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Use of Smartphone Application to Facilitate Weight Loss and Promote Accountability in Obese and Overweight Patients

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USE OF SMARTPHONE APPLICATION TO FACILITATE WEIGHT LOSS AND PROMOTE ACCOUNTABILITY IN OBESE AND OVERWEIGHT PATIENTS

by

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DEDICATION

I DEDICATE MY DISSERTATION WORK TO MY FAMILY AND FRIENDS WHO SACRIFICED SO MUCH TO SEE ME ACCOMPLISH MY DNP DEGREE AND COMPLETE MY EBP PROJECT. A SPECIAL THANKS TO MY HUSBAND AND 5 CHILDREN. IT WAS THEIR CONTINUED SUPPORT AND ENCOURAGEMENT THAT KEPT ME STRONG THROUGHOUT THE PROCESS. INDEBTEDNESS GOES TO MY BEST FRIEND AND SISTER THERESA FOR BEING THERE FOR ME THROUGHOUT MY LIFE, INCLUDING MY EDUCATIONAL JOURNEY. FOR THAT I HAVE A SPECIAL FEELING OF GRATITUDE WHOSE WORDS OF ENCOURAGEMENT AND PUSH FOR PERSISTENCE RING IN MY EARS. YOU HAVE BEEN MY GREATEST CHEERLEADER

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ABSTRACT

In 2015, the U.S. Department of Health and Human Services published a National Health and Nutrition Survey (NHANES) on obesity from 2011 through 2014. From the survey, it was determined that the prevalence of obesity in the U.S. was 36% in adults and 17% in young adults/children (Ogden et al., 2015). Lifestyle modifications including moderation of caloric intake and increased exercise have been shown to be effective for both prevention and treatment of obesity. The purpose of this evidence-based practice (EBP) project involved the design, administration, and evaluation of a technology-assisted weight loss intervention to address the health problem of obesity. This 12-week weight loss intervention utilized a smartphone anthropometric tracking application, MyFitnessPal®, and text message reminders to obtain the real time tracking of dietary and fitness data. The use of convenient mobile technology enabled data to be self-reported in real time and reinforced responsible behaviors that lead to caloric intake awareness, increased weight loss, and lower BMI in participants. The Health Belief Model (HBM) formed the theoretical framework and guided the behavioral changes necessary to achieve the desired weight loss. A sample was drawn from a family practice (N = 66), 34 participants were recruited for the intervention period and a random sample of 33 participants were selected from electronic charts for comparison from the previous year. One participant was lost to attrition in the intervention group (final n = 33) and the non-intervention group (final n = 33). Participant baseline data included weight, BMI, and self-reported activity. Intervention effectiveness was assessed by comparing baseline to post intervention data. Paired t-test analysis demonstrated significant weight loss from pre-intervention (M = 2.03, SD = 3.54) to post-intervention (M = 9.97, SD = 6.24) (t (32) = -6.46, p < .05). Independent t-test demonstrated significant weight loss in the intervention group (M = 9.97, SD = 6.24) compared to the non-intervention group (M = 5.3333, SD = 4.61) (t (2) = 3.433, p < .001). A one-way ANOVA compared self-reported monthly login entries for caloric intake over 3 months and demonstrated a significant gradual decrease in login entries (F (1,2) = 2.55, p < .05). A one-way ANOVA compared self-reported monthly physical activity; 1st month (M = 1.18, SD = .39), 2nd month (M = 1.24, SD = .44), and 3rd month (M = 1.424, SD = .50). There was a significant increase in self-reported physical activity over the 3-months (F (1, 31) = 5.568, p < .05). Paired t-test analysis demonstrated significant BMI reduction from pre-intervention (M = 42.83, SD = 11.77) to post intervention (M = 41.22, SD = 11.54) (t (32) = 9.47, p <.001). Technology-assisted weight

loss interventions utilizing low-cost smartphone applications hold promise because it crosses socioeconomic and geographical barriers when treating overweight or obese patients.

CHAPTER 1

INTRODUCTION

Background

In the United States, many Americans are overweight, and obesity continues to be a common, costly, and preventable public health concern. In 1997, the World Health Organization (WHO) formally recognized obesity as a global epidemic (Caballero, 2007). According to the National Institute of Medicine (IOM), overweight and obesity are major public health concerns in the United States. Research shows a direct link between obesity and many common diseases such as diabetes, heart disease, and cancer. As a result, overweight and obese patients experience significantly higher mortality compared to non-obese individuals (IOM, 2016). The high prevalence of overweight and obese individuals in the American population is attributed to limited engagement in the behaviors that are necessary to manage caloric intake and balance that intake with regular physical activity. The common treatment for obesity involves monitoring caloric intake, dieting, exercise, and frequent monitoring combined with regular health assessments by health care professionals. In addition, the treatment requires discipline, motivation, and constant self-monitoring by patients to achieve meaningful and lasting weight loss that leads to better treatment outcomes and a healthier lifestyle.

In the last decade, smartphones have become a key part of daily life for many Americans. Rapid technological advances in cellular communications have led to the emergence of smartphones that are able to combine traditional voice and text messaging functions of cell phones with advanced computing technology that can support third-party applications, internet access, and wireless connectivity with many other devices (Sharp & Allman-Farinelli, 2014). The popularity of smartphones combined with recent technological innovation and advances in smartphone applications have led to new capabilities in the form of inexpensive anthropometric tracking applications which are offered in both Apple® and Android® formats. In 2015, research by the Pew Research Center indicated that smartphone use had skyrocketed, and consumer downloads of health-related applications were at an all-time high (Perrin, A., 2015). Due to their popularity, these applications have gained substantial attention, within both research and industry, as a potential avenue to deliver or address the limitations of methods used in traditional weight loss programs (Coons et al., 2012). Anthropometric fitness applications are inexpensive and can be easily tailored to a specific type of exercise, health related problem, or medical condition allowing the user to set personalized dietary and fitness goals, self-monitor progress, and access specific information on treatment and care of specific comorbidities. Recent research supports the use of smartphone applications by saying “The technological capabilities of a smartphone may address certain limitations of a traditional weight loss program, while also reducing the cost and burden on participants, interventionists, and health care providers” (Pellegrini et al., 2015, p.1). Specifically, an intervention delivered by smartphone applications can be part of a low-cost strategy, both on clinical and public levels, in the delivery of behavioral weight loss programs.

Statement of the Problem

According to the IOM, overweight and obesity are major public health concerns in the United States (2016). The high prevalence of overweight and obese individuals in the American population is attributed to limited engagement in the personal behaviors that are necessary to manage caloric intake and balance that intake with regular physical activity. As a result, common treatment requires behavioral weight loss programs that monitor caloric intake, dieting, exercise, and frequent weight monitoring combined with regular health assessments by health care professionals. This type of treatment has long been used as the standard treatment for obesity, and on average, results in initial weight loss of 8-10% of body weight over 4-6-month period (Butryn et al., 2011). However, these programs require expensive multiple in-person visits with trained interventionists, healthcare professionals, and providers that may or may not result in a lasting healthier lifestyle and permanent weight loss. Moreover, the associated high cost can limit the program’s availability and fail to appeal as a realistic treatment to many lower income patients. As a result, less intensive alternative intervention methods of delivery are needed to reduce costs and increase appeal across the entire patient population.

Data from the Literature Supporting Need for the Project

Smartphones are upgradable communication devices that provide voice and text communication, internet, and storage of photos and other customized data. Actual numbers can demonstrate the public demand for cell phones and the consumer’s growing dependence on smartphone applications. In 2015, the Pew Research Center concluded that worldwide smartphone use was continuing to rise each year (Poushter, 2018). Specifically, their data indicated that in the United States, 77% of adults owned a smartphone in 2017, and that was an increase from 56% in 2013 (Poushter, 2018). In addition, the same report determined smartphone ownership in the United States was the highest among Hispanic and African-Americans, and these two groups make up the largest segment of the population affected by obesity. This is convincing evidence that most Americans already possess a smartphone device that can be used as a platform to deliver a low-cost intervention for many health-related problems. Supporting this hypothesis, in 2015, researchers completed a review of 193 sources and concluded “Smartphone apps are likely to be useful and low-cost for improving diet and nutrition and addressing obesity in the general population” (Coughlin et al., 2015, p.2).

Data from the Clinical Agency Supporting Need for the Project

The clinical site was a family medicine practice with a focus in bariatric medicine. The physician on site recognized the challenges and impact obesity can have on managing many comorbidities. Therefore, the provider was currently in the process of obtaining certification with the American Board of Obesity Medicine. The clinical site typically treats some adolescent and mainly adults for general medical, bariatric, preventive, and primary health care needs. The physician and owner of the clinical site provided information on the approximate annual census of around 3,500 patients and is a multifaceted family practice that serves a diverse patient population in northwest Indiana. Although the office has been designated as family practice, over one-third of the patient population is more reflective of a bariatric specialty: approximately 75% of the patients seen are adults with more than 25% on Medicare for chronic health conditions. Patients using Medicare, Medicaid, and Indiana health care insurance account for many of the office visits. The patient mix of the practice is reflective of the ethnic diversity of the region. The physician's treating philosophy encompasses whole body approach to medicine and managing comorbidities. As an example, 30% or more of the patients are currently being treated for unwanted weight gain and or lifelong obesity. As a result, many of the patients being treated for comorbidities that have been complicated by their current body mass index (BMI) conditions such as diabetes. Obesity and diabetes have become such a growing portion of the patient load; the practice has added a registered dietician to the staff to assist patients in nutrition services to aid in prevention and obesity management while transitioning to a healthier lifestyle.

Purpose of the Evidence-Based Practice Project

The purpose of this EBP project was to evaluate the effectiveness of using a diet/nutrition anthropometric application, combined with text messaging reminders as a 12-week weight loss intervention in obese or overweight individuals using data collected from one of the most widely used weight loss smartphone applications.

Compelling Clinical Question

What is the effectiveness of a smartphone application combined with text messaging reminders as a 12-week intervention designed to incite behavioral changes that promote caloric intake awareness, lower BMI, and weight loss compared to non-intervention of the same? In addition, did this project increase the dietary compliance and monitoring of weight loss and support for obese patients attempting to lose weight and achieve a healthier lifestyle?

PICOT Question

In obese patients (BMI of 30/higher) or overweight patients (BMI of 25/higher) (P) what is the effectiveness of a smartphone application combined with text messaging reminders (I) compared to non-intervention of the same (C) designed to incite behavioral changes that promote caloric intake awareness, lower BMI, and weight loss (O), as a 12-week intervention (T)?

Significance of the EBP Project

This type of behavioral intervention is unique. It utilized modern technology and the growing American cultural influence of smartphones to transcend many of the normal cultural, environmental, and psychosocial barriers generally reported by providers trying to influence behaviors such as eating patterns, and exercise in obese patients. The main goal of this project was to provide evidence-based research demonstrating the effectiveness of a low-cost intervention modification using technology that can be used by both clinical and public level healthcare providers in the delivery of behavioral weight loss programs. In addition, the project demonstrated the advantages of using of a multi-format smartphone application (app) like

"MyFitnessPal®" to initiate self-monitoring behavior that increases awareness caloric intake, enhance self-efficacy, and track individual progress over time.

CHAPTER 2

THEORETICAL FRAMEWORK, EBP MODEL, AND REVIEW OF LITERATURE

This chapter gives a synopsis of the theoretical framework and EBP model guiding this project to include its applicability, strengths and weaknesses. This section also gives an overview of the synthesis and appraisal of literature, the hierarchy levels used, and the best practice recommendation and how it can answer the clinical question.

Theoretical Framework

Several theory-based behavioral modification strategies could be used to promote behavioral changes required to lose weight and adhere to a healthier lifestyle. However, the Health Belief Model (HBM) is used as the theoretical framework to guide this EBP project. This model guided the combination of health education and specific interventions that are designed to promote a change that leads to a healthier lifestyle. The original (HBM) as introduced by Rosenstock (1966) was developed in the 1950s but was later updated in the 1980s. The earlier assumptions consisted of two components of health-related behavior within the theory: first, the desire to evade illness, or equally find a remedy if already ill, and second, the confidence or belief that a specific health action will avoid the illness or treat it (Rosenstock et al., 1988).

The Health Belief Model (HBM) is a psychological model that could be applied to this EBP project because the model is based on an individual's course of action and the individual’s perceived benefits and or barriers associated with making healthy decisions. Specifically, Rosenstock, Strecher, and Becker (1988) described focusing on attitudes and beliefs of individuals to explain or predict an individual’s behavior. Six concepts form the HBM; the first four are the original concepts of the HBM from the 1950’s. The other two concepts were added as the theory began to evolve in the 1980’s. The first concept is perceived susceptibility which refers to the individual's perceived risk of acquiring the actual illness/disease. An individual's perception of acquiring an illness or managing a disease may vary from person to person. The second concept is perceived severity. This assumption referred to the individual's understanding on the significance of contracting the illness/disease or consequences of forgoing treatment. Similarly, there is varied understanding of severity, including medical consequences to include death. The third concept is perceived benefits. This concept described an individual's awareness of various prevention or treatment modalities available for a perceived threat. The fourth concept is perceived barriers. The concept discussed the individual's feelings on perceived obstacles regarding the recommended health action. In this assumption, there is thought to be a variation in emotions related to the cost/benefit analysis. The individual weighed the pros and cons against the effectiveness of recommended health action. The fifth concept is the cue to action, and entailed the incentive or catalyst needed for the decision-making process to further accept an endorsed health action. For instance, these cues can be an internal beckoning (e.g. shortness of breath, chest pain, intractable pain, etc.) or external influence (e.g. guidance from others, friend or family member with an illness/disease or witnessed event, etc.). The sixth concept is self-efficacy. The self-efficacy concept discussed an individual's aptitude to achieve a specific behavior. Ultimately, many individuals that are overweight or obese pursued the journey of weight loss only after a medical related scare occurred.

Overview of Theoretical Framework

The Health Belief Model (HBM) was chosen because it took a realistic approach to changing behavior by combining education and interventions. It was developed to help healthcare professionals understand why people don't take preventive health measures (Daddario, 2007). Because it will not be enough for the health care professional to try and change the unhealthy behavior, the participants must understand what is at stake and want to change their behavior. In this situation, the primary motivation to change was the participant's perceived threat or risk of obesity, and the primary resource for any change was self-efficacy or the confidence to lose weight and maintain a healthier lifestyle.

The theory drove the primary motivation for change by educating the participants on the threat or risk of obesity, and the primary resource for any change was self-efficacy or the patient's confidence to lose weight and maintain a healthier lifestyle (Daddario, 2007). Thus, the intent of the intervention for the participants to realize the positive benefits to health and well-being. These benefits aren't only in the present, but benefits could last a lifetime.

Within the arena of preventative health programming, studies have shown the importance of maintaining healthy lifestyle habits (Deckelbaum et al., 1999). To accomplish this, it was crucial to reshape and change the daily culture of an individual. To create change, there must be a good reason that outweighs the trouble and turbulence associated with giving up old habits (Acharya et al., 2009). The benefits created by preventative wellness changes provided enough incentive to drive the healthier behavior and actions. This model was favored by healthcare professionals because it addressed multiple unhealthy behaviors and gave the emphasis on change to a person's self-management actions. (Daddario, 2007).

The model relied on several key concepts that tend to shape a person's behavior (Daddario, 2007). The first factor was severity; a person tended to change his or her behavior when he or she understood the severity of the consequences of the unhealthy behavior. The second concept was benefit; a person reacted much quicker creating changes in behavior when he or she understood the benefits linked to changed behaviors such as healthier eating habits. The third concept was barriers; many people found it difficult to switch to healthier behavior such as change in daily eating habits. Hesitation to change might have been due to time, money, or the amount of effort required to change these daily behaviors (Daddario, 2007).

Application of Theoretical Framework to EBP Project

The HBM was used to educate patients by identifying, defining, and prescribing specific behavioral changes needed for patients to experience lasting weight loss. The first step in the model was setting realistic individual goals for weight loss, fitness, and specific changes needed in activities such as eating habits. Participants identified realistic weight loss goals that could be reached in the 12 weeks of the project, followed by educating the participants on the dangers they may face by not adopting an exercise routine and comprehensive weight loss plan. As a result, the seriousness of obesity and the associated illnesses motivated participants to make personal changes in their daily routines. Next, the model approached weight loss and exercise in a positive way, effectively reducing stress by focusing on goals and stressing positive results of exercising reported by the participants. The last step in applying the model was to recognize and work to overcome the challenges or barriers that were preventing participants from losing weight and keeping it off.

Strengths and Limitations of Theoretical Framework for EBP Project

A key strength of the HBM was used to form the basis for many practical interventions across a range of behaviors. The literature supported the model successfully applied increasing voluntary mammogram and Pap smear screening as well as yearly health maintenance bloodwork and weigh-ins. In addition, it lacked strict rules that govern which variables could be combined which gave it enormous flexibility and adaptability (Orji et al., 2012).

A weakness of the HBM was that it was developed in the 1950's and it only focused on the individual and does not take the environmental effects into account. The environmental factors were not addressed with the HBM because some factors tended to be out of an individual's control. For example, if a person couldn't afford healthy eating because organic food costs more than eating fast food from the dollar menu. Specifically, weight could have been better maintained or controlled if people have better sources of healthy calories. Therefore, this was an environmental factor that was beyond the person's control or fault if he/she could not solve his/ her own health problems. The current four variables of susceptibility, severity, benefit, and barrier may be too simple to predict some behavior therefore the model was incomplete (Orji et al., 2012). Researchers proposed adding additional variables rooted in social value or environmental in nature, to help predict why people fail to undertake preventative health measures.

Evidence-based Practice Model

Overview of the EBP Model

The definition of "evidence-based practice (EBP) is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient." (Moore, 2017, p.1). It means integrating individual clinical expertise with the best available external clinical evidence from systematic research (Sackett et al., 1996). The evidence was then used to guide practice decisions to implement the process change while supporting optimal patient outcomes.

The Stetler Model was first developed in 1976 and later revised in 1994, 2001 (Stetler, 2001). The model focuses on using evidence to support best practice. Most recently, the model's latest version consists five phases of evidence while clarifying information and decisions for each phase (Stetler, 2001). The Stetler model has outlined assumptions (National Collaborating Centre for Methods and Tools, 2011). The organization did not necessarily have to be involved in an individual's usage of research or evidence. Another assumption identified was the usage might be contributory, abstract and/or strategic. The evidence identified and utilized was not solely research connected evidence and likely integrated with research conclusions to facilitate and guide decision making. Internal and external factors influenced or affected an individual's or group's perception and usage of evidence. As a result, the evaluation of research/evidence offered information without guaranteed resolutions.

This model is comprised of five phases. Phase I was the preparation phase. Preparation phase encompassed the task of identifying the existing policy needing revision and clarification was given to the probable implication of internal factors (e.g. individual prejudice or objections) and external or environmental factors (e.g. institutional mission, policies, stakeholder politics) that could generate limitations and adjustments to the preparation phase (Stetler, 2001). Phase II entailed validation, which required the project leader to appraise the evidence and validate its quality. This phase allowed for examination of the research to identify if the desired results were established in the outcome of the process (Stetler, 2001).

Phase III involved the comparative evaluation and decision-making process. As a result, it required the project leader to appraise the strengths and weaknesses of the evidence and determined there was enough evidence to support the proposed practice/policy changes. In addition, the project leader determined the viability and feasibility of making the changes permanent. If these components were not analyzed before moving forward in the decision-making phase, delays in later phases could have been the result to use, not use, or consider use of the evidence. (Stetler, 2001).

Phase IV necessitated the translation and application of the evidence. In this segment the project leader determined by what method the evidence could be implemented. This phase was identified by Stetler, as the “how-to’s” of implementing a planned change (Stetler, 2001).

In phase V the project leader dealt with evaluation of the outcomes. In this last phase of the model, formal and informal processes at the institutional and individual level determined the overall degree of the practice change. In this phase, based on the depth and complexity of the proposed practice change, the researcher determined a pilot study was not applicable to evaluate the institutions acceptance.

Application of EBP Model to EBP Project

The application of Phase I included the project leader identifying overweight or obese individuals seen in the clinic daily that were unaware of how weight was affecting their health. Phase II allowed the project leader to guide the participants in setting personal weight loss goals to achieve desired results. Phase III entailed previously identified participants by the project leader that used the smartphone application. The smartphone application is often free with the basic download, which could have been upgraded based on the participants’ wishes but was not required for use. The application viability and feasibility were accessed at each appointment by the medical assistant, nurse and provider upon initial and subsequent appointments. Phase IV Translation/Application, at this time education was provided to the patient on the smartphone application by the project leader, physician or clinical staff nurse. Phase V, after 12-weeks the project leader evaluated the participation and adherence to the intervention. The data were analyzed to include the participant’s initial weight and BMI in comparison to current BMI and weight to determine weight loss data. These data determined sustainability and recommendation of smartphone applications for future use.

Strengths and Limitations of EBP Project

The strengths in using the Stetler model allowed the researcher to evaluate the overall benefits and risks of using the evidence in a practice setting. It focused on defining what data should be used and how it can be implemented efficiently to practice. The model outlines five phases to easily determine the purpose, focus, and potential outcomes before making an evidence-based change a certainty.

The weaknesses identified in the use of the Stetler model included the variance in perceptions and support from the institution in the findings of the evidence. The five phases could be cumbersome and created time constraints, as it was imperative to follow the steps to ensure the implementation was feasible.

Literature Search

Sources Examined for Relevant Evidence

A search for sources related to this EBP project was conducted within the electronic databases: Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane Library, Johana Briggs Institute, Medline with full text via EBSCO, ProQuest Nursing, and Allied Health Literature. Data mining of the related evidence was conducted and appraised to expand the search for sources more closely related to weight loss.

In each database, key words identified from the PICOT question were used for the relevancy. Many variances were trialed to yield suitable evidence related to the project. In combination of key words, mesh terms, Boolean phrases, the use of AND to combine keywords and phrases, OR inside parentheses, truncation, date limiters were all used to yield the best evidence. Each of the following text-words and terms were used to retrieve the best evidence within the identified databases: *continuity*; *obesity therapy, overweight therapy, weight loss, smartphone applications or apps* (see Table 2.1).

The best evidence results yielded 1,060 sources that identified a smartphone application related to either weight loss or increased physical activity. After sifting through the abstracts, the project leader identified 40 relevant sources for further review. Not all 40 sources were based on quality research nor were level I evidence. For simplicity, sources kept for further analysis were either an RCT or systematic review. As a result, of the 40 sources, nine sources of high-quality evidence were kept by the project leader based on the relevancy of the data identified for the evidence-based project. The strongest evidence possible was sought to support this EBP project. Thus, the remaining nine sources were selected for this project and included four systematic reviews and five randomized controlled trials (see Table 2.1).

The inclusion criteria used among the databases included studies conducted in English language between May 2013 and June 2018. The search was limited to scholarly reviewed journals, systematic reviews, and RCTs. The reasons for exclusion included (a) the source focused on a factor other than weight loss, such as smoking cessation; (b) the source focused on a disease process rather than prevention; or (c) the source did not use smartphone technology to deliver intervention. CINAHL database yielded 53 sources varying in relevancy and quality related to the EBP project. Three sources were duplicates already identified in other databases. Eleven sources were examined in further detail for inclusion criteria. In the end, two sources were retained and included one systemic review and one randomized control trial. The Cochrane Library yielded 268 sources with no relevancy found to the EBP. Therefore, the project leader chose to eliminate evidence from this database. Medline with full text via EBSCO yielded 69 sources with two duplicates from previous databases. ProQuest Nursing and Allied Health

Literature database yielded 156 results with four duplicates from various databases. This database yielded no salvageable evidence due to the replication of evidence. The project leader found three relevant sources hand selected from reference lists of previous selected sources that used technology-based applications to aide in weight loss. Many sources within this database identified the use of smartphone applications or technology for successful weight loss. However, to limit the overwhelming amount of evidence, it was determined to examine the highest levels of evidence by examining six systematic reviews and five randomized control trials in further detail for relevancy to the EBP project. After careful consideration on the remaining 11 sources, two were not selected due to relevancy of intervention used for the EBP. It was then determined to keep the remaining nine sources of relevant evidence that were selected as the strongest evidence closely related to the EBP project.

Table 2.1
Literature Search Results

Database	Keyword(s)	Limiters	Date Restraints	Results	Relevance/Saved
CINHAL	(obese* OR overweight OR "weight loss" OR "weight reduction" AND "mobile app* OR " mobile phone apps* OR "smartphone app*)	English Peer Reviewed	May 2013- June 2018	53	1 (1 RCT)
Cochrane Library	(obese* OR overweight OR "weight loss" OR "weight reduction") AND ("mobile app* OR " mobile phone apps* OR "smartphone app*)	English Peer Reviewed	May 2013- June 2018	268	0
Data mining		English Peer Reviewed	May 2013- June 2018	3	3 (2 RCT's, 1 Systematic Review)
Johana Briggs Institute	(obese* OR overweight OR "weight loss" OR "weight reduction") AND ("mobile app* OR " mobile phone apps* OR "smartphone app*)	English Peer Reviewed	May 2013- June 2018	50	0
Medline with Full text via EBSCO	(obese* OR overweight OR "weight loss" OR "weight reduction") AND ("mobile app* OR " mobile phone apps* OR "smartphone app*)	English Peer Reviewed	May 2013- June 2018	69	5 (2 Systematic Reviews, 1 Meta-Analysis of RCT's, 1 systematic Review and Meta-Analysis, 1 RCT)
ProQuest Nursing and Allied Health Database	(obese* OR overweight OR "weight loss" OR "weight reduction") AND ("mobile app* OR " mobile phone apps* OR "smartphone app*)	English Peer Reviewed	May 2013- June 2018	156	0 (4 sources were duplicates 2 in Medline and 2 in CINAHL

Levels of Evidence

There is a large diversity in accepted rating and grading schemes utilized to evaluate evidence in research. However, in 2002, according to the Agency for Healthcare Research and Quality (AHRQ) all accepted rating systems essentially identify three main essential elements required to grade the strength and relevance of evidence. The first element was quality, determined by how the potential impact of bias was minimalized. The second element was quantity, determined by magnitude of effect, number of studies, and sample size. The third, element was consistency, determined by extent at which similar findings are reported using similar and different study designs (AHRQ, 2002).

The critical appraisal of evidence was a fundamental but very important step when ensuring research was based on valid, reliable, and applicable evidence in order to improve practice or support changes in patient care. A critical appraisal of evidence started by ranking the sources of evidence using a hierarchy scale to determine the quality or strength of the evidence. The sources of evidence for this EBP project were evaluated and categorized using the “Hierarchy of Evidence for Intervention/Treatment Questions” also known as the “Pyramid of Evidence” (Melnyke & Fineout-Overholt, 2011; Russel, 2012).

For this EBP project, a total of nine sources were selected and ranked using the Pyramid of Evidence rating scale. The higher the evidence is in the hierarchy, the stronger the evidence and more reliable it is. There are seven essential levels to the Pyramid of Evidence. (Melnyk & Fineout-Overholt, 2011). The highest level of evidence starts at the top of the pyramid as level I and moved down in sequence to level VII or weakest level of evidence at the bottom. Level I consisted of sources of evidence such as systematic reviews and meta-analysis of randomized controlled trials. These sources were considered the best to guide practice. Level II was the next highest level and included evidence obtained from well-designed randomized controlled trials. Level III contained evidence obtained from well-designed nonrandomized controlled trials. Level IV included evidence from case-control or Cohort studies. Level V is reserved for evidence from systematic reviews or descriptive and/or qualitative studies. Level VI contained sources of evidence from a single descriptive or qualitative study. Level VII contained evidence from authoritative opinions and/or reports containing expert opinion or guidelines by AAP guidelines (Melnyk & Fineout-Overholt, 2011; Russel, 2012). Thus, the Pyramid of Evidence was a standardized tool that used a hierarchy scale to assign a level of quality or strength to evidence. Overall, this standardized method for leveling evidence lent clarity to the evidence evaluation process when evaluating evidence to support this research topic or PICOT question.

Appraisal of Relevant Evidence

Validity was essential in determining if the selected evidence was applicable. Evidence-based practice required a critical appraisal of the evidence to ensure the selected research was valid, determined the importance of the results, and if the results of the evidence was useful (http://www.casp-uk.net/checklists). The Critical Appraisal Skills Programme (CASP) tool is effective at evaluating various types of selected research including but not limited to randomized controlled trials (RCT), systematic reviews, qualitative, case control, and cohort studies (CASP, 2017). The CASP tool was selected to critically appraise the selected research for this project. Using the CASP checklist allowed the project leader to quickly appraise the best evidence and/or innovative ideas by assessing for relevance to the subject of clinical change. Once the appraisal was identified the selected research was valid, the second step of the critical appraisal process involved the assigning of an appraisal rating. The appraisal rating was based on the quality of each study, while establishing transparency, and identifying potential points of bias. However, the CASP tool did not include a rating scale for each individual type of study being appraised. Rather, those were determined by the project leader conducting the appraisal. For this EBP project, the appraisal ranking was identified by high, medium, and low for the quality or strength of evidence. A source with high evidence was given statistical analysis data related to the amount of weight lost, to show research effectiveness, sufficient weight loss and minimal attrition rates. Medium quality evidence had statistical data analysis with some weight loss and a higher attrition rate. The low-quality evidence had bias (e.g. selection bias), lack of follow through with the researchers, high attrition rate or no evidence of weight loss. The project leader determined, high or medium quality of evidence if the source indicated weight loss was achieved, minimal attrition rate and the statistical analysis data was available. The sources that were given a low-quality score was determined if no statistical analysis data was given, bias was conducted, high attrition rate of more than half the participants or no evidence of weight loss was indicated.

Bias can influence a study's conclusions and can occur at any time in the research process including study design or planning, implementation, data collection, analysis, and publication phases of research. Bias was defined as any tendency which prevents unprejudiced consideration of a question (Pannucci, 2010). In this EBP project, every effort was taken to minimize bias including a proper study design and data analysis is used to assist the project leader in guarding against any potential source of bias.

Level I Evidence

A systematic review by Tang et al. (2014) evaluated the efficacy evidence and design features of other published reviews to examine the effectiveness of self-directed interventions and how they promoted weight loss and encouraged weight maintenance. This systematic review examined 20 reviews (16 systematic reviews, 4 RCTs) focused on self-directed interventions such as interactive websites, smartphone applications, and text messaging. Tang et al. (2014) concluded that current evidence supports self-directed interventions such as smartphone applications and text messages as effective interventions that can independently promote weight loss. However, this review was awarded a medium appraisal using the CASP tool checklist because the review did not examine which behavioral change technique, context, or delivery methods were the most effective and associated with weight loss.

Liu et al. (2015) completed a systematic review and pooled meta-analysis. The purpose was to examine the use of mobile phone technology in the form of text messaging reminders as a weight loss intervention strategy among overweight and obese adults. Data from 14 randomized controlled trials with more than 1,300 participants, documented a significant decrease (1.4 kg) in body weight and .24 units decrease in body mass index (BMI). The findings indicated a mobile-phone intervention using message reminders about healthy eating and exercise could be an important strategy for promoting weight loss. The appraisal score on this research was high due to the meta-analysis providing important quantitative evidence of benefits of mobile-phone interventions in body weight and BMI reduction. In addition, interventions utilizing mobile phone technology has demonstrated to be convenient while facilitating a higher compliance in participants already using mobile phones (Liu et al., 2015). The combination of evidence of high compliance by participants when using mobile phones and strong quantitative evidence associated with weight loss supported the need for this EBP project.

Levine et al. (2014) completed a systematic review entitled “Technology-Assisted Weight Loss Interventions in Primary Care”. This review of available literature examined technology-assisted interventions provided in the primary care setting in 16 trials ranging moderate to excellent in quality with durations lasting 3-36 months. Technology-assisted

Interventions were defined as web-based applications, clinician-guided software, mobile-phone applications, and text messages. All interventions utilized evidence-based elements to promote behavioral change such as self-monitoring by self-reported daily dietary and physical fitness activity by technology assisted means (85%) of the time. Bias was monitored and kept to a minimum using Delphi and EPOC criteria where blinding of the provider, patient, or outcome assessor was noted. Findings indicated technology-assisted interventions possess many key elements such as self-monitoring, in-person feedback, targeted and structured life-style coaching which are already proven to be crucial in many types of other interventions. Overall, results suggest interventions using clinician-guided software with trained personnel may be more likely to promote weight loss. In this review, 85% of the studies using technology-assisted interventions demonstrated significant weight loss. Statistical outcomes were given using useful information and sensitivities. The appraisal score given to this systematic review was medium level I evidence. This systematic review highlighted texting as an under-represented technology in literature that was consistently popular despite continuous technological advances and recommended it as a component in future studies. This recommendation was important as texting reminders will be a component in the intervention design of this project.

Aguiler-Martinez et al. (2014) completed a systematic review of the available weight loss literature. The purpose of the review examined the use of applications, text messaging, and or web-based programs on mobile phones as the main component of an intervention strategy for weight-loss in multiple countries. Participants were geographically and culturally diverse from European, Asian, and North American regions. This systematic review selected 10 sources from the available research that described studies that lasted between 2-4 months and one study had a max duration of one year. Most (8/10) of the reviewed studies indicated successful weight loss, lower BMI, waist circumference, and body fat from numerous studies utilizing mobile phone applications. Strength of this systematic review was the participants were geographically and culturally diverse. Yet, the findings noted several key elements that seemed to transcend cultural and geographic boundaries and were universally important to be successful when using mobile applications as part of an intervention strategy to treat obesity. First, there was a strong proportional relationship between weight loss and phone application or program use. Applications seem to encourage self-monitoring of food intake, activity, and weight. This self-reporting activity empowers and encourages greater responsibility by participants for their own health. Second, participants benefitted the most when they took a proactive approach to problems. Third, the regular self-reporting of weight coupled with personalized counseling and feedback was important to participants and their success. Results showed that mobile phone applications or programs were welcomed by participants, well-accepted, and associated with almost immediate loss in weight. No publication bias was noted, and the appraisal score given to this systematic review was medium level I evidence.

A systematic review and meta-analysis by Mateo et al. (2015) of available literature using studies that utilized mobile phone applications and text messaging type interventions for weight loss and increase physical activity. A total of 12 published sources were selected from several different databases and utilized funnel plots in the meta-analysis to avoid publication bias. This systematic review and meta-analysis produced results demonstrating interventions based on mobile phone applications are more likely to result in more weight loss than other types of interventions. Moreover, the results of the meta-analysis indicated a significant increase in participant’s physical activity. However, several key issues were noted in the analysis. Most of the studies failed to conceal the blinding of participants and research personnel. This leaves room for their expectations to influence the data thus weakening the evidence. For this reason, the appraisal score given to this systematic review was low level I evidence.

Level II Evidence

Gordino et al. (2016) conducted a 2-year randomized controlled trial on theory-based weight loss intervention using social media, mobile phone applications, text messaging, electronic mail, website, and technology-mediated communication with a health coach that targeted young adults in the college setting. This study favored social support, accountability, and creating healthy social norms around weight-related behaviors using the participants existing social networks. Key strengths of the study were determined to be a large ethnically diverse sample of 404 young adults. A key finding was the effectiveness of targeting the interests expressed by young adults in social media and their regular use of mobile phone applications by completing the 2-year study with a very high 84% retention rate. Results indicated moderate short-term weight loss (-5%) and reduction in waist circumference for the first six months and overall weight loss and BMI reduction lasted for at least one year. However, the study did not yield long term weight loss by participants. Concern for contamination became an issue when it was learned in the exit interview that 30% of the control group were friends with one or more participants in the intervention group and were able to view intervention comments posted on social media. This may have diluted the intervention effects and weakened the evidence. For this reason, the appraisal score was medium.

A randomized controlled trial by Carter et al. (2013) was selected from the available literature. The purpose of this study was to demonstrate the acceptability and feasibility of a self-monitoring weight management intervention using three separate intervention delivery methods of smartphone application, website, and paper diary over a six-month duration. This application included goal setting, self-monitoring of diet and physical activity, and solicited feedback via weekly text messages. Results indicated the use of a smartphone application to be acceptable and feasible. Adherence to the trial was greater in the smartphone application group 93% (40/43) than in the website 55% (19/42) or paper diary 53% (20/43) groups mirroring rating results that showed high satisfaction and acceptability scores to the smartphone application. However, contamination of evidence was noted by one participant who was randomly assigned to the paper diary group downloaded an application to the personal phone and used it for the duration of the trial. It is possible this gave that participant insight into other weight loss information that he or she would not have had with just the paper diary. For this reason, appraisal score was lowered to medium.

A randomized controlled trial by Stephens et al. (2017) was selected from the available literature. The purpose of this study was to test the effectiveness of a behaviorally-based smartphone application for weight loss combined with text messaging to promote weight loss in young adults. The intervention used a smartphone application to self-monitoring weight loss combined with text messages and personal coaching. Results provided evidence in support of a strategy combining the use of smartphone application, text messages, and a health coach to assist young adults in college to lose weight, lower BMI and reduce their waist circumference. This study included 62 participants and used a strong randomized design. Limitations included small sample size (62) and short study duration (3 months). Appraisal score on this research was awarded as medium level I evidence due to the limitations mentioned. This study does provide important quantitative evidence of the benefits of combining smartphone applications, text messages or reminders, and personal health coaching to form a successful strategy as an intervention for young people to lose weight and combat obesity. This strategy seems to be much more effective than using text messaging reminders, smartphone application or coaching would be as a stand-alone intervention.

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Aguilar-Martínez et al. (2014)	Obese or overweight adults >18 The mean body mass index (BMI) varied from 22-36kg/m2 Studies lasted 2–4 months and the maximum duration was 1 year There were 19–534 weight loss participants per study	Systematic Review Mobile-phone applications or web-based programs were used as an intervention for weight loss	The evidence shows BMI values in the intervention groups decreased by 0.6kg/m2 14 and 0.78kg/m2 The evidence shows waist circumference values in the intervention groups decreased by 6.3cm and 2.3cm Attrition rates were not listed, no additional statistical data were given	Level I	Medium Mobile phone interventions were welcomed and well accepted by participants

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Carter et al. (2013)	128 overweight participants were randomized for selection (email, internet, newsletters and posters) Recruitment for 3 months between March-May 2011	Randomized Controlled Trial Mobile-phone applications used as an intervention for weight loss	Weight change at 6 months was -4.6 kg 95% CIs [–6.2, –3.0] in the smartphone app group, BMI change at 6 months was –1.6 kg/m2 95% CIs [–2.2, –1.1] in the smartphone group, change in body fat was 1.3% 95% CIs [–1.7, 0.8] in the smartphone group	Level I	High Demonstrated smartphones were a cost-effective intervention delivery device

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Godino et al., (2016)	202 obese/overweight college students in the non-control group 202 obese/overweight students in the control group Overweight/obese students from 3 college campuses Adults aged 18-35 years, body mass index (BMI) ≥25 and ≤34·9 kg/m2	Randomized Controlled Trial	Weight loss participants' mean (standard deviation (SD) body mass index (BMI) was 29·0 (2.8) kg/m2. Reassessed BMI at 24 months, −1·33 kg, 95% CIs [−2·36, −0·30], *p* = 0·011 and 12 months −1·33 kg, 95% CIs [−2·30, −0·35], *p* = 0·008 Study results in 18 months −0·67 kg, 95% CIs [−1·69, 0·35] *p* = 0·200 Study results in 24 months −0·79 kg, 95% CIs [−2·02, 0·43] *p* = 0·204 were not significant	Level I	Medium The lack of long-term engagement with Mobile technologies No sustained weight loss

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Laing et al., (2014)	Two primary care clinics in California 212 primary care patients with body mass index ≥ 25 kg/m2 6 months of primary care without application (*n* = 107) MyFitnessPal® app onto the patient's smartphone (*n* = 105) `	Randomized Controlled Trial Mobile-phone applications were used as an intervention for weight loss	There was no significant difference between the intervention and control groups in weight change (mean between group difference, −0.67 lb. 95% CIs [−3.3, 2.1;] *p* = 0.63 or in SBP (mean between group difference, −1.7 mmHg CIs [−7.1, 3.8]; *p* = 0.55 The intervention group showed an increase in the use of personal calorie goal compared to the control group (mean between group difference, 2.0 days per week CIs [1.1, 2.9]; *p* < .001, The other self-reported behaviors did not show a difference between the groups	Level I	Medium 32% of intervention group was lost at 6-months; 19% of control group lost at 6 months

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Levine et al., (2014)	6,786 weight loss participants From 16 RCTs Trial duration was 3-36 months 10 studies reported results after at least 1 year of follow-up with attrition rates ranges from 6 to 80%	Systematic Review	Weight loss ranged from 0.08 kg to 5.4 kg (0.8% - 5.8% of baseline) Percentage of participants losing at least 5% of baseline weight ranged from 5% to 45%	Level I	Medium 32% of intervention group was lost at 6-months; 19% of control group lost at 6 months
Liu et al., (2015)	1,337 weight loss participants Weight loss participants ages ranged from 40-49 years Interventions lasted between 1-6 months	Meta-Analysis of Randomized Controlled Trials Mobile-phone applications were used as an intervention for weight loss	Significant changes in body weight and body mass index (weight (kg)/height (m)2) of −1.44 kg 95% CIs [−2.12 −0.76], [−0.40, −0.08] Body weight changes were −0.92 kg 95% CIs [−1.58, −0.25] and −1.85 kg 95% CIs [−2.99, −0.71] in trials of shorter (<6 months) and longer (≥6 months) duration	Level I	High Mobile phone intervention may be a beneficial tool for weight loss

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Mateo et al., (2015)	12 Systematic reviews and meta-analyses from 2010 -2015 900-1243 weight loss participants	Systematic Review and Meta-Analysis Mobile-phone applications were used as an intervention for weight loss	Smartphone application showed a significant decrease in body weight of 1.04 kg 95% CIs [-1.75, -0.34] compared with the control group with no intervention. A significant net difference in BMI between mobile phone app and control intervention groups (WMD -0.43 kg/m2, 95% CIs [-0.74, -0.13] Results showed a nonsignificant difference in physical activity *SMD* 0.40, 95% CIs [0.07, 0.87] Reduced body weight compared with various control interventions by 1.04 kg, reduced BMI by 0.43 kg/m2, and non-significantly increased physical activity by an *SMD*, 0.40	Level I	Medium Study shows that mobile application interventions may be useful tools for weight loss Studies failed to conceal blinding’s

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Stephens et al., (2017)	62 overweight young adults, aged 18-25 years, randomized to receive a smartphone application, a health coach intervention and counseling sessions or control condition with a counseling session Outcomes were assessed at baseline and 3 months	Randomized controlled trial Mobile-phone applications were used as an intervention for weight loss	The group that used the smartphone application and a health coach lost significantly more weight (p=0.026) and had a significant reduction in BMI (p=0.024) and waist circumference (p<0.01) compared to controls The study results support the use of Smartphone technology and feedback from a health coach on improving weight loss	Level I	High Intervention improved self-efficacy behavior in exercise and diet

Table 2.2
Levels of Evidence

Authors	Population/Duration	Design/ Intervention(s)	Results/Findings	LOA	Appraisal
Tang et al., (2014)	418 overweight or obese participants aged 30-62 years with intervention durations of 6-12 months Publications between 2006-2012	Systematic Review of Reviews	The evidence proposes that self-directed interventions can independently promote weight loss and can supplement personal contact Weight loss ranged from 0.8-7.8kg across several relevant studies	Level I	High Intervention improved self-efficacy behavior in exercise and diet

Synthesis of Critically Appraised Literature

The appraised literature discusses traditional weight loss programs and several inherent limitations encountered by health care providers. Participants in traditional weight loss programs exposed to nutritional, dietary, and fitness based plans often experience weight regain after the initial weight loss has occurred (Aguilar-Martinez et al., 2014; Carter et al., 2013; Godino et al., 2016; Laing et al, 2014; Levine et al., 2014; Liu et al., 2015; Mateo et al., 2015; Stephens et al., 2017; Tang et al., 2014). Aguilar-Martinez et al. (2014) points out the difficulty in changing weight-control behaviors seems to be the main cause behind weight regain. For any behavioral intervention or weight loss plan to be successful long-term, the basic idea must be liked and accepted by the participating patients. Aguilar-Martinez et al. (2014) found that studies showed mobile phone interventions were generally welcomed, well-accepted, and were linked to an almost immediate weight loss.

The synthesis of the reviewed literature for this EBP indicates strong evidence in support of single or stand-alone weight loss interventions that combines technological-assisted elements with traditional nutritional, dietary, and fitness driven component (Aguilar-Martinez et al., 2014; Levine et al., 2014; Liu et al., 2015; Stephens et al., 2017; Tang et al., 2014). These strategies are more effective when combined as compared to a single multi-layered strategy to combat obesity, and they generate successful behaviors that support a healthier lifestyle (Aguilar-Martinez et al., 2014; Levine et al., 2014; Liu et al., 2015; Stephens et al., 2017; Tang et al., 2014). In addition, technology-assisted interventions can address known barriers to providing care and direction to patients by demonstrating cost savings, convenience of use, quicker feedback, and better self-monitoring capability than traditional methods (Aguilar-Martinez et al., 2014; Levine et al., 2014; Liu et al., 2015; Stephens et al., 2017; Tang et al., 2014).

Evidence supports a technology-assisted approach to interventions that cross social, ethnic, and economic barriers by appealing to a wide audience in the population (Levine et al., 2014; Stephens et al., 2017). A sound strategy to lose weight and conform to a healthier lifestyle requires fundamental behavior changes that are sustained over an extended period. These behavioral changes included but were not limited to improved accountability, goal setting, and adherence to an improved quality diet, increased physical activity, restricted caloric intake, and using technology to improve self-monitoring (Liu et al., 2015).

Accountability

The difficulty in changing weight-control behaviors is the main cause of obesity and weight regain (Aguilar-Martine et al., 2014). A fundamental behavioral change must occur in a person's daily behavior. Logic dictates that a person taking a more responsible approach to one's **o**wn health would increase self-regulating behavior through self-monitoring activities (Brawlet et al., 2003). This included self-regulating behavior such as goal setting, feedback with health care professionals, planning and tracking of healthier dietary intake, weighing and recording daily weight, and making time for and planning physical activities (Tang et al., 2014). In addition, the portability of cell phones made it easier to utilize smartphone applications to plan and record the daily caloric intake of each meal in real time. Caloric intake recorded in real-time increased the possibility that information is accurate, not forgotten, and was a good example of technology encouraging self-regulating behavior and accountability (Aguilar-Martinez et al., 2014; Levine et al., 2014; Liu et al., 2015; Stephens et al., 2017; Tang et al., 2014).

Increased Physical Activity

Mobile phone applications encouraged self-monitoring behavior by prompting the user to input physical activity performed, tracking caloric expenditure by activity, and calories needed to burn to lose weight. Obesity resulted from taking in too many calories and burning too few. The most easily modified factor contributing to overweight was the amount of activity people do each day. Evidence showed smartphone applications combined with text reminders motivated someone to plan and track increased physical activity to lose weight over a longer period than traditional weight loss initiatives (Aguilar-Martinez et al., 2014; Levine et al., 2014; Liu et al., 2015; Stephens et al., 2017; Tang et al., 2014).

Lower Body Mass Index

Studies have shown smartphone applications combined with text messages produced results for participants by losing significantly more weight, having a significant reduction in BMI, and significantly decreasing waist size circumference (Stephens et al., 2017). Liu et al. (2015) identified significant reductions in body weight and BMI of 1.44kg and 0.24 units, respectively due to mobile phone intervention in comparison with the control group.

Utilization of Technology

Technology-assisted or Mobile interventions as part of an overall strategy to lose weight stimulated reductions in weight loss. Moreover, technology-assisted interventions cross social, ethnic, and economic barriers by appealing to a wide audience in the population (Levine et al., 2014; Stephens et al., 2017). Liu et al. (2015) concluded that mobile phone intervention was convenient for study participants, and the widespread use of and accessibility of mobile phones helped facilitate continued compliance after other interventions experience lag in participant compliance. In addition, Liu et al. (2015) findings supported incorporating the use of frequent message reminders utilizing mobile devices to remind participants about healthy eating habits and exercise to be a useful tool for achieving successful long-term weight management. Tang et al. (2014) concluded technology to be a big advantage in interventions by having the ability to tailor information, 24-hour availability, anonymity, online social support, and affordability of using smartphone applications.

Best Practice Model Recommendation

The best practice model recommendations were developed to reflect the synthesis of the selected literature. The use of smartphone applications combined with text messaging reminders was used to produce the most effective weight loss intervention. A free public smartphone application called MyFitnessPal®**.** Most smartphone applications are designed to work with either Android® or iPhone® devices. Most participants have either format on their personal cell phone and a publicly available "universal" application that operates with either format will be the best choice to work with their existing devices.

MyFitnessPal® was selected for the purpose of this EBP project. Specifically, MyFitnessPal® smartphone application allows the user to self-report and track diet and exercise data to determine the optimal caloric intake and nutrients for the application user. The smartphone application had the ability to set a personalized weight goal, and the proficiency to track the foods and beverage consumed. After the food or beverage items were selected within the application, it had the capability to attach a caloric count to each food or beverage item selected. The selected application also had the option to select a personalized physical activity to encourage increased levels of physical activity. MyFitnessPal® has a feature that gave the ability to set notifications for overlooked or missed records of meals, beverages or physical activity completed. The notifications were delivered to the phone in the form of a text message and could be tailored to fit the participant's needs. The combined actions in each application facilitated the weight loss process.

The project leader educated the staff physician, dietician, and clinical nurse on the smartphone application usage. This process ensured accurate teaching was provided to the participants. The participants were instructed to download the smartphone application and create an account within the application to personalize their weight loss goal based on body caloric intake needs and desired physical activity.

The participants were able to log and track their daily meals, including snacks and beverages. The application sent daily reminders formatted as text messages to the personal device if the participants failed to log in data for meals, snacks, beverages and physical activity. This accountability allowed for greater weight loss as the patient was more aware of their meal and activity choices. Participants were on a two-week or monthly follow-up schedule based on personal requests, motivational needs or monitored health necessities. As a result, at each follow-up appointment, the intervention was discussed with the project leader or clinical nursing staff to address any drawbacks and complications experienced by participants to reduce the likelihood of attrition. The smartphone application allowed the participants to track their personal weight loss journey for 12-weeks while being self-reliant and accountable throughout the process. Participants were called by the project leader at regular intervals for support, guidance and reminded participants to self-report progress.

How the Best Practice Model Will Answer the Clinical Question

This EBP project demonstrated a type of behavioral intervention that was unique because it utilized modern technology and the growing cultural influence of smartphones to transcend many of the normal environmental, cultural, and psychosocial barriers generally reported by healthcare providers when attempting to influence behaviors such as eating patterns, and exercise in overweight or obese patients.

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

Research utilization was defined as the use of research findings in clinical practice, often based on a single study (Melnyk & Fineout-Overholt, 2011). Overweight and Obesity were chronic conditions with behavioral origins that could be traced back to childhood. This project demonstrated a unique intervention using technology to bridge environmental, cultural, and psychological barriers experienced by healthcare professionals when treating patients for weight loss or obesity. In this chapter, the project methodologies used to guide the EBP change in clinical practice are discussed. These methodologies included the participants, setting, outcomes, design, measures, data analysis, and implementation of the practice change.

Participants and Setting

Setting

The clinical site is board certified in family and bariatric medicine and typically treats adolescents and adults for general medical, bariatric, preventive, and primary health care needs. The combination of treatments made this clinical site a multifaceted family practice with an approximate daily census of about 25-35 patients. The patient population was diverse, multicultural, and represents various socioeconomic backgrounds within the surrounding community.

Participants

The EBP project included 33 participants from the approved clinical site. Although the clinical site has a designation as a family practice, over one-third of the patient population was more reflective of a bariatric specialty. It was suggested that the clinical site has approximately 75% adults, with more than 45% Medicare recipients and having various chronic health conditions (personal communication, July 23, 2018). Patients using Medicare, Medicaid, and Indiana health care insurance account for many of the office visits. Moreover, the practice has a patient mix that is reflective of the ethnic diversity of the surrounding community and region.

The clinic's physician has a treating philosophy that encompasses a whole-body approach to medicine and managing patients' comorbidities. As an example, 30% or more of the patients were currently being treated for unwanted weight gain and or lifelong obesity. Poor health choices and inactive lifestyle have led to many patients being treated for comorbidities that have been complicated by their current body mass index (BMI). As an example, many of the patients were seen on a regular basis for obesity have diabetes. As a result, obesity and diabetes have become such a growing portion of the patient load; the practice has added a registered dietician to the staff to assist patients in nutrition services. Specifically, the dietician has a specific role to play in the prevention and management of obesity through dietary modifications or restrictions for patients that assisted in transitioning to a healthier lifestyle. For this EBP project, participants were required to attend a meeting with either the project leader, physician, and/or dietician as a follow-up visit to track BMI, weight change, and receive dietary guidance.

Inclusion Criteria

When conducting EBP, selection of the population is based on an accessible population, previous research, and the PICOT question (Farrugia et al., 2010). In order to ensure generalizability and validity of project results, participants represented the target population. Current patients were screened and offered the chance to participate in the project if they met the required criteria. The inclusion criteria used to identify the participants for this EBP project included:

- 18 – 65 years of age

- speak English
- be overweight or obese (BMI for overweight/obese greater than or equal to 25)
- agree to participate in the EBP project, clinical visits, and APN management,
- participate in downloading and use of selected mobile phone application,
- agree to receive mobile phone text alerts, and
- participate in clinical office visit for monitoring and follow up every two weeks.

Exclusion Criteria

To reduce the risk of bias, specific exclusionary criteria were used to ensure participants safety, generalizability of project findings, and uniform effect on all selected participants. The following exclusionary criteria was used for this EBP project:

- patients identified with diagnosed dementia, psychological disorder, or communication barriers due to potential difficulty in following protocols or understanding the instructions for the prescribed treatment;
- patients without access to a personal smartphone or smart device; and
- pregnant or expecting to become pregnant within two years.

The project leader ensured inclusion and exclusion criteria were assessed for each potential participant. In addition, each eligible participant received a written-informed consent prior to performing baseline measurements or starting the EBP project.

Outcomes

The selected outcomes of interest were consistent with the review of evidence and the supporting literature. Data collection took place bi-weekly or monthly at the scheduled follow-up visits during the 12-week intervention period. Weight loss data were collected and compared to the initial baseline measurements. The selected outcomes measured were the participants' changes in body weight, BMI or body fat percentage. Weight was objectively measured in pounds. Participant demographical information of age, gender, ethnicity, and race was self-reported at the beginning as baseline measurements were taken. The primary outcome (weight) was measured objectively in pounds using a calibrated digital clinical scale. BMI was measured as weight in kg divided by height in m^2. Participation was measured using log-in information, self-reported weekly progress reports, and attending bi-weekly or monthly follow-up appointments with the project leader, physician, nurse practitioner and or clinical dietician.

Intervention

The intervention was primarily delivered using two modalities:

- weight loss smartphone application with MyFitnessPal®, and
- receiving mobile phone text messaging or EBP project reminders.

Recommendations on obesity screening, diagnosis, and treatment from the U.S. Preventive Services Task Force (USPSTF) was endorsed by the American Academy of Family Physicians and used as a guide in the planning, design, and implementation of the EBP project practice changes (Moyer, 2012). The project leader identified participants for this EBP project by either a clinical report generated by EPIC or referral from the clinical physician. Once individuals were identified, the project leader approached each of the individuals to see if he or she had an interest in participating in a weight loss EBP project. The project leader provided 15 minutes of structured evidence-based education regarding the health risks associated with obesity and provided an opportunity for a brief question and answer session. Once agreeable, an informed consent from each interested participant was obtained prior to project participation. A detailed handout was provided to each participant, which included a brief introduction of the selected smartphone application MyFitnessPal® or MFP (see Appendix A). Each handout contained screen shots with instructions to assist each participant with initial log-in, set-up, profile creation, fitness activity preference, and weight loss goals. After download, the project leader assisted each participant with the creation of the personal profile and individualized weight loss goals.

At each follow-up visit, the project leader verified smartphone application use, fitness activity data, and caloric intake self-reported by participants. The project leader made phone calls to each missed follow-up visit, recorded missing participant data, and scheduled new visits as recommended by the provider.

This project demonstrated a unique intervention using technology to bridge environmental, cultural, and psychological barriers experienced by healthcare professionals when treating patients for weight loss or obesity. Phase I of the EBP project encompassed the following initial steps in the intervention:

- performed an initial risk assessment, check vital signs, and measured Body Mass Index (BMI);
- performed an evaluation of participant's current lifestyle, fitness interests, weight loss goals, and general health history;
- discussed obesity education and created an individualized weight loss plan to help the participant lose weight and improve their overall health;
- introduced the selected smartphone application MyFitnessPal®, explained tracking features, instructions on application use, daily caloric tracking, and created their individualized profile; and
- performed an InBody™ scan – this advanced test was performed and explained by the clinical dietitian. Results of each scan provided detailed results on initial body

composition with the muscle, fat, and water values of the participant. Test composition data included pounds of lean mass and fat values in each segment of the body. Results were used by the dietician to determine dietary modifications and physical activity that might affect their body in a more individualized weight loss plan.

The intervention strategy combined the portability and convenience of a smartphone type device with the interest of using application technology to encourage behavioral changes that can lead to a healthier lifestyle. At the initial appointment, participants received verbal directions on what to self-report including; how to track caloric intake, physical activity, and weight loss data over the duration of the 12-week project. The follow-up visits were scheduled every 2 weeks or monthly to ensure clinical physician oversite and weight loss verification by clinical personnel for the duration of the project.

Planning

The approval to implement this 12-week EBP project depended on demonstrating the quality and depth of the best practice evidence provided by the appraisal of available literature. After careful review, the best practice evidence supported a technology-based weight loss intervention strategy that capitalized on the convenience and popularity smartphones generate in today's society. The literature search provided compelling level I evidence that formed the foundation for the intervention strategy designed to combine the use of a smartphone application software and text massaging reminders that supported traditional self-reporting behaviors to form a multi-layered technology-based intervention for weight loss.

Data

Measures

In research, the ability to accurately measure success of an intervention is critical to establishing weight loss and obesity intervention methods. Furthermore, the accountability of apps used in interventions are fundamental, both for public use as well as use as weight management tools in clinical practice or for public health interventions designed to target obesity. The available literature listed weight loss, BMI, percentage of body fat, and fat mass as common relevant outcomes measured to determine weight loss success. BMI and weight are ubiquitous in weight loss studies (Franz et al., 2007). As a result, this EBP project objectively tracked changes in the participants' weight and BMI measurements in order to assess the intervention-related change. Initially, an InBody™ scan was completed by the clinical dietitian. Results of each scan provided detailed results on initial body composition with the muscle, fat, and water values of the participant. Test composition data included pounds of lean mass and fat values in each segment of the body. Results were used by the dietician to determine dietary modifications and physical activity that might affect their body in a more individualized weight loss plan. All participants were included in this primary analysis prior to intervention assignment.

The outcomes measured at baseline, follow-up weight, follow-up BMI, attrition, and average changes are presented in the project summary. The primary outcome (weight) was measured objectively using a digital scale. Height was measured objectively using a stadiometer that was calibrated by the physician daily. The medical assistant (MA) measured the participant's height and weight without shoes and wearing lightweight clothing only. Pre-intervention weight and BMI were identified as the participants' baseline measurements and were recorded.

Participants' body weight and BMI were objectively measured and recorded at each office visit for the duration of the 12-week EBP project. At each follow-up visit, the physician verified the participant's height and weight using a stadiometer and standing digital scale. Participant BMI was calculated automatically by the EMR once height and weight was verified and entered by the physician. The final body weight and BMI measurements were identified as follow-up measurements in the principle summary of the project. Changes in body weight and BMI attributed to the 12-week intervention EBP project were calculated as weight change from baseline to follow-up weight. In addition, any participants who chose to drop out of participating in the project was recorded as attrition in the final project summary.

Collection

All participant data were recorded on project flowsheets. One flowsheet contained four columns: one for an assigned participant number 1-33, one for DOB, one for dietician appointment date, and one for InBody™ scan completion date (see Appendix C). Another flow sheet contained six different columns to record bi-weekly weight loss data. Demographic information on age, sex, ethnicity, and race were self-reported at baseline. Pre and post-intervention measurements were objectively taken of each participant and recorded in the clinical setting.

Management and Analysis

When not in use, all project data were secured in a locked clinical room that required code pad access. Confidentiality was always observed on project documentation as each participant was identified by an assigned participant number and DOB.

Protection of Human Subjects

Prior to project implementation, this EBP project requested and received the customary project approval from the Institutional Review Board (IRB) at Valparaiso University. Careful attention was given to place safeguards on participant data recorded on project spreadsheets, notes, and other project documents. In addition, in order to protect patient information, weight and BMI data, follow-up flowsheets, and other miscellaneous project data was secured in a locked clinical room that required code pad access.

CHAPTER 4

FINDINGS

The purpose of this EBP project was to evaluate the effectiveness of using a diet/nutrition anthropometric application, combined with text messaging reminders as a 12-week weight loss intervention in obese or overweight individuals using data collected from one of the most widely used weight loss smartphone applications. The specific PICOT question for this project was: In obese patients (BMI of 30/higher) or overweight patients (BMI of 25/higher) (P) what is the effectiveness of a smartphone application combined with text messaging reminders (I) compared to non-intervention of the same (C) designed to incite behavioral changes that promote caloric intake awareness, lower BMI, and weight loss (O), as a 12-week intervention (T)? This chapter provides the results from this EBP project. To measure effectiveness, primary and secondary outcomes were analyzed using IBM Statistical Package software for Social Services (SPSS) V22 for statistical analysis. IBM describes the SPSS statistical software as the world's leading statistical software designed to solve complex research problems using hoc analysis, hypothesis testing, geospatial analysis and predictive analytics. Specifically, this software is often used in research to understand data, analyze trends in findings and validate assumptions that lead to accurate conclusions (Leech, et al., 2014). Data from this project was analyzed using the IBM SPSS software and the findings are discussed in this chapter.

Participants

Size and Characteristics

This EBP project was implemented in a family practice clinic with a subspecialty of weight loss during a 12-week intervention period. Participants were required to attend a meeting with either the project leader, physician, and/or dietician as a follow-up visit to track BMI, weight change, and receive dietary guidance every two weeks during the intervention.

Descriptive statistics were used to summarize the population data and measures from the chart audit participants. The descriptive statistics were used as a means to provide summaries of the data sets. A total of 34 participants were recruited for the intervention period and a random sample of 33 participants were selected from electronic chart/EHR for comparison from the previous year. One participant was lost to attrition in the intervention group (final $n = 33$) and the non-intervention group (final $n = 33$). The majority of the participants who received the intervention were female (69.7%), Caucasian or Hispanic (33.3% each), and single (44.1%) (see Table 1). Ages ranged from 19 to 60 years of age ($M = 40.39$, $SD = 9.1$). One participant in the intervention group was lost to attrition, due to unwillingness to utilize the smartphone application MyFitnessPal® and log caloric intake and increased physical activity.

The characteristics of the comparison group from the electronic charts are reported in Table 4.1. The comparison group was predominantly female (72.7%), Caucasian (42.4%), and married (33%) with an average age of 41.81 years ($SD = 8.65$, ranges 29 to 60 years). The chi-square test was used to examine differences in gender, race, and marital status between the two groups (see Table 4.1). No significant differences were found between the groups for gender ($\chi^2 = .074^a$, p = >.05), race ($\chi^2 = 3.737^a$, p = > .05), or marital status ($\chi^2 = 6.287^a$, p = > .05). An independent samples *t*-test also showed no significant difference between the average ages of both groups ($t\ (64) = -1.266$, $p > .05$).

Changes in Outcomes

Statistical Testing and Significance

Using SPSS Version 22 for analysis, parametric tests were run to compare the smartphone application weight loss between the two different groups: comparison ($n = 33$) and intervention ($n = 33$). Statistical significance for all data was established as $p < .05$. A paired *t*-test was calculated to examine the differences in weight loss between the use of a multidimensional intervention and the traditional weight loss intervention. Secondary variables of interest included changes in BMI before and after the 12-week intervention, self-reporting of an increase in physical activity, and participants recording of times logged into the smartphone application MyFitnessPal® every four weeks.

An independent samples *t*- test was calculated comparing the weight loss of participants in the intervention group who used the MyFitnessPal® smartphone application to the weight loss of participants in the comparison group who did not use the MyFitnessPal® smartphone application. The independent *t*-test found a significant difference (t (2) = 3.433, p < .001) among the smartphone application users. The mean weight loss of the intervention group (M = 9.97, SD = 6.24) was significantly higher than the mean weight loss of the non-intervention group (M = 5.3333, SD = 4.61). A paired-samples *t*-test was calculated to compare the mean pre-intervention weight loss (M = 2.03, SD = 3.55) to the mean post-intervention weight loss (M = 9.97, SD = 9.67) after 12-weeks in the intervention group. A significant increase in weight loss was found (t (32) = -6.46, p < .001).

A one-way ANOVA was calculated comparing monthly login amounts as participants self-reported caloric intake data. Login totals with participants utilizing the intervention ranged from the first month (M = 42.39, SD = 15.20) to the second month (M = 34.18, SD = 14.64) and third month (M = 26.33, SD = 11.87). A significant difference was found to be a gradual decrease in login activity for the 3-month period (F (1,2) = 2.55, p < .05). (see Table 4.2, Table 4.3, Table 4.4).

A one-way ANOVA was calculated comparing monthly physical activity. Self-reported physical activity with participants utilizing the intervention ranged from the first month (M = 1.18, SD = .39167) to the second month (M = 1.24, SD = .43519) and third month (M = 1.424, *SD* = .50189). A significant difference was found to be a gradual increase in self-reported physical activity for the 3-month period (F (1,31) = 5.568, p < .05). (see Table 4.5, Table 4.6, Table 4.7).

A paired-sample *t*-test was calculated to compare the mean pre-intervention BMI to the mean post-intervention BMI for the 12-week intervention group. The mean pre-intervention BMI was (*M*= 42.83, *SD* = 11.77), and the mean on the post intervention was (*M* = 41.22, *SD* = 11.54). A significant decrease in pre-intervention BMI to final BMI was found (t (32) = 9.47, p <.001).

At the completion of the 12-week intervention project, each participant completed a verbal exit questionnaire as a review of the MyFitnessPal® experience. Although App use decreased during the 12-week project, participants reported high satisfaction with 84% stating they were satisfied with the app, and 50% reported they would recommend this app. In addition, 84% reported they liked the reminders and would continue to use the app after the project. Additional questions were asked about the app usage with 84% who indicated the app was easy to use, and 75% liked the feedback on goal progress. Twenty-four percent of participants reported other comments including the app helped increase their awareness of healthy food choices. Awareness in caloric intake was reported by 22%, and awareness of portion size was reported by 18%. However, only 13% reported using the bar code scanner function of the app to scan packages of food items. Moreover, 66% said the app was tedious, and only 12% found the app fun to use.

Table 4.1

Demographic Characteristics (N = 66)

	Comparison (n = 33) Group		*Intervention (n = 33) Group*		*Test Statistic & Significance*
	n	*%*	*n*	*%*	
Gender					
Male	9	27.3%	10	29.4%	$\chi2 = .074^{a}$, p = >.05
Female	24	72.7%	24	70.6%	
Ethnicity					
Caucasian	14	42.4%	11	32.4%	$\chi2 = 3.737^{a}$, p = >.05
African American	12	36.4%	10	29.4%	
Hispanic	7	21.2%	11	32.4%	
Asian	0	0.0%	2	5.9%	
Marital Status					
Single	9	27.3%	14	44.1%	$\chi^2 = 6.287^{a}$, p = > .05
Married	11	33.3%	9	26.5%	
Divorced	9	27.3%	9	26.5%	
Widowed	4	12.1%	0	0.0%	
Separated	0	0.0%	2	2.9%	

Table 4.2

MyFitnessPal® Log-in Attempts for Month 1 Intervention Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	14.00	1	1.5	3.0	3.0
	18.00	1	1.5	3.0	6.1
	19.00	2	3.0	6.1	12.1
	25.00	1	1.5	3.0	15.2
	27.00	1	1.5	3.0	18.2
	28.00	1	1.5	3.0	21.2
	29.00	2	3.0	6.1	27.3
	30.00	1	1.5	3.0	30.3
	32.00	1	1.5	3.0	33.3
	36.00	2	3.0	6.1	39.4
	39.00	1	1.5	3.0	42.4
	41.00	2	3.0	6.1	48.5
	45.00	1	1.5	3.0	51.5
	46.00	1	1.5	3.0	54.5
	47.00	1	1.5	3.0	57.6
	48.00	1	1.5	3.0	60.6
	49.00	2	3.0	6.1	66.7
	54.00	1	1.5	3.0	69.7
	55.00	1	1.5	3.0	72.7
	56.00	1	1.5	3.0	75.8
	58.00	2	3.0	6.1	81.8
	59.00	2	3.0	6.1	87.9
	61.00	1	1.5	3.0	90.9
	62.00	1	1.5	3.0	93.9
	63.00	1	1.5	3.0	97.0
	67.00	1	1.5	3.0	100.0
	Total	33	50.0	100.0	
Missing	System	33	50.0		
Total		66	100.0		

Table 4.3

MyFitnessPal® Log-in Attempts for Month 2 Intervention Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10.00	1	1.5	3.0	3.0
	11.00	1	1.5	3.0	6.1
	12.00	1	1.5	3.0	9.1
	17.00	2	3.0	6.1	15.2
	18.00	1	1.5	3.0	18.2
	21.00	1	1.5	3.0	21.2
	22.00	3	4.5	9.1	30.3
	29.00	2	3.0	6.1	36.4
	30.00	1	1.5	3.0	39.4
	31.00	1	1.5	3.0	42.4
	33.00	4	6.1	12.1	54.5
	38.00	2	3.0	6.1	60.6
	39.00	1	1.5	3.0	63.6
	40.00	1	1.5	3.0	66.7
	41.00	2	3.0	6.1	72.7
	42.00	1	1.5	3.0	75.8
	45.00	2	3.0	6.1	81.8
	46.00	1	1.5	3.0	84.8
	47.00	1	1.5	3.0	87.9
	55.00	1	1.5	3.0	90.9
	59.00	1	1.5	3.0	93.9
	61.00	1	1.5	3.0	97.0
	68.00	1	1.5	3.0	100.0
	Total	33	50.0	100.0	
Missing	System	33	50.0		
Total		66	100.0		

Table 4.4

MyFitnessPal® Log-in Attempts for Month 3 Intervention Use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	2	3.0	6.1	6.1
	15.00	2	3.0	6.1	12.1
	16.00	1	1.5	3.0	15.2
	17.00	2	3.0	6.1	21.2
	19.00	2	3.0	6.1	27.3
	20.00	1	1.5	3.0	30.3
	21.00	2	3.0	6.1	36.4
	22.00	2	3.0	6.1	42.4
	23.00	1	1.5	3.0	45.5
	27.00	2	3.0	6.1	51.5
	28.00	2	3.0	6.1	57.6
	29.00	3	4.5	9.1	66.7
	30.00	2	3.0	6.1	72.7
	33.00	2	3.0	6.1	78.8
	37.00	2	3.0	6.1	84.8
	39.00	2	3.0	6.1	90.9
	43.00	1	1.5	3.0	93.9
	47.00	1	1.5	3.0	97.0
	57.00	1	1.5	3.0	100.0
	Total	33	50.0	100.0	
Missing	System	33	50.0		
Total		66	100.0		

Table 4.5

MyFitnessPal® Self-reported Activity Increase for Month 1 Intervention Use.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	27	40.9	81.8	81.8
	No	6	9.1	18.2	100.0
	Total	33	50.0	100.0	
Missing	System	33	50.0		
Total		66	100.0		

Table 4.6

MyFitnessPal® Self-reported Activity Increase for Month 2 Intervention Use.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	25	37.9	75.8	75.8
	no	8	12.1	24.2	100.0
	Total	33	50.0	100.0	
Missing	System	33	50.0		
Total		66	100.0		

Table 4.7

MyFitnessPal® Self-reported Activity Increase for Month 3 Intervention Use.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	19	28.8	57.6	57.6
	no	14	21.2	42.4	100.0
	Total	33	50.0	100.0	
Missing	System	33	50.0		
Total		66	100.0		

CHAPTER 5

DISCUSSION

This EBP project examined the clinical research question: Will the use of a smartphone application combined with text messaging reminders, incite behavioral changes that promote caloric intake awareness, lower BMI, and weight loss. The available literature supports the use of smartphone technology to enhance traditional interventions. With that in mind, the goal of this EBP project was to implement an obesity intervention that utilized the smartphone application MyFitnessPal® combined with text reminders to heighten caloric intake awareness, increase physical activity, and achieve weight loss in participants seeking to lose weight. This chapter will explore the project findings, applicability of the theoretical and EBP framework, strengths and weaknesses, and implications for the future.

Explanation of Findings

The PICOT question asked: "In obese patients (BMI of 30/higher) or overweight patients (BMI of 25/higher) (*P*) what is the effectiveness of a smartphone application combined with text messaging reminders (*I*) compared to non-intervention of the same (*C*) designed to incite behavioral changes that promote caloric intake awareness, lower BMI, and to weight loss (*O*), as a 12-week obesity intervention (*T*)?"

A total of 67 participants were initially chosen for this EBP project. Composed of 34 participants in the intervention group combined with data compiled from 33 random chart/EHR audits to complete the comparison group. Soon after, one intervention group participant was lost to attrition (final $n = 33$) and the non-intervention or comparison group ($n = 33$).

After the 12-weeks of weight loss intervention, the final participant weight, BMI, and activity data were recorded by the clinical staff. A statistical analysis of the final data was performed using an independent samples *t*-test to analyze weight loss data of participants in the intervention group who used the MyFitnessPal® application compared to the final data of participants in the comparison group who did not use the MyFitnessPal® application. The statistical analysis from the independent samples *t*-test found a significant difference (t (2) = 3.433, p < .001) in the outcome among the smartphone application users. Specifically, the data revealed a mean weight loss of the intervention group (*M* = 9.97, *SD* = 6.24) and a mean weight loss of the non-intervention group (*M* = 5.3333, *SD* = 4.61) (t (2) = 3.433, p >.001). Then, a paired-samples *t*-test was used to analyze data comparing the mean pre-intervention weight loss (*M* = 2.03, *SD* = 3.55) to the mean post-intervention weight loss data (*M* = 9.97, *SD* = 9.67). After 12-weeks, the overall findings indicated a significant difference in weight loss (t (32) = -6.46, p < .001) in the intervention group compared to the non-intervention group. This finding was similar to the literature. A systematic review and meta-analysis by Mateo et al. (2015) showed mobile phone app interventions resulted in significant decreases in body weight. The weight loss was -1.04 kg, more than with the control group. Liu et al. (2015) indicated a body weight loss ranged from −5.16 kg to −0.05 kg in the intervention groups, in comparison to −2.60 kg to 1.41 kg weight loss in the control groups. In contrast, Laing et al. (2015) indicated in a randomized control trial, weight change was minimal, with no difference between groups −0.30 kg [95% CI, −1.50 to 0.95 kg]; p = 0.63.

The validity of the project weight loss findings required testing any differences in the pre- and post- intervention participant characteristics using a Pearson's chi-square test. The chi-square test analysis was completed and found no measurable differences or association among the participant characteristics of gender or race in either of the pre- and post-implementation groups. As a result, the significant weight loss measured in the intervention group was attributed to the success of the EBP project and the ability of smartphone technology to enhance traditional obesity interventions. Statistical testing was done to see if there were differences among the participant characteristics in the intervention and non-intervention groups. Since there were no significant differences, the weight loss is more likely attributed to the weight loss intervention. This finding was similar to research. According to Aguiler-Martinez et al. (2014), there appeared to be no proportional relationship between gender, age or relationship status and weight loss. The weight loss was associated to the smartphone application intervention use. Lui et al. (2015) also stated weight loss was respectively due to the mobile phone intervention in comparison with the control group.

Overweight and obese individuals are at greater risk for complex comorbidities including high blood pressure, diabetes, heart disease, breathing difficulties, and some forms of cancer. One-point increase in BMI leads to a 4% increase in medical costs and an alarming 7% increase in medicinal expenses (Wang et al., 2006). A paired-sample *t*-test was calculated to compare the mean pre-intervention BMI to the mean post-intervention BMI for the 12-week intervention group. A significant decrease in post-intervention BMI to pre-intervention BMI was found (t (32) = 9.47, $p < .001$). The intervention in this EBP project indicated a higher BMI reduction than indicated in the literature. Liu et al. (2015) documented a significant decrease (1.4 kg) in body weight and .24 decrease in body mass index (BMI). Mobile phone intervention was associated with significant variations in BMI compared with the control group, BMI reduction of −1.44 kg and net body weight changes were −0.92 kg and −1.85 kg. These findings provide evidence that mobile phone intervention may be a useful tool for promoting weight loss among overweight and obese adults. Liu et al. (2015) findings indicated the BMI change ranged from −0.50 to zero change in the intervention group and a BMI reduction of −0.50 to 1.00 in the control group.

Monthly self-reported caloric intake data for participants showed a gradual decrease in login activity for the 3-month period (F (1,2) = 2.55, $p < .05$). Although, self-reported caloric intake entries gradually deceased over time, the weight loss intervention consisting of logging caloric intake and physical activity are associated with weight loss. The findings were similar in the literature. Liu et al. (2015) indicated that adherence to self-reporting caloric intake is higher in those using a smartphone application than those using a paper log. Laing et al. (2015) conducted a 6-month study; the consistency of logins among users decreased quickly after participation. Logins in the first month were 2 to 24 and 0 to 2 logins by the sixth month. No data were given for the in-between months. The findings indicated login activity diminished among application users significantly over the intervention period. Mobile-phone intervention with strict adherence to monitoring caloric intake with physical activity could still be a vital strategy for promoting weight loss.

A one-way ANOVA was calculated comparing monthly physical activity. Self-reported physical activity with participants utilizing the intervention ranged from the first month (M = 1.18, SD = .39167) to the second month (M = 1.24, SD = .43519) and third month (M = 1.424, SD = .50189). A significant difference was found to be a gradual increase in self-reported physical activity for the 3-month period (F (1,31) = 5.568, $p < .05$). The findings were varied among the literature. Liu et al. (2015) identified that the significant reductions in body weight and BMI of 1.44 kg and 0.24 units, in comparison with the control group was respectively due an increase in physical activity. A change or increase in physical activity was shown in 43% of the participants using smartphone technology to improve weight loss (Stephens et al., 2017). Mobile phone applications have shown to be effective for increasing physical activity and/or reducing overweight/obesity. Evidence showed smartphone applications combined with text reminders motivated participants to plan and track increased physical activity to lose weight over a longer period than traditional weight loss initiatives (Aguilar-Martinez et al., 2014; Levine et al., 2014; Liu et al., 2015; Stephens et al., 2017; Tang et al., 2014). Though, Mateo et al. (2015) showed a nonsignificant difference in physical activity was observed between the two groups with a standardized mean difference of 0.40, 95% CI -0.07 to 0.87; I2 = 93%.

Evaluation of Applicability of Theoretical and EBP Frameworks

The theoretical framework that was used to guide this EBP project was the HBM Model (Rosenstock et al., 1988). In addition, to the HBM, the Stetler EBP Model (Stetler, 2001). was used to guide the implementation of best practice in the clinical setting. The theoretical and EBP framework applicability, strengths, and limitations are discussed further.

Theoretical Framework

The Health Belief Model (HBM) was used as the theoretical framework to help guide this EBP project (Rosenstock et al., 1988). This model was used to guide the combination of health education and specific interventions designed to promote a change that can lead to a healthier lifestyle. The applicability of the HBM was ideal for the implementation of this EBP. The HBM was used as a guide when educating patients by identifying, defining, and prescribing specific behavioral changes needed for patients to experience lasting weight loss.

The first step in the HBM model was setting realistic individual goals for weight loss, fitness, and address changes in behaviors. To change behaviors and raise awareness about obesity related health risks, a wellness lab panel was drawn on each patient to establish each individual health risk. Laboratory panels included glucose levels to rule out weight gain possibilities including but not limited to insulin resistance. In addition, cholesterol, triglyceride, vitamin D3 and B12 levels were obtained for baseline data. This stage instilled urgency in many participants after results identified personal health perils. Additionally, this stage enabled participants to set realistic weight loss goals that could be attained in the 12-weeks of the project. As a result, participants understood the seriousness of obesity, and risks of many of the associated illnesses helped to motivate participants to make personal changes in their daily routines and personal habits.

Next, the model supported approaching weight loss and exercise in a reassuring way by setting realistic goals and emphasizing positive results of exercise reported by the participants. The last step in applying the model was to recognize and work to overcome the challenges or barriers that were preventing participants from losing weight and keeping it off. At this stage, each participant was able to self-reflect with the dietician on individual challenges or barriers that were preventing him/her from losing weight. This phase allowed for the dietician and participants to re-evaluate personal goals and modify as necessary. This was an important step in the EBP implementation process in order to avoid deterrence and negative feelings leading to slowing or stopped weight loss progress.

EBP Framework

The Stetler Model provides a conceptual framework for gathering evidence and ensuring current evidence can be safely implemented into practice (Stetler, 2001). The Stetler model utilizes five steps which includes: preparation, validation, comparative evaluation/decision making, translation/application, and evaluation (Stetler, 2001). Phase I was the preparation phase. The preparation phase encompassed the task of identifying the existing policy needing revision and clarification was given to the probable implication of internal factors (e.g. individual prejudice or objections) and external or environmental factors (e.g. institutional mission, policies, stakeholder politics) that could generate limitations and adjustments to the preparation phase (Stetler, 2001). It was recognized in the EBP site that many patients were unaware of caloric intake and personal physical activity needs leading to complex health issues and unwarranted weight gain. Obesity is one of the main factors for chronic diseases, such as diabetes, cancer, and cardiovascular disease (Aguiler-Martinez et al., 2014).

Phase II entailed validation, which required the project leader to appraise the evidence and validate its quality. For this EBP project, five databases and citation considerations were employed using search terms identified for best evidence. The best evidence results yielded 1,060 sources, some sources overlapping among the different databases. After appraising abstracts for applicability, 9 sources of high-quality evidence were kept by the project leader based on the relevancy of the data identified for this EBP.

Phase III involved the comparative evaluation and decision-making process. As a result, it required the project leader to appraise the strengths and weaknesses of the evidence and it was determined there was enough evidence to support the proposed practice/policy changes. Evidence was categorized with the guidance of the Melnyk and Fineout-Overholt's Hierarchy of Evidence (Melnyk & Fineout-Overholt, 2011). and the CASP tool (CASP, 2017) was used to critically appraise the selected research.

Phase IV necessitated the translation and application of the evidence. The translation/application process began with an initial request for implementation being presented to the clinical site physician along with evidence from the literature indicating a greater weight loss, lower BMI, increased physical activity and accountability with smartphone application MyFitnessPal®. No IRB was necessary from the private family practice. However, prior endorsement was attained by Valparaiso University IRB to implement the EBP project.

After approvals were received, the recruitment process was started and formal education on the usage of MyFitnessPal® was given to the physician, nurse practitioner, dietician, clinical nurse and medical assistant.

Data flowsheets were created by the project leader to collect participant DOB, dietician appointment date, InBody ™ scan completion date, weight loss results, and physical activity and app login attempts post-implementation. The project leader used the flowsheets to review the weight loss and BMI results from prior appointments. A flowsheet was also created to document weight loss and BMI results from the non-implementation group. Data were collected over 12-weeks during scheduled biweekly or monthly follow-up visits based on personal requests, motivational needs, or monitored health necessities.

In phase V the project leader evaluated the outcomes. The evaluation process is a continual process. The project leader was present and available within the facility as much as possible to ensure sustainability of the EBP project. Similarly, the project leader was easily available via cell phone for consultation concerning accurate data for height, weight and BMI was entered into the electronic medical record (EMR).

Strengths and Limitations of the EBP Project

Appraisal of this EBP project exposed a variation of strengths and weaknesses. The following segment offers a summary of facets that theoretically impacted the implementation and outcomes of this EBP project. This section also outlines recommendations for improvement in future replications.

Strengths

This EBP project had several strengths. The most impactful effect on the project was the collaboration with the dietician, site physician, clinical nurse, and medical staff. The support and leadership from the site physician were instrumental in the success of this EBP project. An additional strength to the EBP project was the usage of a free smartphone application with the capabilities for upgrade and personalization if desired. The MyFitnessPal® application set-up only takes a few minutes to sign up and personalize meals and exercises. The application has capabilities to calculate calories ingested versus calories expended. The application allows for personal recipes to be entered to calculate the meals' calories per servings. The basic application has provisions to support any fad diet including but not limited to Atkins, South Beach Diet and Keto. MyFitnessPal® contains a searchable food database that is updated periodically. The food database also includes menu choices for healthier restaurant options for people with an active lifestyle. The app also offers a community forum for questions and advice about gaining, losing, or maintaining weight. Some participants gained personal motivation in hearing weight loss success stories. MyFitnessPal® free app download has capabilities to connects with several mobile applications and tracking devices to track steps. There is a scanning capability with food packaging barcode to give its nutritional details. The application can provide recommended daily calorie intake to help personalize weight goals with data memory capabilities of desired meals and activity. Technology gives overweight or obese patients the options to undergo weight loss intervention semi-remotely. The continued promise of this approach lies in the fact that it is not geographically confined and could be disseminated to a large number of individuals.

Limitations

The leading limitation to this EBP project was a small number of participants or sample size in both groups. Also, the project was of short duration of three months during the traditional year-end holiday season. Unfortunately, many foods during this time of year are not nutritionally balanced at home or at holiday parties. During this holiday period, many participants were inconsistent when self-reporting caloric intake and physical activity data. In addition, alcohol consumption, eating holiday sweets, and or indulging in second helpings contributed to some lack of weight loss progress during this same holiday period. Even though this time of year was difficult, the participants still lost significant weight during these three months.

The acceptability and appeal of an app for weight loss is beneficial only if its technology remains steadfast and up-to-date to its target audience. Some participants mentioned during food logging the application would freeze prohibiting the data from being entered in a timely manner. Another complaint was accurately calculating the portion size of every meal. Self-reported data are precise if each participant relays the information truthfully and in its entirety. Perhaps, if a participant inaccurately identifies an 8-ounce chicken breast as 6 ounces and records it in the application, the caloric count will be skewed. To avoid this type of pitfall, every intervention participant met with the clinical site dietician for meal education. Thus, food logging and self-monitoring can be time-consuming and tedious, resulting in noncompliance and altered data to avoid the inconvenience of self-reporting of data. Participants in this project reported logging every meal and snack item over time can be tedious and time consuming. Additionally, login data for each condiment used and accurate amounts can be more exasperating.

Another noted limitation to the smartphone application was the personal food database could only be accessed with an internet connection. However, the use of self-reported data is important for participants to see their progress against their individualized goals and track caloric intake and not used as a measurement. Specifically, self-reported data entered into a tracking application like MyFitnessPal® will benefit the participant to see where he/she is in relation to daily and weekly caloric intake or activity goals. Therefore, any further use of this type of intervention would be beneficial if the participant kept a paper record of caloric intake and physical activity when application is unavailable for any cause. Keeping the paper record can allow for easier recollection of data that could have been mistakenly omitted. Ultimately, the written caloric intake log can improve data accuracy with self-reported data. Despite the fact self-reported data is a subjective limitation, the primary outcome was participant biweekly/monthly weight loss progress and BMI measurements which both improved significantly.

Implications for the Future

Practice

Weight loss interventions using a combination of a smartphone application combined with text messages reminders could be helpful in driving self-monitoring of caloric intake and physical activity by obese or over weight patients. This EBP project had a short duration of only three months but successfully demonstrated the strategic benefit of using mobile technology to enhance traditional weight loss intervention methods. Therefore, providers should consider using the combination of smartphone tracking applications and text reminders to enhance traditional weight loss interventions used in short and long-term weight loss efforts. The ability to use mobile technology to self-report caloric intake and physical activity in real time cannot be understated for accuracy and portability of mobile technology. In addition, this project demonstrated a clear example of a collaborative health care team consisting of site physician, on-site dietician, project leader, clinical nurse, and support medical staff. The benefit of an on-site dietician reinforced the need for dietary modification in the form of reduced caloric intake to facilitate weight loss in participants.

Apps such as MyFitnessPal® can be a useful tool combined with traditional methods to combat obesity and its costly long-term consequences. This project demonstrated the ability to report data in real time combined with reminders helped to drive short-term weight loss.

Theory

One of the crucial strengths of this EBP project was the theory-guided approach intervention around the feature of the smartphone MyFitnessPal® application such as accountability. This model guided the combination of health education and specific interventions that are designed to promote a change that leads to a healthier lifestyle. The HBM is a psychological model that applied to this EBP project because the model is based on an individual's course of action and the individual’s perceived benefits and or barriers associated with making healthy decisions. The HBM was chosen because it took a realistic approach to changing behavior by combining education and interventions. The theory fit well within this EBP project as it is not enough for the health care professional to try and change the unhealthy behavior in an individual. The individual must understand what is at stake and want to change their behavior. In this EBP, the primary motivation to incite change was the participant’s perceived threat or risk of obesity and associated health risks. The primary resource or any change was self-efficacy or the confidence to lose weight and maintain a healthier lifestyle. The theory drove the primary motivation for change by educating the participants on the threat or risk of obesity, and the primary resource for any change was self-efficacy or the patient’s confidence to lose weight and maintain a healthier lifestyle (Daddario, 2007). Thus, the EBP goal of the weight loss intervention was for the participants to understand the positive benefits to health and well-being. These benefits aren’t only in the present but have the propensity to last a lifetime.

Research

Further research and education are needed to determine if weight loss is sustainable using smartphone applications in combination with caloric intake self-awareness, provider direction and regular monitoring. The use of a clinical dietician for all phases of this weight loss project was instrumental in participant education and should be a component of future research. Additionally, future research should ponder variations in smartphone applications to make them less tedious and more appealing to the user.

Education

Patient education was provided throughout this EBP project with the use of printed materials and project leader initiated patient dialogue. Effective weight loss management is prevention of unsolicited weight gain. Therefore, future education on weight loss management is necessary for primary care providers to understand and utilize the available and up-to-date technology to aid in weight loss management. None of the providers at the clinical site were utilizing any smartphone application for weight loss in this patient population prior to the EBP project implementation. Nurse Practitioners (NPs) play an important role in preventive care in the exam room and into the community. Continuous education is necessary for healthcare providers to remain steadfast with primary prevention toward overweight and obesity to avoid long-term health consequences. NPs can educate patients to empower individuals to make healthier food choices and make sustainable lifestyle changes to prevent comorbidities related to obesity. It is imperative that NPs and other providers stay educated and abreast of preventive measures and current treatment modalities. Staying up-to-date can be achieved by autonomous medical education such as reading literature and earning continuing educational credit and attending conferences with peer-to-peer interactions. Thus, the more knowledgeable the NP is the better he/she will be at health promotion in the clinical setting and the community.

Conclusion

While this EBP project involved a small number of participants, the findings did signify a feasible and effective evidenced-based intervention for primary care providers to contribute to self-awareness, effective weight loss and increased physical activity. Furthermore, introducing a weight-loss app to overweight or obese patients in primary care did result in increased weight loss. In the motivated weight loss patient who is really prepared to self-monitor calories, MyFitnessPal® may be a useful tool for losing weight. The willingness and adherence to self-monitoring and reporting of caloric intake and physical activity must be addressed prior to use to avoid obesity and its costly long-term consequences in primary care. Therefore, providers can refer patients to MyFitnessPal® for successful weight-loss.

Findings from this EBP project were similar to that reported in the literature and answered the PICOT question: In obese patients (BMI of 30/higher) or overweight patients (BMI of 25/higher) (P) what is the effectiveness of a smartphone application combined with text messaging reminders (I) compared to non-intervention of the same (C) designed to incite behavioral changes that promote caloric intake awareness, lower BMI, and weight loss (O), as a 12-week intervention (T)? Smartphone ownership has gained popularity, leading to the formation of various health-related apps targeting physical activity, caloric intake, and weight loss. However, this EBP project only utilized MyFitnessPal® and it indicated weight loss, lower BMI and increased physical activity. As a result, primary care providers should consider encouraging patients to utilize the smartphone application to promote self-awareness.

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BIOGRAPHICAL MATERIAL

Angela Marie Turner

Mrs. Turner is an Indiana native and graduate of Indiana University Northwest (IUN) campus in 2009 where she earned an associate degree in health information technology. Mrs. Turner obtained her Registered Health Information Technician (RHIT) certification in 2009. She is a member of the American Health Information Management Association (AHIMA). She continued her education at IUN and earned her Bachelor of Science degree in nursing in 2004. Simultaneously, earning her a membership in Sigma Theta Tau International Honor Society of Nursing (Sigma). As a registered nurse she gained valuable knowledge in areas including; medical surgical, orthopedics and rehabilitation. Mrs. Turner decided to pursue her Doctor of Nursing Practice (DNP) degree from Valparaiso University in the family nurse practitioner program. She currently works at Community Hospital in Munster, Indiana, as a patient flow coordinator. Her post-graduate interests include; professional experience as a family practitioner treating complex conditions including mental health for both pediatrics and adults. Mrs. Turner became interested in this area after working closely with the emergency department and experiencing first-hand the critical shortage of mental health providers. She quickly realized the need in the community may perhaps be satisfied by a DNP in family medicine treating pediatric and adult mental health services. Mrs. Turner also has an interest in bariatrics during her family nurse practitioner clinical rotation. As a result, she chose to demonstrate how technology can enhance traditional weight loss interventions as her Evidence-Based Practice (EBP) project. Specifically, the EBP project used a free smartphone application MyFitnessPal® to encourage self-reporting behaviors, such as monitoring caloric intake, tracking of fitness data, and reporting changes in weight. The project used the popularity of smartphones to bridge the environmental, cultural, and psychological barriers reported by healthcare professionals when treating overweight or obese patients.

ACRONYM LIST

ANOVA: Analysis of Variance

APP: Application

BMI: Body Mass Index

CASP: Critical Appraisal Skills Programme

CDC: Centers for Disease Control

CINAHL: Cumulative Index of Nursing and Allied Health Literature

DNP: Doctor of Nursing Practice

DOB: Date of Birth

EBP: Evidence-Based Project

HBM: Health Belief Model

IRB: Institution Review Board

IOM: National Institute of Medicine

MA: Medical Assistant

PICOT: Problem, Intervention, Comparison, Outcome, Time

RCT: Randomized Controlled Trial

RN: Registered Nurse

SM: Stetler Model

US: United States

USPTF: United States Preventive Services Task Force

USPSTF: US Preventive Services Task Force

APPENDIX A

Smartphone Application Handout

MyFitnessPal® Smartphone Application for Weight Loss

https://www.kirtland.af.mil/News/Commentaries/Display/Article/1489113/weight-loss-its-more-than-calories-in-vs-calories-out/

MyFitnessPal ® *FREE Application (preferred)

Create a log in with username and password

Fill in required field of height and weight from the clinical scale

Next, fill in goal weight

Select caloric intake to reach potential weight goal

Now that you are set up to use this weight loss application, look on the bottom left of the phone screen for the **"diary"** selection tab. (Pic #2) it will open the breakfast, lunch, dinner, snack, exercise and water menu

- This area allows you to log in your meals/snacks intake to track your caloric intake and monitor your goal and help you to achieve your goal
- This **"diary"** selection also helps you to log your physical activity (such as cardio, strength)
    - This area can be edited to add other exercises by scrolling the existing menu (such as aerobics, bicycling and basketball)

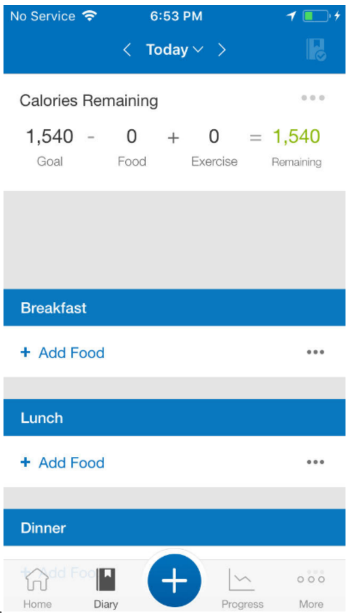
The top left should have a **"Weight"** selection tab

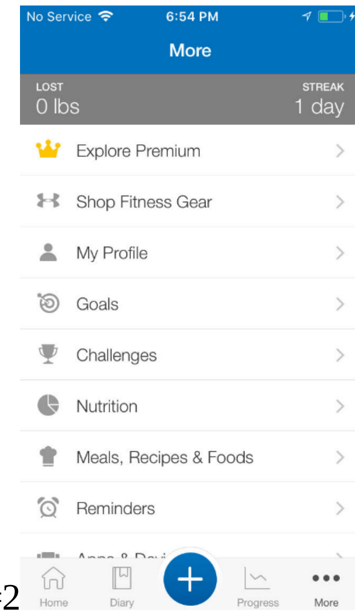
The top right has a date range selector tab (1-week, 1 month, 2 months, 3 months, 6 months etc.)

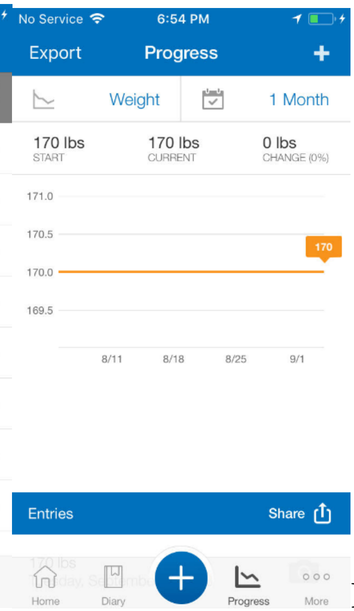
- Select **"since starting weight"**; this will be the starting scale weight

The +symbol in the bottom center of the screen allows for quick access to all diary log categories

The "**progress**" selection tab on the bottom right of the screen allows you to view your progress by selected range (1-week, 1 month, 2 months, 3 months, 6 months etc.) See Picture #3

Pic#1 

Pic#2 



Pic #3

APPENDIX B

Smartphone Application Participant Flowsheet

Participant number	**Participant DOB**	**Dietician Appointment**	**InBody ™ Scan Completion Date**

APPENDIX C

Smartphone Application Participant Weight Flowsheet

Intervention Participant #	**Weight-loss week 2**	**Weight-loss week 4**	**Weight-loss week 6**	**Weight-loss week 8**	**Weight-loss week 10**	**Weight-loss week 12**
SMARTPHONE APPLICATION MYFITNESSPAL® INTERVENTION PARTICIPANTS						

APPENDIX D

Non-Intervention Participant Weight Flowsheet

NON-Intervention Participant #	**Weight-loss week 2**	**Weight-loss week 4**	**Weight-loss week 6**	**Weight-loss week 8**	**Weight-loss week 10**	**Weight-loss week 12**
NON- INTERVENTION PARTICIPANTS						

APPENDIX E

Smartphone Application Participant Activity Flowsheet

Intervention Participant #	**Physical Activity Week 2**	**Physical Activity Week 4**	**Physical Activity Week 6**	**Physical Activity Week 8**	**Physical Activity Week 10**	**Physical Activity Week 12**
SMARTPHONE APPLICATION MYFITNESSPAL® INTERVENTION YES/NO						

APPENDIX F

Smartphone Application Entry Flowsheet

Intervention Participant #	**APP LOGIN WEEK 2**	**APP LOGIN WEEK 4**	**APP LOGIN WEEK 6**	**APP LOGIN WEEK 8**	**APP LOGIN WEEK 10**	**APP LOGIN WEEK 12**	**APP LOGIN TOTALS**
SMARTPHONE APPLICATION MYFITNESSPAL® INTERVENTION PARTICIPANTS							