians thanking them for their participation and encouraging those who had not yet participated (Appendix B).

Survey Approval and Informed Consent

Prior to distribution, the survey and the research proposal were reviewed for approval by the Eastern Michigan University Human Subjects Review Committee (Appendix E). Approval was also obtained from the Commission on Dietetic Registration (Appendix A). Informed consent was obtained from the participants through their reading the informed consent page at the beginning of the survey and clicking "Agree" (Appendix C). The recruitment e-mail included a brief description of the purpose of the study, the statement that participation is voluntary, and the link to participate in the survey (Appendix B). The informed consent at the beginning of the survey also included details about the survey and instruction that the survey is voluntary, that the

participant may opt out at any time, that there is no cost to the participant, and that there is no benefit or foreseeable risk to participate. Furthermore, the informed consent also stated that all of the participants' responses will be kept confidential and anonymous, and all data presented will be in summary format with no identifiers of any participant. Finally, participants were informed that the results of the study may be presented at research meetings or conferences, in scientific publications, and as part of this Master's thesis being conducted by the principal investigator.

Data Collection and Statistical Analysis

Participant responses were collected via the SurveyMonkey® software program. The collected data was then exported for analysis to the statistical software package Statistical Package for the Social Sciences (SPSS) (version 22.0, 2013; SPSS Inc., an IBM Company, Chicago, IL). Descriptive statistics were used to record dietitian demographics. A paired t-test was used to determine if dietitians perceive patients/clients to be more adherent to tracking food intake, and if they notice an increase in patient/client weight loss with self-monitoring using smartphone apps and dietitian intervention versus without dietitian intervention. Pearson's chi-square analysis was performed to determine the relationship between dietitian demographics (gender, age, highest level of education completed, years practicing as a dietitian, and geographical region) compared to if dietitians recommend smartphone apps for weight loss, and compared to dietitians' comfort level recommending smartphone apps for weight loss. This study used a significance level of 0.05.

Chapter 4: Results

Demographics

The survey was sent out to 85,633 dietitians residing in the United States. The response to the study was 7,869 dietitians (9.2% response rate). Of those 7,869 dietitian responses, 2,532 responses were from dietitians who qualified and met the inclusion criteria.

Demographics for gender, education, age, number of years in practice, and geographical region are presented in Table 3. Dietitians that responded were 96.8% females and 51.5% had completed a master's degree as their highest level of education. Approximately 40% of dietitians range in age between 25–34 years. About one-third of dietitians reported that they have been practicing as a dietitian for 0–5 years. Dietitians were represented from every state in the United States and classified into four geographical regions and nine divisions based on the U.S. Census Bureau geographical map. The largest percentage of dietitians was from the East Midwest division (17.8 %), the South Atlantic division (16.2%), and the Pacific division (14.4%).

Table 3. Dietitian demographics

Demographics	(n)	% of Total
Gender	**Total n=2525**	
Female	2444	96.8
Male	81	3.2
Highest Level of Education	**Total n=2526**	
Bachelor's Degree	1161	46.0
Master's Degree	1302	51.5
Doctorate Degree	63	2.5
Age	**Total n=2526**	
Under 25	99	3.9
25 to 34	973	38.5
35 to 44	554	21.9
45 to 54	457	18.1
55 to 64	396	15.7
65 or older	47	1.9
Total Years Practicing as a Dietitian	**Total n= 2522**	
0-5	835	33.1
6-10	466	18.5
11-15	336	13.3
16-20	231	9.2
21-25	196	7.8
26-30	191	7.6
31+	267	10.6
Regions and Divisions	**Total n=2455**	
Northeast New England (CT, ME, MA, NH, RI, VT)	176	7.2
Mid-Atlantic (NJ, NY, PA)	348	14.2
Midwest East Midwest (IL, IN, MI, OH, WI)	437	17.8
West Midwest (IA, KS, MN, MO, NE, ND, SD)	205	8.4
South South Atlantic (DE, FL, GA, MD, NC, SC, VA, DC, WV)	398	16.2
East South Central (Al, KY, MS, TN)	120	4.9
West South Central (AR, LA, OK, TX)	233	9.5
West Mountain (AZ, CO, ID, MT, NV, NM, UT, WY)	184	7.5
Pacific (AK, CA, HI, OR, WA)	354	14.4

Data on dietitians current practice setting is presented in Table 4. Approximately one-half of dietitians reported their current practice setting as being in an outpatient clinic (51.3%). Less frequent practice settings also included hospital, private practice, corporate/worksite wellness, and other. Most frequent comments in the other category were supermarkets, research sites,

universities, and on-line coaching. Other practice settings were government agencies, fitness

centers, and insurance companies.

Table 4: Dietitian's current practice setting

Current Practice Setting (Total n=2,526)[a]	(n)	% of Total
Hospital	653	25.9
Outpatient Clinic	1295	51.3
Fitness Center	176	7.0
Government Agency	269	10.6
Private Practice	572	22.6
Corporate/Worksite Wellness	322	12.7
Insurance Company	74	2.9
Other	338	13.4

[a]Responses equal >100% as participants selected all that applied

Data regarding dietitians' smartphone use is presented in Table 5. The vast majority of

dietitians personally or professionally own a smartphone (94.8%). Also, a high percentage of

dietitians feel extremely comfortable or comfortable using smartphone weight loss applications

(81.2%) compared to the minority of dietitians who feel uncomfortable or extremely

uncomfortable (4.4%).

Table 5: Dietitians and smartphone use; if they own a smartphone and their comfort level using smartphone applications

Dietitians and Smartphone Use	(n)	% of Total
Smartphone Ownership	**Total n= 2523**	
Yes	2393	94.8
No	130	5.1
Dietitian Comfort Level Using Weight Loss Apps	**Total n= 2530**	
Extremely Comfortable	1029	40.6
Comfortable	1024	40.4
Neutral	366	14.5
Uncomfortable	83	3.3
Extremely Uncomfortable	28	1.1

Dietitians' Outpatient Weight Management Practice

Data regarding dietitians' outpatient weight management practice is presented in Table 6. In regard to the dietitian respondents own weight management practice, 29.3% see patients/clients under 18 years old, 77.7% see 18–40 year old patients/clients, 83.1% see 41–65 year old patients/clients, and 48.5% see over 65-year-old patients/clients. The methods for self-monitoring most frequently recommended are paper journals (89.5%), smartphone phone apps (85%), and websites or spreadsheets (56.4%). The overwhelming majority of dietitian respondents reported that they provide feedback to their weight management patient/clients regarding their food logs (94.6%). However, of the dietitian respondents who provide feedback, about one-third of dietitians only monitor between 1–25% of their patient/clients food logs with less than a quarter of dietitians monitoring between 76–100% of their patients/clients food logs.

Table 6: Dietitians' outpatient weight management practice; age of client, recommended type of self-monitoring, if dietitians provide feedback to their clients through food logs, and the percentage of clients dietitians monitor through food logs

Dietitians' Outpatient Weight Management Practice	(n)	% of Total
Age of Client	**Total n=2505[a]**	
Under 18	735	29.3
18–40	1947	77.7
41–65	2081	83.1
Over 65	1216	48.5
Recommended Type of Self-Monitoring	**Total n=2503[a]**	
Paper Journal	2240	89.5
Website/Spreadsheets	1411	56.4
Smartphone Apps	2127	85
Photo	406	16.2
I don't recommend	76	3
Other	44	1.8
Do you provide feedback to your clients regarding their food logs?	**Total n= 2497**	
Yes	2361	94.6
No	136	5.4
Percentage of clients that you monitor through food logs	**Total n=2507**	
1–25%	739	29.5
26–50%	610	24.3
51–75%	482	19.2
76–100%	551	22
I don't monitor	125	5

[a]Responses equal >100% as participants selected all that applied

Smartphone Weight Management Patient/Client Recommendations

As shown in Table 7, approximately one-third of dietitians report that 76–100% of their patients/clients own a smartphone. Two-thirds of dietitians report that more than 50% of their patients/clients own smartphones.

Table 7. Patient/client smartphone ownership

Smartphone Ownership (Total n=2498)	(n)	% of Total
1–25%	132	5.3
26–50%	400	16
51–75%	832	33.3
76–100%	887	35.5
I don't know	247	9.9

Data regarding dietitians' recommendations for smartphone weight management apps is presented in Table 8. Eighty-three percent of dietitians recommend smartphone weight management apps to their patients/clients. MyFitnessPal® app was the app that was most commonly recommended to patients/clients (94%) with the LoseIt!® App being the second most recommended (44.9%). The most frequent comment in the other category referred to the dietitian recommending any app that the patient/client was familiar with and willing to use.

Table 8: Dietitians' recommendations for smartphone weight management apps

Recommendations for smartphone weight management apps	(n)	% of Total
Recommend Apps to Patients/Clients	**Total n=2510**	
Yes	2091	83.3
No	419	16.7
Recommended Apps	**Total n=2071[a]**	
MyFitnessPal®	1947	94.0
Lose It!®	930	44.9
Choosemyplate.gov	779	37.6
Spark People®	677	32.7
Fooducate®	314	15.2
Livestrong®	224	10.8
MyNetDiary®	142	6.9
Fat Secret®	103	5.0
Other	345	16.7

[a]Responses equal >100% as participants selected all that applied

A bar graph showing dietitians' comfort level in recommending weight management apps is presented in Figure 1. The majority of dietitians (78.4%) reported being extremely comfortable or comfortable recommending smartphone apps for weight loss with 36.5% of dietitians being

extremely comfortable and 41.9% of dietitians reporting being comfortable. Only a small

percentage of dietitians reported being either extremely uncomfortable or uncomfortable

recommending smartphone apps for weight loss (5.5%).
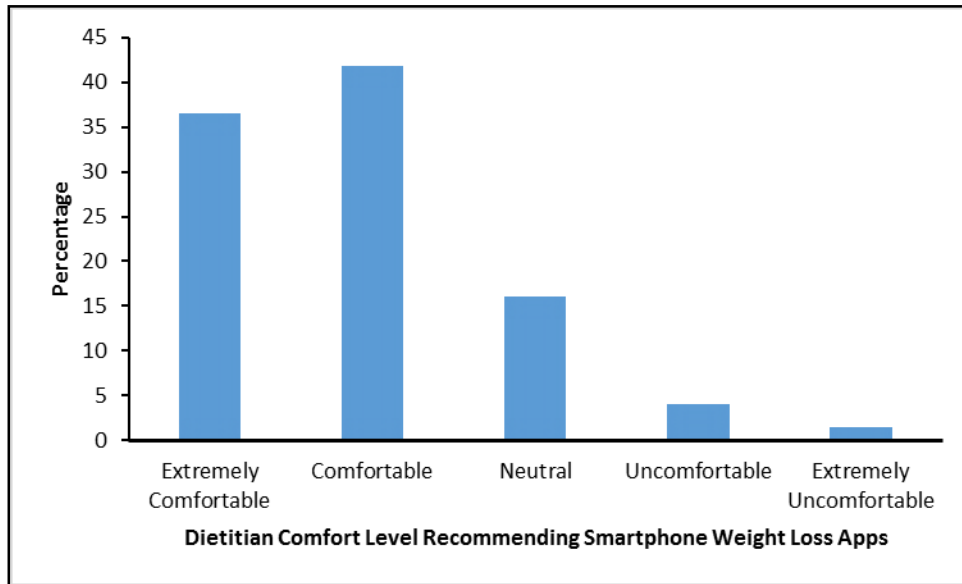
Figure 1. Percentage of dietitians' comfort level in recommending weight management apps (n=2363)

Pearson chi-square analysis was performed to determine if dietitian recommendation of

smartphone apps for weight loss to weight management patient/clients depended on dietitian

demographic data. As presented in Table 9, a statistically significant relationship exists between

dietitian recommendation of smartphone apps for weight loss and dietitian age (p=.019). Of

those that recommend smartphone weight loss apps for their weight management patients/clients,

dietitians aged 35 to 44 years recommend most frequently (87.0%) with a decrease in

smartphone weight loss app recommendations with dietitians over 45 years of age. Interestingly,

the smallest group of dietitians who recommend smartphone apps by dietitian age is the under 25

year old group (77.6%).

Table 9. Relationship[a] between dietitian recommendation for patient/client smartphone app use and dietitian age

Dietitian Age[b]	Do you recommend smartphone weight loss apps to your weight management patients/clients?	
	Yes	**No**
Under 25	76 (77.6%)	22 (22.4%)
25 to 34	813 (84.2%)	153 (15.8%)
35 to 44	480 (87.0%)	72 (13.0%)
45 to 54	366 (81.7%)	82 (18.3%)
55 to 64	312 (79.4%)	81 (20.6%)
65 or older	38 (89.0%)	9 (19.1%)

[a]Pearson χ^2 = 13.48, df = 5, p=.019
[b]Count of dietitians (% by age group and not by total population)

As presented in Table 10, a significant relationship was also found between dietitian recommendation of smartphone apps for weight loss and geographical regions of northeast, midwest, south, and west (p=.028). Dietitians who recommended smartphone weight loss apps for their weight management patient/clients with a current practice setting in the midwest (86.6%) recommended smartphone apps the most frequently with dietitians from the west (80.6%) and south (81.9%) regions recommending smartphone apps the least frequently.

Table 10. Relationship[a] between dietitian recommendation for patient/client smartphone app use and dietitian practice setting geographical region

Region[b]	Do you recommend smartphone weight loss apps to your weight management patient clients?	
	Yes	**No**
Northeast	443 (84.1%)	82 (15.9%)
Midwest	554 (86.6%)	86 (13.4%)
South	610 (81.9%)	135 (18.1%)
West	431 (80.6%)	104 (19.4%)

[a]Pearson χ^2 = 9.08, df = 3, p=.028
[b]Count of dietitians (% by region group and not by total population)

No significant differences were found between dietitian recommendation of smartphone apps for weight loss and gender (p=.444), highest level of education completed (p=.148), total years practicing as a dietitian (p=.509), and U.S. census geographical division (p=.087).

Pearson's chi-square analysis was also used to analyze the relationship between dietitian comfort level recommending smartphone apps for weight loss and dietitian demographic data. As presented in Table 11, the comfort level of a dietitian recommending a smartphone app for weight loss and the number of years the dietitian has been practicing was found to be significant (p=.036). While the majority of dietitians are extremely comfortable or comfortable recommending smartphone weight loss apps, dietitians practicing between 11–15 years report the highest percentage of extremely comfortable or comfortable (81.3%) with dietitians practicing 16–20 years also having a high percentage with an extremely comfortable or comfortable level recommending smartphone apps for weight loss (80.9%). At least seventy-five percent of all other age ranges were found to be extremely comfortable or comfortable when recommending smartphone weight loss apps for patients/clients.

Table 11. Relationship[a] between dietitian comfort level recommending smartphone apps for weight loss and number of years the dietitian has been practicing

Years as a Dietitian[b]	How comfortable do you feel recommending smartphone apps for weight loss?				
	Extremely Comfortable	**Comfortable**	**Neutral**	**Uncomfortable**	**Extremely Uncomfortable**
0–5	275 (35.3%)	328 (42.2%)	128 (16.5%)	32 (4.1%)	15 (1.9%)
6–10	171 (39.0%)	175 (39.9%)	67 (15.3%)	10 (4.3%)	7 (1.6%)
11–15	135 (43.5%)	117 (37.7%)	48 (15.5%)	10 (3.2%)	0 (0.0%)
16–20	70 (33.5%)	99 (47.4%)	32 (15.3%)	3 (1.4%)	5 (2.4%)
21–25	78 (41.9%)	70 (37.6%)	27 (14.5%)	9 (4.8%)	2 (1.1%)
26–30	65 (35.9%)	74 (40.9%)	28 (15.5%)	12 (6.6%)	2 (1.1%)
31 +	67 (26.6%)	122 (48.4%)	48 (19.0%)	12 (4.8%)	3 (1.2%)

[a]Pearson χ^2 = 37.86, df = 24, p=.036
[b]Count of dietitians (% by years as a dietitian group and not by total population)

As presented in Table 12, a statistically significant relationship was found between the dietitian's comfort in recommending smartphone apps for weight loss and geographical region (p=.028). All geographical regions reported that at least seventy-five percent of dietitians being extremely comfortable or comfortable recommending smartphone apps for weight loss with the

midwest in the highest percentage of comfort (81.7%) and the south in the lowest percentage of

comfort (76.0%).

Table 12. Relationship[a] between dietitian comfort level recommending smartphone apps for weight loss and dietitian practice setting geographical region

	How comfortable do you feel recommending smartphone apps for weight loss?				
Region[b]	**Extremely Comfortable**	**Comfortable**	**Neutral**	**Uncomfortable**	**Extremely Uncomfortable**
Northeast	179 (37.1%)	215 (44.6%)	70 (14.5%)	10 (2.1%)	8 (1.7%)
Midwest	220 (36.5%)	272 (45.2%)	77 (12.8%)	28 (4.7%)	5 (0.8%)
South	260 (37.2%)	271 (38.8%)	126 (18.0%)	29 (4.1%)	13 (1.9%)
West	180 (35.2%)	201 (39.3%)	96 (18.8%)	26 (5.1%)	8 (1.6%)

[a]Pearson χ^2 = 23.03, df = 12, p=.028
[b]Count of dietitians (% by years as a region group and not by total population)

No significant differences were found in dietitian's comfort level in recommending

smartphone apps for weight loss by gender (p=.102), highest level of education completed

(p=.908), dietitian age group (p=.058), and U.S. census geographical division (p=.056).

Data regarding the attributes of weight management patients/clients that make dietitians

more likely to recommend smartphones apps for weight loss is presented in Figure 2. Data

regarding perceived barriers that prevent dietitians from recommending smartphone apps for

weight loss is presented in Figure 3. Ownership/usage of a smartphone, patient/client readiness

to change, and patient/client age were reported as the top attributes and perceived barriers

affecting dietitians' likeness to recommend smartphone apps for weight loss.
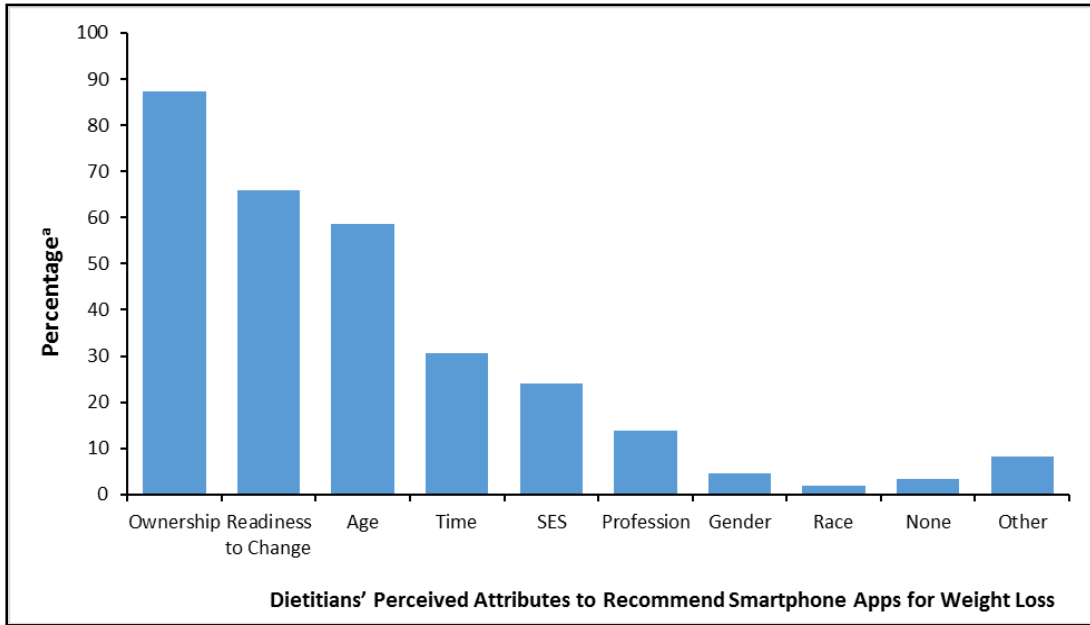
Ownership, Ownership/ Usage of Smartphone; SES, Socioeconomic Status
[a]Responses equal >100% as participants selected all that applied

Figure 2. Percentage of dietitians' perceived attributes to recommend smartphone apps for weight loss (n= 2476)
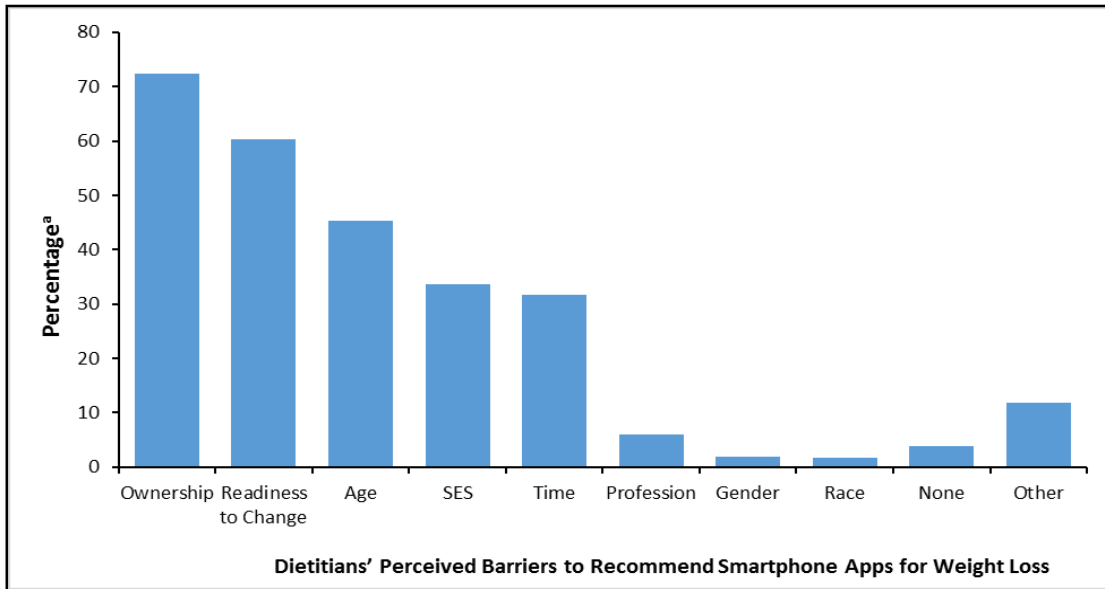
Ownership, Ownership/ Usage of Smartphone; SES, Socioeconomic Status
[a]Responses equal >100% as participants selected all that applied

Figure 3. Percentage of dietitians' perceived barriers to recommend smartphone apps for weight loss (n=2477)

Data regarding dietitians who provide feedback to their weight management patients/clients through smartphone weight loss apps (via messages within the app) is presented in Table 13. Only 15% of dietitians reported providing feedback within the app. Of those dietitians, 32.6% reported providing feedback as frequently as needed/PRN and 23.9% reported providing weekly feedback. Within this group of dietitians providing feedback within the app, 57.3% reported that providing feedback increases adherence to a large or very large extent. Dietitians also reported that providing feedback leads to increased weight loss to a large or very large extent (51.0%). When comparing smartphone apps to paper food logs, about two-thirds of dietitians report that smartphone apps result in greater weight loss (65.5%).

Table 13. Dietitians who provide feedback to their weight management patients/clients through smartphone weight loss apps (via messages within the app)

Dietitian Feedback within the App	(n)	% of Total
Do you provide feedback within the app?	**Total n=2486**	
Yes	384	15.4
No	2102	84.6
Frequency of Feedback Within the App	**Total n=377**	
Daily	27	7.2
Several times per week	45	11.9
Twice per week	15	4.0
Weekly	90	23.9
Twice per month	33	8.8
Monthly	38	10.1
PRN/As needed	123	32.6
Other	6	1.6
With apps, to what extent does providing feedback increase adherence?	**Total n=363**	
To a very large extent	62	17.1
To a large extent	146	40.2
To a moderate extent	130	35.8
To a small extent	19	5.2
To a very small extent	6	1.7
With apps, to what extent does providing feedback lead to increased weight loss?	**Total n=327**	
To a very large extent	38	11.6
To a large extent	129	39.4
To a moderate extent	126	38.5
To a small extent	26	8.0
To a very small extent	8	2.4
In terms of weight loss, how do smartphone apps compare to paper food logs?	**Total n=272**	
Smartphone apps result in a much greater weight loss	54	19.9
Smartphone apps result in a slightly greater weight loss	124	45.6
No difference in weight loss	82	30.1
Paper logs result in a slightly greater weight loss	12	4.4
Paper logs result in a much greater weight loss	0	0.0

Dietitian Perceptions of Adherence and Weight Loss

Data regarding perceptions of adherence and weight loss with and without dietitian

feedback is presented in Tables 14 and 15. Paired t-tests were performed to compare the mean

scores of dietitian perception on patient/client adherence and weight loss with dietitian feedback versus without dietitian feedback. Perception of average adherence of patient/client feedback is statistically significantly greater with dietitian feedback than without dietitian feedback (t= 43.98, p=.000). A 95% confidence interval for the average difference in adherence with and without dietitian feedback was [0.83, 0.91], which seems practically significant with a five-point scale.

Dietitian perception of average patient/client weight loss is statistically significantly greater with dietitian feedback than without dietitian feedback (t= 44.48, p=.000). A 95% confidence interval for the average difference in the effectiveness that smartphone apps have on patient/client weight loss with and without dietitian feedback is [0.76, 0.83] which seems practically significant with a five-point scale.

Table 14. Average difference in dietitian perception of patient/client adherence to tracking intake using smartphone apps with and without dietitian feedback

In your perception, how adherent are patients/clients to tracking food intake using smartphone apps? (n = 1810)

Average Adherence Level[a]					
With Dietitian Feedback	Without Dietitian Feedback	Difference	t	df	p
3.11	2.24	0.87	43.98	1809	.000

[a]1 = Very Poor; 2 = Poor; 3 = Fair; 4 = Good; 5 = Very Good

Table 15. Average difference in dietitian perception of patient/client weight loss to using smartphone apps with and without dietitian feedback

In your perception, what effect, if any, does the use of smartphone apps have on patient/client weight loss? (n=2331)

Average Effectiveness Level[a]					
With Dietitian Feedback	Without Dietitian Feedback	Difference	t	df	p
3.33	2.53	0.80	44.48	2330	.000

[a]1 = Little or No Effect; 2 = Somewhat Effective; 3 = Moderately Effective; 4 = Very Effective; 5 = Extremely Effective

Data regarding the likelihood that dietitians would recommend smartphone apps to patients/clients if peer reviewed studies showed improved outcomes is listed in Table 16. Almost 80% of dietitians reported that they would be either more likely or far more likely to recommend smartphone apps if peer reviewed studies showed improved outcomes. An extremely small minority of 0.3% reported they would be less likely or far less likely to recommend if peer reviewed studies showed improved outcomes.

Table 16: Likelihood that dietitians would recommend smartphone apps to patients/clients if peer reviewed studies showed improved outcomes (n= 2469)

Likelihood to Recommend Smartphone Apps	Total (n)	% of Total
Far more likely	601	24.3
More likely	1328	53.8
Equally as likely as not	533	21.6
Less likely	2	0.1
Far less likely	5	0.2

Chapter 5: Discussion

To the researchers' best knowledge, this was the first study that was conducted to evaluate weight management dietitians' perceptions and the use of smartphone weight loss apps. The results of this study are difficult to evaluate because this is the first study of its kind. Dietitians and smartphones have not yet been evaluated and researched together.

Dietitians' Outpatient Weight Management Practice

Dietitians' outpatient weight management practice is primarily adults between 18 and 40 years old. Most dietitians do provide feedback to their patients/clients regarding their patient's/client's self-monitoring of food logs. While dietitians do report that they provide feedback, the actual percentage of patients/clients that they provide feedback to widely varies. Dietitians also reported that the majority of their patients/clients own a smartphone, which supports current smartphone ownership trends.[13]

Dietitians' Recommendations of Smartphone Apps

Overwhelmingly, the majority of weight management dietitians were found to recommend smartphone weight loss apps to their patients/clients for weight management. While weight management dietitians promote the use of smartphone weight loss apps, the majority of dietitians also recommend paper food logging, which may demonstrate that dietitians are recommending the best tool for patients based on patient needs. This supports the previous research done by Shay and colleagues[9] and Wharton and colleagues[21], which demonstrated that weight loss is achievable by both smartphone apps and/or paper food logs.

While dietitians are recommending both paper food diaries and smartphones apps as methods of self-monitoring, this study found that dietitians' perceive that smartphone apps result in greater weight loss than paper food logs. Dietitians' may have perceived this due to optimism

that their recommendations to use smartphone apps in conjunction with their recommendations for weight loss are successful or, possibly, as Tang and colleagues[15] found, smartphone apps along with standard weight loss programs (e.g., dietitians) promote effective weight loss. While this study did not look at individual cases of patient/client weight loss like the study by Baligalupo and colleagues[14], this study does show that dietitians perceive that weight loss is effective with smartphone apps as Baligalupo and colleagues also found.

Dietitians recommended several different smartphone apps for weight loss. The most recommended smartphone app by dietitians is MyFitnessPal®. Other highly recommend apps are LoseIt!®, Choosemyplate.gov, and Spark People®. While these smartphone apps were the most frequently recommended, many dietitians reported that they would recommend any smartphone app that a patient/client is familiar with, has used before, or is willing to start using.

Dietitians also reported that the top attributes and barriers to recommending smartphone apps for weight loss were ownership of a smartphone, patient/client readiness to change, and age of the patient/client. Dietitians reported that the attributes to recommend smartphone apps for weight loss mirrored barriers to recommend, except they perceived patient/client time as a greater attribute over socioeconomic status. Gender and race were perceived as insignificant for both barriers and attributes.

Demographics and Dietitians' Recommendations for Smartphone Apps

Contrary to popular belief that dietitians provide weight loss counseling to patients/clients in an outpatient setting, this research found that dietitians are providing counseling in a wide variety of settings. While the outpatient clinic remains the most common setting, dietitians are also providing weight loss counseling within hospitals, private practice, corporate worksite wellness, government agencies, fitness centers, and insurance companies.

Other settings also include grocery stores, research sites, universities, and online coaching. Almost two-thirds of dietitians indicated that they practice in multiple settings and/or chose multiple responses to best describe the setting in which they work (64.3%).

There were no significant differences found between gender, highest level of education completed, and total years practicing as a dietitian when evaluating if dietitians recommended smartphone apps for weight loss. Age was found to be a significant factor for dietitians recommending smartphones apps, with dietitians aged 35 to 44 years old recommending smartphone apps for weight loss most frequently. Interestingly, dietitians under 25 years old recommended smartphone apps the least frequently among all age groups.

Geographical region also was found to be a significant factor for dietitians recommending smartphone apps for weight loss. Dietitians with a current practice setting in the midwest and northeast regions recommended smartphone apps for weight loss most frequently. Dietitians with a current practice setting in the west and south regions recommended smartphone apps for weight loss less frequently but still at a high rate.

No significant differences were found by gender or dietitian age when evaluating dietitians' comfort level recommending smartphone apps for weight loss. The number of years a dietitian has been practicing was found to be significantly associated with comfort level recommending smartphone apps for weight loss. Dietitians who have been practicing between 11 to 15 years reported being the highest comfort level when recommending smartphone apps for weight loss.

Geographical region was also significantly associated with dietitians' comfort level to recommend smartphone apps for weight loss. Dietitians in the midwest region reported the highest comfort level when recommending smartphone apps for weight loss compared to

dietitians in the south who reported the lowest majority of a comfort level in recommending smartphone apps for weight loss. Overall, dietitians report high levels of comfort when recommending smartphone apps for weight loss.

While many dietitians recommend smartphone apps for weight loss and feel comfortable doing so, current coordinated dietetics programs do not include competencies or mandated training in technology. The field of dietetics is always changing and needs to keep up with technology and technology based programs that may aid the dietitian in promoting positive behavior change and lead to weight loss. While it is likely that graduates from dietetic programs today are familiar with smartphones, if technology education is not mandated within coordinated dietetics programs, dietitian graduates may not be familiar with technology that is available within their field of practice.

Adherence and Weight Loss

This study shows that dietitians' perceive that adherence with smartphone apps is significantly greater with dietitian feedback than without dietitian feedback. Dietitian perception on patient/client adherence to tracking food intake using smartphone apps found "good" adherence compared to "fair" adherence without dietitian feedback. These results are significant in that previous research shows increased adherence to self-monitoring is associated with greater weight loss,[7,8,10,16,22] which the results of this study mirror. If dietitians can motivate and counsel patients while promoting self-monitoring through smartphone apps, adherence may be greater and lead to more weight loss than is shown in current research with PDA devices where increased adherence led to increased weight loss.[10,12]

This study did not define adherence, only asking if dietitians perceived adherence to be greater with dietitian feedback. The actual level of food logging required to lead to the increased

adherence needed to have greater weight loss is still not known. That said, this study supports the conclusion that dietitians perceive diet monitoring with smartphone apps leads to increased adherence and, therefore, increased weight loss.

This study also shows that dietitians perceive that weight loss with smartphone apps is significantly greater with dietitian feedback than without dietitian feedback. Dietitians perceive that weight loss using smartphone apps for patient/client weight loss is very effective with dietitian feedback compared to only moderately effective without dietitian feedback. This result may further support the apparent link between increased adherence and increased weight loss.

Research by Burke and colleagues[7], found that the use of a PDA devices with daily automated feedback was effective for weight loss. The daily feedback was not personalized to the subject. Their study did not investigate the effects of personalized dietitian feedback on weight loss. Dietitians' perceptions outlined in this study may suggest the importance of direct personalized feedback in relationship to both adherence and, ultimately, weight loss. Further research is needed to determine how dietitian feedback may affect adherence and weight loss compared to automated feedback.

In summary, this research shows that dietitians perceive adherence to the use of smartphone weight loss apps is greater with dietitian feedback than without dietitian feedback. Dietitians also perceive weight loss with the use of smartphone weight loss apps to be greater with dietitian feedback than without dietitian feedback.

Dietitian Feedback Within the App

A small minority of dietitians provide feedback to patients within an app itself. Most dietitians provide feedback on an as needed/PRN basis. Unfortunately, the majority of dietitians are not utilizing features within smartphone apps that allow the dietitian and the patient/client to

connect through the app, send messages, and review food logs. Dietitians who do use these features find that the feedback within the apps results in increased adherence and increased weight loss. There are likely several reasons why dietitians are not using these features within the apps. Due to time constraints in a dietitian's day, time is often not blocked for a dietitian to review patient/client food logs within apps. This may make a dietitian less likely to connect with patients/clients via the app and provide feedback. Also, since the patient/client is not physically in front of the dietitian, they most likely cannot bill this time and not likely to be reimbursed for the time that they would be reviewing their food log within the app. While this study shows that dietitian feedback via the app would likely increase adherence and could lead to increased weight loss, most dietitians are limited to only providing patient/client feedback at follow-up appointments. Lastly, dietitians, especially at hospitals and outpatient clinics, are most certainly legally mandated to maintain privacy and confidentiality. This is per the protocols of many clinics and also per the mandates of the Health Insurance Portability and Accountability Act (HIPAA). Since most smartphone weight loss apps do not appear to be designed with these specific privacy requirements in mind, there may be concern that the patient's/client's privacy could be compromised. These concerns may be addressed by the creators of weight management apps as the demands of patients/clients, as well as dietitians, become more apparent and the technology supporting the apps continues to advance. These limitations are some of the possible reasons why dietitians may not provide feedback within smartphone apps, which may limit potential benefits to patients/clients and their weight loss.

Smartphone apps are an effective tool for communication with patients/clients and dietitians. Increasing patient/client adherence to self-monitoring though smartphone apps is

believed to increase patient/client weight loss. The findings of this research support the use of

smartphone app technology in conjunction with dietitian intervention and counseling.

Chapter 6: Conclusions

Conclusions

This survey produced extremely useful, applicable, and valuable results. Dietitians are overwhelmingly recommending smartphone apps to patients/clients for weight management. Dietitians from the midwest and northeast regions recommend smartphone apps for weight loss most frequently and feel the most comfortable doing so. Dietitians perceive that patients/clients are more adherent to smartphone weight loss apps with dietitian feedback than without dietitian feedback. Dietitians also perceive that weight loss with the use of smartphone weight loss apps is greater with dietitian feedback than without dietitian feedback. Most dietitians are not providing feedback to patients/clients within the smartphone apps themselves, but those dietitians who are providing feedback within the app typically provide feedback to patients/clients on a PRN/as needed basis. In conclusion, the data showed that dietitians perceive smartphone apps to be effective for weight loss management by increasing adherence to smartphone apps.

Application to Practice

The results from this study support smartphone apps as an effective tool for dietitians to use with their weight management patients/clients. If dietitians can motivate and counsel patients/clients while using smartphone apps as a self-monitoring tool, adherence may be increased and in turn lead to increased amounts of weight loss. Dietitians can effectively communicate with their patients/clients through the smartphone apps themselves, but they need to consider time constraints, billing limitations, and patient/client confidentiality.

Study Limitations

The results from this study are based on dietitian perceptions and may not actually reflect a dietitian's current practice. While a dietitian may believe their strategies for weight

management are effective, the reality may be that the patient/client data does not support this. This study was not able to evaluate actual patient weight loss data within smartphones, so randomized control trials are still needed to determine if dietitians perceptions of smartphone app use with dietitian intervention leads to increased adherence and weight loss. Answers to this study were dependent on dietitians completing the survey screening questions honestly and accurately, as well as their responses reflecting those of the population of dietitians with at least six months experience and at least 25% of their practice involved with weight management.

Future Research

Further research is needed regarding smartphone apps and increased adherence with dietitian intervention. Randomized controlled trials should be conducted with patients/clients using smartphone apps for weight loss and split into two groups: a dietitian intervention group and control (no dietitian intervention and food logging on their own). Future research is also needed to determine if dietitian intervention through a smartphone app is a cost effective way for dietitians to connect with patients outside of a traditional counseling session leading to increased adherence and without a patient/client having to follow up as often. Lastly, research is needed to determine the necessary level or amount of adherence a patient/client must meet through a weight loss app to have the optimal amount of weight loss.

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APPENDIX

Appendix A: Commission on Dietetic Registration Use of Registered Dietitian Database Approval Letter

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RDN List for Research Project

Pearlie Johnson <PJohnson@eatright.org>   Thu, Feb 12, 2015 at 12:11 PM
To: Kate Abernathy <katemabernathy@gmail.com>

Hi Kate,

Your request has been received, reviewed and approved. The RDN list will be sent to you by end of day Monday, February 16, 2015.

Please let me know if you have any questions.

Pearlie Johnson-Freeman, MBA

Director, Credentialing Services

Commission on Dietetic Registration

the credentialing agency for the

Academy of Nutrition and Dietetics

120 South Riverside Plaza, Suite 2000

Chicago, IL 60606-6995

phone: 312-899-4839

fax: 312-899-4772

pjohnson@eatright.org

Appendix B: Recruitment E-mails to Dietitians

<u>Initial E-mail</u>

E-mail Subject: Invitation to participate in research related to smartphone weight loss apps

Dear Registered Dietitian,

You are invited to participate in an online survey as part of a graduate thesis project. This survey asks questions related to dietitian perceptions toward smartphone weight loss apps and impacts on patient/client adherence. The results of the study may benefit current and future dietitians as these results may provide support for connecting with patients/clients outside of a formal nutrition counseling session to maximize patient/client results until further randomized controlled trials can be conducted.

The survey is voluntary and you may withdraw at any time. The survey will be open to complete for two weeks and should take less than 15 minutes of your time. At the end of the survey you will have the opportunity to provide your e-mail address for a chance to win a $50 Amazon.com gift card.

Should you have any questions or concerns related to this survey or research project, please contact Kathleen Abernathy at kaberna1@emich.edu or my faculty advisor Dr. Rubina Haque at rhaque@emich.edu.

Please click on the link below to complete the survey. Please complete the survey by April 17, 2015.

https://www.surveymonkey.com/r/6RMLGZN

Thank you for your time and support.

Sincerely,

Kathleen Abernathy RD, LDN
Graduate Student, Eastern Michigan University
MS in Human Nutrition

Follow-up E-mail

E-mail Subject: Invitation to participate in research related to smartphone weight loss apps

Dear Registered Dietitian,

Last week you received an e-mail to participate in an online survey as part of a graduate thesis project. If you have already taken the survey, thank you for your participation. If you have yet to participate, there is still time.

This survey asks questions related to dietitian perceptions toward smartphone weight loss apps and impacts on patient/ client adherence. The results of the study may benefit current and future dietitians as these results may provide support for connecting with patients/clients outside of a formal nutrition counseling session to maximize patient/client results until further randomized controlled trials can be conducted.

The survey is voluntary and you may withdraw at any time. The will be open to complete for <u>one more week</u> and should take less than 15 minutes of your time. At the end of the survey you will have the opportunity to provide your e-mail address for a chance to win a $50 Amazon.com gift card.

Should you have any questions or concerns related to this survey or research project, please contact Kathleen Abernathy at kaberna1@emich.edu or my faculty advisor Dr. Rubina Haque at rhaque@emich.edu.

Please click on the link below to complete the survey. Please complete the survey by April 15, 2015.

https://www.surveymonkey.com/r/6RMLGZN

Thank you for your time and support.

Sincerely,

Kathleen Abernathy RD, LDN
Graduate Student, Eastern Michigan University
MS in Human Nutrition

Appendix C: Informed Consent

INFORMED CONSENT TO PARTICIPATE IN RESEARCH SURVEY

Title: Patient Adherence to Smartphone Weight Loss Apps: A Dietitian Perception Study

Kathleen Abernathy RD, LDN– Principal Researcher
Rubina Haque PhD, RD, Professor of Human Nutrition and Dietetics – Co-Investigator

Purpose of Research:
The purpose of this study is to determine dietitian perception on whether dietitian involvement with the use of smartphone weight loss apps result in increased patient/client adherence and increased weight loss. Participation in this study will involve completing an online survey through SurveyMonkey®.

Participation:
Completing this survey is voluntary. The survey should take 15 minutes or less to complete. The survey will be open for two weeks. You may choose not to participate and you may opt out at any time during the survey without penalty. There is no cost or compensation for participation.

Benefits and Risks:
There is no direct benefit to you from participating in this research. The results of the study may benefit current and future dietitians as these results may provide support for connecting with patients/clients outside of a formal nutrition counseling session to maximize results until further randomized controlled trials can be conducted. There is minimal risk to participate, including loss of confidentiality and the release of potential information about your practice.

Confidentiality:
All answers and information provided during the survey will be confidential and anonymous. The results of the survey may be presented at research meetings or conferences, in scientific publications and as part of a master's thesis being conducted by the principal investigator. All data presented will be in group format with no identifiers to any participant.

Survey Completion:
At the completion of the survey you will have the opportunity to provide your e-mail address for a chance to win a $50 Amazon.com gift card. The e-mail address that you provide will not be linked to your survey responses.

Additional Questions or Concerns:
Should you have any questions or concerns related to this survey or research project, please contact Kathleen Abernathy at kaberna1@emich.edu or faculty advisor Dr. Rubina Haque at rhaque@emich.edu.

This research protocol has been reviewed and approved by Eastern Michigan University's Human Subject's Review committee on March 18, 2015. For questions about your rights as a

research subject, you can contact the Eastern Michigan University Office of Research Compliance at human.subjects@emich.edu or by phone at 734-487-3090.

I have read the above information regarding this research survey, including the possible risks and benefits to me. By agreeing to participate I acknowledge that I have had a chance to ask any questions regarding this study and that they have been answered for me. I understand that this survey is voluntary and that I may withdraw from the study at any time.

_____ Agree   _____Disagree

Appendix D: Survey Questions

Pre-Survey Screening

*Are you a Registered Dietitian who has been practicing for at least six (6) months?

○ Yes

○ No

*Does your current practice involve outpatient weight management?

○ Yes

○ No

*What percentage of your practice involves outpatient weight management?

○ Under 25%

○ 25- 49%

○ 50-74%

○ 75% or more

Part 1: Dietitian Demographics

Instructions: Please answer the following multiple choice questions as accurately as possible in regards to your own current practice.

1. What is your gender?

○ Female

○ Male

2. What is the highest level of education you have completed?

○ Bachelor's Degree   ○ Master's Degree   ○ Doctorate Degree

3. What is your age?

○ Under 25   ○ 45 to 54

○ 25 to 34   ○ 55 to 64

○ 35 to 44   ○ 65 or older

4. Total years that you have been practicing as a dietitian

[▾]

5. In what state is your primary practice located?

[▾]

6. Please select your current practice setting (check all that apply)

- [ ] Hospital
- [ ] Outpatient Clinic
- [ ] Fitness Center
- [ ] Government Agency
- [ ] Other (please specify)

[   ]

- [ ] Private Practice
- [ ] Corporate/Worksite Wellness
- [ ] Insurance Company

7. Do you personally or professionally own a smartphone?

- ( ) Yes
- ( ) No

8. How comfortable do you feel using smartphone weight loss applications (apps)?

Extremely Comfortable	Comfortable	Neutral	Uncomfortable	Extremely Uncomfortable
( )	( )	( )	( )	( )

Part 2: Dietitian's Outpatient Weight Management Practice

9. What is the age of your weight management patients/clients? (Check all that apply)

- [ ] Less than 18
- [ ] 18-40
- [ ] 41-65
- [ ] Over 65

10. What methods of self-monitoring (food log) completion do you recommend? (Check all that apply)

- [ ] Paper Journal
- [ ] Websites or Spreadsheets
- [ ] Smartphone Apps
- [ ] Other (please specify)

[   ]

- [ ] Photo
- [ ] I don't recommend self-monitoring

11. Do you provide feedback to your weight management patients/clients regarding their food logs?

- ( ) Yes
- ( ) No

12. What is the percentage of your weight management patients/clients that you monitor through food logs as follow up (ie- office visit, e-mail, smartphone apps, website)?

1-25%	26-50%	51-75%	76-100%	I don't monitor
( )	( )	( )	( )	( )

Part 3: Smartphone Weight Management Patient/Client Recommendations

13. What is the percentage of your weight management patients/clients who have smartphones?

○ 1-25%   ○ 26-50%   ○ 51-75%   ○ 76-100%   ○ I don't know

*14. Do you recommend smartphone weight loss apps to your weight management patients/clients?

○ Yes

○ No

Part 3: Smartphone Weight Management Patient/Client Recommendations (contin...

What weight management smartphone apps do you recommend? (Check all that apply)

☐ Lose It!   ☐ Choosemyplate.gov Super Tracker

☐ MyFitnessPal Calorie Counter and Diet Tracker   ☐ Livestrong My Plate Calorie Tracker

☐ Spark People Calorie Counter and Weight Loss   ☐ Fooducate Healthy Weight Loss, Food Scanner and Diet Tracker

☐ MyNetDiary Calorie Counter and Diet Tracker   ☐ Fat Secret Calorie Counter

☐ Other (please specify)

Part 3: Smartphone Weight Management Patient/Client Recommendations (contin...

15. How comfortable do you feel recommending smartphone apps for weight loss?

Extremely Comfortable	Comfortable	Neutral	Uncomfortable	Extremely Uncomfortable
○	○	○	○	○

16. What weight management patient/client attributes make you more likely to recommend smartphone apps for weight loss? (Check all that apply)

☐ Age

☐ Race

☐ Gender

☐ Socioeconomic status

☐ Patient/Client profession

☐ Other (please specify)

☐ Patient/Client ownership/ usage of smartphone

☐ Patient/Client availability of time

☐ Patient/Client readiness to change

☐ None

17. What are perceived barriers to you recommending smartphone apps for weight loss? (Check all that apply)

☐ Age

☐ Race

☐ Gender

☐ Socioeconomic status

☐ Patient/Client profession

☐ Other (please specify)

☐ Patient/Client ownership/ usage of smartphone

☐ Patient/Client availability of time

☐ Patient/Client readiness to change

☐ None

✱18. Do you provide dietitian feedback to your weight management patients/clients through smartphone weight loss apps (via messages within the app)?

○ Yes

○ No

Part 3: Smartphone Weight Management Patient/Client Recommendations (contin...

How often do you typically provide dietitian feedback to your weight management patients/clients through smartphone apps?

- ○ Daily
- ○ Several times per week
- ○ Twice per week
- ○ Weekly
- ○ Other (please specify)

- ○ Twice per month
- ○ Monthly
- ○ PRN/ As needed

With smartphone apps, to what extent:

	To a very large extent	To a large extent	To a moderate extent	To a small extent	To a very small extent	Not sure
does providing feedback increase adherence to food logging?	○	○	○	○	○	○
does your feedback lead to increased weight loss?	○	○	○	○	○	○

In terms of weight loss, how do smartphone apps compare to paper food logs?

- ○ Smartphone apps result in a much greater weight loss
- ○ Smartphone apps result in a slightly greater weight loss
- ○ No difference in weight loss
- ○ Paper logs result in a slightly greater weight loss
- ○ Paper logs result in a much greater weight loss
- ○ Not sure

Part 4: Perception of Adherence and Weight Loss

Please answer the next questions based on your own perception related to weight management patients/clients.

19. In your perception, how adherent are patients/clients to tracking food intake using smartphone apps?

	Very Good	Good	Fair	Poor	Very poor	Not sure
WITH dietitian feedback	○	○	○	○	○	○
WITHOUT dietitian feedback	○	○	○	○	○	○

20. In your perception, what effect, if any, does the use of smartphone apps have on patient/client weight loss?

	Extremely effective	Very effective	Moderately effective	Somewheat effective	Little or No effect
WITH dietitian feedback	○	○	○	○	○
WITHOUT dietitian feedback	○	○	○	○	○

21. If peer reviewed studies showed improved outcomes in patient/client weight loss when smartphone app usage was coupled with dietitian feedback, how would that affect your likelihood to recommend smartphone apps to patients/clients?

Far more likely	More likely	Equally as likely as not	Less likely	Far less likely
○	○	○	○	○

Thank you for your participation.

If you would like to be entered into the drawing for a chance to win a $50 Amazon.com gift card, please provide your email address below. By entering your email address your answers to this survey will in no way be linked to your identity and your answers will remain anonymous.

If you are not interested in the gift card, please leave the box blank and select "Next".

Thank You!

If you have any comments or questions regarding this research please contact kaberna1@emich.edu

Thank you for your help!
Kathleen Abernathy RD, LDN
Eastern Michigan University Graduate Student

Appendix E: Exempt Status Approval Letter

RESEARCH @ EMU

UHSRC Determination: **EXEMPT**

DATE: **March 30, 2015**

TO: **Kathleen Abernathy**
Eastern Michigan University

Re: **UHSRC: # 724389-2**
Category: Exempt category 2
Approval Date: March 30, 2015

Title: **Patient Adherence to Smartphone Weight Loss Applications: A Dietitian Perception Study**

Your amendment request for research project, entitled **Patient Adherence to Smartphone Weight Loss Applications: A Dietitian Perception Study,** has been determined to maintain an **Exempt** status in accordance with federal regulation 45 CFR 46.102. UHSRC policy states that you, as the Principal Investigator, are responsible for protecting the rights and welfare of your research subjects and conducting your research as described in your protocol.

Renewals: Exempt protocols do not need to be renewed. When the project is completed, please submit the **Human Subjects Study Completion Form** (access through IRBNet on the UHSRC website).

Modifications: You may make minor changes (e.g., study staff changes, sample size changes, contact information changes, etc.) without submitting for review. However, if you plan to make changes that alter study design or any study instruments, you must submit a **Human Subjects Approval Request Form** and obtain approval prior to implementation. The form is available through IRBNet on the UHSRC website.

Problems: All major deviations from the reviewed protocol, unanticipated problems, adverse events, subject complaints, or other problems that may increase the risk to human subjects **or** change the category of review must be reported to the UHSRC via an **Event Report** form, available through IRBNet on the UHSRC website

Follow-up: If your Exempt project is not completed and closed after **three years**, the UHSRC office will contact you regarding the status of the project.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-3090 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,

April Nelson
University Human Subjects Review Committee

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Generated on IRBNet

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