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Improving Staff Knowledge and Competence in the Use of mHealth in Weight Loss Management.

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Abstract

Obesity is a complex and multifactorial public health issue. The prevalence of obesity in the world has increased significantly in the past four decades, and in the United States alone more than 90 million people are affected. It is associated with chronic conditions such as diabetes mellitus, hypertension, sleep apnea, and certain cancers. Obesity is responsible for high expenses not only in healthcare, but in society as well. Obesity management requires a multifaceted approach to reduce weight and improve health outcomes. There is a need for a cost-effective treatment of obesity that helps improve quality of life, provides patient centered care, and offers a long-term solution. Mobile health is an effective tool that assists with promotion of behavioral changes while increasing patient provider interaction and access to information. The purpose of this project was to improve knowledge in the use of mobile health and perceived competence of using this technology for weight management. A total of 10 adults who are part of the staff of a medical bariatric office participated in a quality improvement project. Participants were evaluated in their knowledge of mHealth and perceived competence to use it in weight management. Participants completed a demographic survey and a pre- and post-intervention survey. Statistical analysis was performed using a Mann Whitney U test. Upon completion of statistical analysis, a significant improvement in test scores from pre-intervention to post-intervention surveys were found. Results of this quality improvement project can be used to increase knowledge and perceived competence in the use of mHealth in providers for further implementation of a clinical practice change in weight management program.

Keywords: obesity, mHealth, weight management

Improving Staff Knowledge and Competence in the Use of mHealth in Weight Loss Management

Obesity is considered a serious, complex, and multicausal public health issued that requires a combination of approaches in order to be treated (Wang et al., 2020). Globally, its prevalence has increased significantly over the past 40 years (Islam et al., 2020) and it is responsible for considerable public health costs (Wang et al., 2017). According to the Centers for Disease Control and Prevention (CDC), obesity affects over 92 million adults in the United States (Wang et al., 2020). Further, excess weight (being overweight) and obesity are associated with a wide array of chronic conditions such as cardiovascular disease, type 2 diabetes mellitus, and some forms of cancer (Cavero-Redondo et al., 2020). Despite high levels of spending on obesity research, treatment, and clinical weight loss programs, obesity continues to be an epidemic in the United States (Caldwell & Sayer, 2019).

Conventional weight loss interventions that are based on behavioral changes indeed may offer a solution, but they can be costly and do not provide a long-term resolution to the underlying issues (Beleigoli et al., 2019; Gomez-Marcos, et al., 2018). Due to the complex nature of obesity, there is a need for multiple strategies to manage this problem. Mobile health (mHealth) is emerging as a rapid and developing field that can provide the necessary long-term solutions (Wang et al., 2020). mHealth may provide a low cost and effective solution while increasing quality of life, increasing patient health outcomes, and reducing healthcare costs (Wang et al., 2017). The integration of this valuable technology into weight management programs can offer a key to solving this multifactorial issue.

Problem Statement

Background

The terms obesity and overweight are defined as an abnormal accumulation of fat that can be detrimental to an individual's health (Zaidan & Roehrer, 2016). A body mass index (BMI) of 25 kg/m^2 or more is considered overweight and a BMI of 30 kg/m^2 or more is classified as obese (Fruh, 2016). As noted, obesity is a complex and multifactorial issue, where behavioral and genetic factors are often combined (Wang et al., 2020). Additionally, there are other modifiable factors, such as lack of physical activity, increased intake of refined carbohydrates and processed foods (Banerjee et al., 2020), education, and food marketing and advertisement effectiveness that can all negatively affect weight (Wang et al., 2020).

This complex disease requires a variety of strategies to reduce weight and improve health outcomes (Wang et al., 2020). According to the United States Preventive Services Task Force (USPSTF), weight management must be focused on intensive counseling and behavioral interventions (Croghan et al., 2019). Therefore, the approach for obesity management must also be multifaceted and includes nutrition modifications, physical activity, behavioral changes, and constant support to ensure adherence for long-term benefits (Brunacini, 2019).

The strongest predictor of success for behavioral changes and one of the most important strategies in weight management is self-monitoring (Payne et al., 2018). According to Zaidan and Roehrer (2016), self-awareness increases through self-monitoring, enhancing behavioral changes like diet modifications and physical activity. This strategy can lead to prevention and treatment of obesity, increasing self-awareness of target behaviors and outcomes (Zaidan & Roehrer, 2016). However, most weight loss programs are focused on standard behavioral therapy (Jacobs et al., 2017). The components of standard behavioral therapy include a calorie deficit diet plan, exercise (Gomez-Marcos et al., 2018), self-monitoring (Jacobs et al., 2017), and pharmacological agents (Fruh, 2017). These interventions are usually in person, have associated

costs, and generate both participant and staff burden; interventions generate a high demand for patients, thus creating additional burden for healthcare due to the prevalence of obesity (Beleigoli et al., 2019).

Problem

Obesity is a public health issue and a global epidemic. Approximately 40% of adults worldwide are overweight or obese (Wang et al., 2017). The prevalence of obese and overweight individuals in the world has almost tripled since 1980 (Islam et al., 2020). In the United States, obesity is considered an epidemic (Lee et al., 2018), because more than 60% of the population is considered overweight or obese (Wang et al., 2017). Yet obesity affects mostly Hispanics, African Americans, and individuals with a low education level and/or low socio-economic status (Wang et al., 2020).

To make matters worse, obesity management is not as prevalent as it needs to be. Insurance companies do not cover these treatments since they are often thought to be a cosmetic issue, and in the end, more money is spent treating the diseases associated with obesity and its complications (Sarwer & Grilo, 2020). There are a variety of interventions aimed at fostering weight management that are successful, but they can be expensive and time consuming (Sittig et al., 2020). Those interventions require an in-person consultation as well as behavioral counseling (Godino et al., 2019). They offer modest results and are not proven to be effective long term (Beleigoli et al., 2019). Weight reduction programs also require effort and commitment from patients, providers, and stakeholders, and these programs can be met with many challenges such as time constraints, non-adherence, and poor social support (Wang et al., 2017). There is a need for strategies that promote adherence, self-monitoring, social support, and motivation in weight management programs that lead to increase weight loss and commitment (Jacobs et al., 2017).

According to Sittig et al. (2020), weight interventions that are cost-effective, and accessible are critical for weight loss success and provide long term effects.

Consequences

Obesity and being overweight are closely linked to elevated morbidity and mortality, having not only a financial impact, but physical, functional, and psychological consequences as well (Lee et al., 2018). Obesity is highly associated with premature mortality, and it is greatly responsible a decline in life expectancy in the United States by 5 to 10 years (Sarwer & Grilo, 2020). Additionally, higher patient BMI is correlated with a higher hazard ratio for all-cause mortality (Fruh, 2016). Obesity is a chronic condition that affects numerous systems, and it is strongly associated with the development of type 2 diabetes mellitus, hypertension, hyperlipidemia (Wang et al., 2017), cardiovascular disease, some types of cancer (Beleigoli et al., 2019), osteoarthritis, gallbladder disease, and sleep apnea, among others (Wang et al., 2020). Obesity also has many psychological implications such as stigmatization, discrimination, personality disorder (Fruh, 2017), depression, and anxiety (Wang et al., 2020).

According to Knoll et al. (2018), obesity in adults is also associated with a higher probability of becoming disabled in life, affecting not only the health, but also the socio-economic status of the individual and society. Obesity also increases the years of life lost (YYL) as higher BMI increases the premature mortality rate (Knoll et al., 2018). As noted, obesity affects not only the individual, but it also impacts society (Lee et al., 2018). The Organization for Economic Cooperation and Development (OECD) believes that the cost of obesity in healthcare could bankrupt the healthcare system in the United States in the next 20-30 years (Sarwer & Grilo, 2020).

In the U.S. healthcare system, obesity has direct costs, such as those related to prevention, diagnosis, and management, as well as indirect costs, like morbidity and mortality related costs, low productivity, absenteeism, disability, and early death (Wang et al., 2020). The cost of obesity in the U.S. can add up to $210 billion annually (Thorndike & Sunstein, 2017), and the healthcare cost of an obese individual is approximately $1500 more per year than an individual with a healthy weight. The productivity cost of obesity-related absenteeism in the U.S. ranges from three to seven billion dollars (Wang et al., 2020), making obesity a very expensive chronic disease. As noted, reducing the prevalence of obesity not only has health benefits but financial benefits as well.

Knowledge Gaps

Studies have shown that lifestyle modifications help reduce obesity and maintain weight loss in obese patients (Islam et al., 2020), and even a moderate weight loss of 5-10% can significantly improve health related outcomes and decrease comorbidities associated with obesity (Fruh, 2016). Interventions that are directed at increasing motivation to undergo the process of change, while providing goal setting and feedback, can help greatly in weight management and maintenance (Islam et al., 2020). Social support is an important component of weight loss management and can help establish effective interventions for further weight loss success and long-term effects (Lee et al., 2018). There is a need for a cost-effective treatment for obesity as well as self-management that will reduce healthcare costs while improving quality of life and patient care (Wang et al., 2017).

Mobile technology has grown exponentially over the past few years. The use of smartphones and tablets has reached almost all levels in society, marking a social and cultural revolution. Mobile health was first introduced in 2000, and now more than 40% of smart phone

applications are related to health (Hernandez-Reyes et al., 2020). Various mHealth interventions are directly focused on the use of mobile technology such as text messages, cellphone applications, and wearable devices (Lee et at., 2018).

Digital health may facilitate prevention, diagnosis, and management of chronic conditions in partnership with conventional healthcare, providing evidence-based interventions as well as personalized and precise care (Croghan et al., 2019). mHealth interventions support changes in behavior while providing timely information, assistance (Islam et al., 2020), self-monitoring, motivation, and social support (Zaidan & Roehrer, 2016). According to Rodder et al. (2018), there are currently more than 150,000 health related applications, but only about one-third of healthcare professionals recommend their use to patients. This can be explained partly by the lack of knowledge of healthcare providers to evaluate and recommend those apps, and partly because of the lack of regulation by certifying entities such as the Food and Drug Administration (FDA). Based on this current reality, it would seem that the gap is associated with the lack of provider knowledge to use mHealth for the treatment of obesity.

Proposed Solution

Mobile technology is considered a simple and cost-effective approach that can promote behavioral changes (Lee et al., 2018). mHealth is an effective tool used to assist with interaction among patients, staff, and healthcare providers. This technology has been used in disease management for different conditions such as HIV, asthma, diabetes, tuberculosis, and smoking cessation (Wang et al., 2017). Mobile health is a developing field that empowers consumers into making informed health behavior choices and healthcare decisions (Wang et al., 2020).

Numerous researchers have found benefits in using text messages, for example, for healthy behavior promotion like smoking cessation, mental health management, and weight loss

(Lee et al., 2018). According to Houser et al. (2019), studies that used mobile technology, when compared with others that used telemedicine or eHealth, showed a statistically significant association with weight loss. The use of mobile applications has provided increased interaction between patient and providers and increased patient access to information. According to a meta-analysis conducted by Islam et al. (2020), mobile application interventions promoted weight loss, weight maintenance, an increase of physical activity, and overall improvement in quality of life. The proposed solution to this problem will, therefore, consist of an educational program directed to staff at a specialized bariatric clinic to increase the knowledge of mHealth to target weight loss management and maintenance and increase perceived competence for further implementation in the practice to supplement weight management.

Significance

Obesity is not just a complex and multifactorial health issue that affects a great percentage of our population in the United States (Wang et al., 2020), one that has consequences not only on the individual's health, but across society and the economy (Lee et al., 2018). It is a public health issue that is highly preventable with both individual and environmental strategies (Dounavi & Tsoumani, 2019). There are multifaceted interventions that aim to decrease obesity and increase health outcomes (Brunacini, 2019), but those interventions can prove costly and, in many cases, offer modest weight loss, that can be short lived (Sittig et al., 2020).

Weight management interventions should be focused on delivering patient-centered care which is designed to promote behavioral changes that have a long-term effect and are cost-effective (Croghan, 2019). The use of mobile health can be the answer in providing the support and self-monitoring that are needed in interventions that focus on weight management. Increasing knowledge of mobile technology in staff members of a bariatric clinic and their

perceived competency in using those in weight loss management patients can provide a cost-effective outcome as well as long-term behavioral changes.

Summary of Literature

The literature review was directed by the PICO question, and included five electronic databases. The articles were published in a five-year range (2015-2020) and included peer reviewed articles written in English. The review comprised articles about the efficacy of mobile health in weight management and maintenance, as well as barriers and facilitator in the use of the technology by healthcare providers.

Literature Search Process

The literature review was conducted using five electronic databases: CINAHL, PubMed, Cochrane, OVID, and ProQuest. The keywords used, either targeting the abstract or the title, included: weight loss, weight management, weight reduction, education, training, mHealth, mobile health, smartphone application, smartphone apps, and mobile apps. The search was limited to articles published in the past five years (2015-2020). In addition, articles had to have been peer reviewed and written in English. The initial search yielded 204 articles and a breakdown of the articles located in the search can be found in Appendix A. The data abstraction table indicated that across all databases, 204 articles were retrieved. Of these articles, 186 were excluded as irrelevant to the project. The remaining 18 articles were subjected to full-text review and 13 were retained for this project.

The articles were screened based on the following inclusion criteria—adult population, standard intellectual ability, weight management—and exclusion criteria: intellectual disability, pregnant, and post-partum. After screening, 18 articles were chosen and after a careful review, 13 articles were included in the literature review. The articles included in this literature review

combined evidence on the use of mHealth in weight loss and weight maintenance, healthcare providers and the use of mobile health applications, barriers, and facilitators to adopt this technology in the treatment of obesity and overweight. In addition, the articles were systematic reviews, meta-analyses, randomized controlled trials, or qualitative research studies that provided an objective appraisal of the evidence and transparency.

Literature Appraisal

The Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) evidence rating hierarchy was used to evaluate the level of research evidence for each article (Dang & Dearholt, 2018). The JHNEBP model uses a defined quality rating scale tool that guides appraisal and determines research quality (Dang & Dearholt, 2018). The scale provides a rating level and quality based on the type of the study and on the research evidence. Evidence levels range from level I to level V, and quality ratings are assigned from A (high quality) to C (low quality) (Dang & Dearholt, 2018). The higher level of the evidence and the quality most likely represents best practices.

Interventions aimed at behavioral changes that promote a healthy lifestyle are the foundation for weight management programs (Cavero-Redondo et al., 2020). Self-monitoring, goal setting, and social support are paramount for success (Dounavi & Tsoumani, 2019; Mangieri et al. 2019). Mobile health interventions can offer a solution to help target this epidemic issue. A systematic review and meta-analysis were conducted by Cavero-Redondo et al. (2020) to estimate the effect of weight management interventions that are focused on behavioral changes using self-monitoring strategies with mHealth. It also assessed adherence to those interventions when mHealth was utilized. The authors conducted a literature search in four

electronic databases for experimental studies following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

The studies reviewed by Cavero-Redondo et al. (2020) met thorough inclusion and exclusion criteria. The studies were published between 2007 and 2019; 17 studies were randomized controlled trials (RCTs) and three were nonrandomized controlled trials (non RCTs). Participants ranged in age between 20 and 59 years, while the sample sizes ranged from 11 to 131 participants in the intervention groups and from six to 133 in the control groups. The intervention using mHealth was delivered using smartphones, PDAs, and webpages, while the intervention in the control group was completed using paper records and usual care. The systematic review conducted by Cavero-Redondo et al. (2020) showed that the use of mHealth in weight management provides moderate weight reduction and better adherence when compared with usual care. The full critique of this study and all of the research included in this literature review can be found in Appendix B.

The systematic review completed by Cavero-Redondo et al. (2020) also showed that interventions delivered via smartphones are more effective in weight management in the adult population. The effect was deeper in short term interventions (less than 6 months) and when compared with the traditional care. Behavioral intervention using mHealth self-monitoring exhibited higher adherence when compared with paper records or any other intervention. In addition, smartphones were demonstrated to be the most effective devices to provide mHealth in weight management. There are some limitations noted to this study, however, as the risk of bias was moderate to high due to the lack of blind interventions, there was no comparison between devices that provide mHealth, and there was a variety of devices or technology used (Cavero-Redondo et al., 2020).

A systematic review conducted by Dounavi and Tsoumani (2019) evaluated the effectiveness of mobile health applications on weight management. A literature search was conducted using two databases, including only peer-review studies. Thirty-nine studies were selected based on inclusion and exclusion criteria; 22 studies were randomized controlled trials, and 17 were nonrandomized studies. The results reported by these authors indicated that patients reported positive attitudes related to the use of mHealth technology and satisfaction with the use of the app as it was found useful for attaining weight loss and exercise goals. These results were seen even in older patients. The use of mHealth apps has shown to be effective in weight reduction, and the led to the betterment of other health indicators such as blood pressure and sugar levels. Another important finding from this study was the positive association among engagement, adherence, and weight loss. In reference to the limitations of this systematic review, risk of bias was high, especially due to lack of blinding in participants and researchers. Additionally, a meta-analysis was not included due to the complexity of the studies (Dounavi & Tsoumani, 2019).

Mangieri et al. (2019) conducted a prospective randomized controlled trial to compare the use of a mobile health application with a standard weight loss monitoring in patients after bariatric surgery. Inclusion criteria comprised adults that underwent laparoscopic gastric sleeve in the previous year; while exclusion criteria were pregnancy, patients with post-surgical complications, and non-English speakers. Patients were randomized in two groups: a control cohort (n=28) and the intervention cohort (n=28). The intervention cohort used an app called MyFitnessPal, as well as training and technical support. The control cohort were encouraged to use journals for self-monitoring and instructed not to use mHealth technology.

The main outcomes measured in the study were the percent of body of excess body weight loss (%EWL) and percent of excess of body mass index (BMI) loss (%EBL) (Mangieri et al., 2019) The secondary outcome was related to quality of life, measured using RAND 36 surveys. In terms of results, the mHealth cohort had better %EWL and %EWL when compared with the control group. Additionally, the mHealth group had a more stable weight loss when compared with the control. However, there were no significant differences in term of quality of life. The study had some limitations due to the low sample size which could lead to type I error. Also, the true effect of mHealth in weight management cannot be shown due to the timing of the intervention (post-surgical), or the short follow up time for patients during the intervention (at least five years is recommended) (Mangieri et al., 2019).

A randomized clinical trial conducted by Gomez-Marcos et al. (2018) analyzed the effectiveness of a smartphone app in a traditional behavior modification program for weight loss. The intervention measured BMI, waist circumference (WC), and body fat percentage (BF%) at three and 12 months. Inclusion and exclusion criteria are included in Appendix B. From 1553 individuals, 833 subjects were chosen to participate, and were randomly assigned one to one to the control (n=418) and intervention group (n=415). Both groups received a counselling session about exercise and a Mediterranean diet. The intervention group received a smartphone with an app designed to promote diet and increase exercise. The trial was single blinded to researchers and assessment nurses. The main outcomes were BMI, WC, and BF%, and the secondary outcome was to examine the effect of the intervention by gender. Other variables were gathered such as employment, education level, and smoking status. Adherence to the app also was obtained (Gomez-Marcos et al., 2018).

With regards to the results, there were no benefits in using a mobile apps after 12 months, but a decrease in WC and BF% was observed in the women of the intervention group that was statistically significant without changes in BMI (Gomez-Marcos et al., 2018). This effect was greater in women 50 years or younger. In addition, an improvement of BMI and BF% was observed after three months of the intervention in participants over 65 years of age. This study has its limitations as well. Due to the nature of the intervention the study cannot be double blinded, the application was only used for the first three months of the intervention, and the drop-out rate was higher than 10% (Gomez-Marcos et al., 2018).

Bennet et al. (2018) evaluated the effectiveness of an app along with provider counseling on weight loss in an RCT that lasted one year. This trial was conducted in North Carolina among a low socioeconomic status population with hypertension, diabetes, and hyperlipidemia. There were 351 participants (men and women) who had a BMI between 30 and 44.9 and had been diagnosed with any of the aforementioned chronic diseases. The participants were randomized using one to one assignment and were not blinded. The intervention group had 176 subjects and the control group had 175 subjects (Bennet et al., 2018).

Bennet and coauthors (2018) reported that the intervention group had access to an app called Track where they could self-monitor four behaviors and set personal goals. The intervention group also received phone calls which focused on social support, motivation, and behavior changes, as well as dietitian counselling. In addition, the participants received counselling from providers at the time of their visits to the clinic. The control group received service training to increase awareness of obesity treatments, self-help materials, and community resources only (Bennet et al., 2018).

In the intervention group, Bennet et al. (2018) found that more that 40% of the participants lost more than five percent of their weight. The engagement of the participants in the intervention group was high, and engagement was positively related to weight loss. In addition, there were significant reductions in blood pressure in both groups, but not changes in hemoglobin, A1C, or lipids. Some limitations to this study include the difficulty of determining which interventions are attributed to success because of the multicomponent nature of the study. Also, the study was done in a lower socioeconomic status population with preexisting conditions, all of which can affect external validity (Bennet et al., 2018).

In another randomized trial that lasted 24 weeks, Brindal et al. (2019) aimed to develop and evaluate a mobile phone application intervention called MotiMate for weight maintenance that improves well-being and engagement. After meeting inclusion and exclusion criteria, 88 participants were randomized in a one-to-one ratio. The trial was controlled and single blinded. All the participants received an application at the baseline visit and there was no face-to-face intervention. The control group had an application that only allowed them to track weight, food intake, and physical activity.

Brindal et al. (2019) reported that the intervention group had the full version of the app where the same variables were tracked, but there was also immediate feedback on weight and meal data. The app would also provide notifications that reminded the participants to enter data. If the participant gained weight, an email was sent, and the subject was contacted by a registered dietitian for further advice or questions. In addition, mood was monitored through the app, and if there was a negative mood change, an email would be sent that provided psychological support. Participants were assessed at baseline, four, eight, twelve, and twenty-four weeks (Brindal et al., 2019).

The primary outcomes in the study were well-being and weight loss (Brindal et al., 2019). Other outcomes were engagement with application, self-efficacy (nutrition, physical activity, and weight loss), resilience, coping, lifestyle behaviors, and demographics. Also, confounding variables such as self-esteem, dietary restraint, optimism was measured at baseline. Mixed modeling was used to analyze well-being, weight, diet, and exercise. Bivariate correlations were used to evaluate relevance of confounding variables. Results showed that the app did not have additional benefits on well-being and weight maintenance. Improvements in life satisfaction and weight loss self-efficacy were noted. Most of the participants maintained their weight with more than 50% remaining at 2% of baseline (Brindal et al., 2019).

In the results reported by Brindal et al. (2019), 40% of participants did lose weight. Participants in the intervention group had more positive attitudes toward the app than the control group and thought that it was helpful for weight maintenance. Furthermore, engagement with the app was higher in the intervention when compared with the control group, but after six months it fell in both groups. There was no association with greater adherence to better weight maintenance effects. Limitations to this study include its small sample size, but the size provided enough evidence to detect effects. Additionally, the study was focused on weight maintenance, but weight loss was attained (Brindal et al., 2019).

A systematic review by Holmes et al. (2018) focused on the effectiveness of mobile technology and telemedicine on weight maintenance. The systematic review followed PRISMA guidelines and was conducted on three electronic databases: MEDLINE, EMBASE, and PubMed. Keywords and search terms were included, articles were screened, and seven RCTs were included in the review. The inclusion and exclusion criteria can be found at Appendix B.

The total number of participants in all trials were 1,939 (lowest 34 and highest 1032) as summarized in Appendix B.

The trials reviewed by Holmes et al. (2018) lasted from three months to 30 months. Trials used text messages, internet-based systems, and email. They measured weight changes, BMI, and BMI standard deviation score. More than 50% of trials showed that technology was effective for weight maintenance when compared to face to face or no intervention in three to 24 months. There was no significant effect in weight maintenance when using digital technology in three trials. The technology was mainly used for self-monitoring and self-reporting. Limitations for this systematic review are the small sample size and the lack of data to complete a meta-analysis (Holmes et al., 2018).

Covolo et al. (2017) conducted a systematic review on RCTs to evaluate the efficacy of smartphone apps that promote a healthy lifestyle following the PRISMA guidelines. The literature search was undertaken using PubMed, EMBASE and Google Scholar. The inclusion and exclusion criteria are mentioned in Appendix B. Forty RCTs were included, and the quality of most of the studies was moderate according to the Effective Public Health Practice Project. In 24 studies, a mobile app alone was used as an intervention. In four studies, an app was used in addition to counselling, while in the remaining studies, a smartphone app was used in conjunction with text messages, e-mails, websites, or devices.

The participants involved in the study conducted by Covolo et al. (2017) are outlined in Appendix B. Ten trials showed effects on lifestyle changes that were statistically significant, 20 showed no effect, and 10 studies presented positive results in some of the outcomes. Weight management, increased exercise, and healthy eating were the main outcomes of the studies. Limitations of the systematic review include the quality of the RCTs, which ranged from

moderate (62%) to weak (38%), the sample selection in some of the trials were biased and non-generalizable, and only three search engines were used to acquire evidence (Covolo et al., 2017).

A systematic review conducted by Gagnon et al. (2015) evaluated factors that facilitated or limited the utilization of mobile health by healthcare providers. A literature search was conducted following PRISMA guidelines on four electronic databases: PubMed, EMBASE, CINAHL, and PsycINFO. Studies were independently reviewed, and 33 studies were chosen based on inclusive and exclusion criteria provided in Appendix B. The most important facilitators found on the review for the adoption of mHealth are the usefulness and easiness to use the technology. Other facilitators noted by Gagnon et al. (2015) included increased patient empowerment and resulting improvements in patient care. This technology is considered ubiquitous, accessible, and provides timely communication between patients and providers. In terms of barriers, adoption of mHealth by providers include affordability of the technology, as well as increased workload and changes in the workflow. The systematic review included both qualitative and quantitative studies but did not have a meta-analysis. Lastly, the search was performed in only four electronic databases (Gagnon, et al., 2015).

In a systematic review conducted by Oosterveen at al. (2017) that followed the PRISMA statement, seven electronic databases were searched: MEDLINE, MEDLINE in process, EMBASE, PsycINFO, Science Citation Index, CINAHL, and the Cochrane Library. The search included articles published between 2000 and 2015. The systematic review contained only RCTs, and the aim of the review was to evaluate the effectiveness of mobile health in smoking cessation, alcohol intake, exercise levels, obesity, and healthy diet in young adults. The studies were reviewed independently, and 45 studies were chosen. Out of these 45 studies, seven were on smoking, one was on nutrition, 26 were on alcohol, four were conducted on exercise, four on

obesity, and three focused on multiple lifestyle behaviors. This systematic review showed that mobile health interventions are more effective at encouraging behavior changes when compared to control groups. The strongest evidence found was on a study in which alcohol consumption per week decreased significantly after the digital intervention. Most of the studies which evaluated behavioral changes that targeted smoking, nutrition, alcohol consumption, physical activity, and obesity, demonstrated that the effectiveness of behavioral changes was higher when using mHealth (Oosterveen et al., 2017).

In addition, the review conducted by Oosterveen et al. (2017) showed that different types of mobile health can facilitate behavior changes. Among the limitations of this review are the lack of single or double blinded studies, unclear bias selection and or reporting, and the fact that many of the studies were on alcohol intake and smoking cessation. Other limitations include the absence of long-term evaluations and the reality that most of the studies were conducted in the United States, decreasing the chances of generalizability.

A qualitative study done by Byambasuren et al. (2020) examined the barriers and facilitators that healthcare providers and patients encounter when recommending a smartphone application. Participants were recruited using purposive sampling and interviews were conducted in 20 healthcare providers and 15 patients. The interview was designed to discover the attitudes towards mHealth apps, thoughts on recommending apps and perceived barriers and facilitators to prescribe mobile applications.

Most healthcare providers and patients recognized the benefits of mobile health apps, but a lack of knowledge, absence of trustworthy app sources, technology literacy, time constraints, and privacy and security were some of the barriers noted (Byambasurem et al., 2020). Other barriers cited were the age of the patient and healthcare provider (old age negatively impacts use

of mHealth apps), a lack of education, and training (Byambasurem et al.,2020). Among the facilitators noted were having a good source to obtain information about apps, the ubiquity of smartphones, and the recommendation from a healthcare provider. The limitations of this study were its small sample size, the demographics of the participants that decreased generalizability, and possible interviewer bias (Byambasuren et al., 2020).

Leigh et al. (2020) conducted a discrete choice experiment to determine the barriers and facilitators of mHealth app use in healthcare providers. A survey was sent using social media and 222 responses were received. The factors identified that facilitate mHealth app prescribing were the approval by a governmental organization (National Health Service), published studies, cost of the technology, and a recommendation by another healthcare provider. Barriers found in this study by Leigh et at. (2020) were the cost of the app as well as the notion that the older the healthcare provider, the less likely they were to prescribe a mobile app. One of the strengths of this study was the combination of a qualitative pilot test followed by a quantitative assessment of attitudes regarding mHealth apps. There were some limitations such as the sample size, and relevant attributes that factor into the decision of the provider to prescribe an app were not provided (Leigh et al., 2020).

A study conducted by Byambasuren et al. (2019) evaluated knowledge and use of mobile apps in general practitioners, along with barriers and facilitators in the prescription of those apps. In addition, solutions were explored as well. A survey with 50 questions was sent through email to general practitioners but only 16 questions were analyzed. The survey was sent to 21,884 health care providers (HCPs) and 1014 HCPs responded to the survey (Byambasuren et al., 2019).

More than 60% of HCPs use apps and 50% of them recommend apps to patients (Byambasurem et al., 2019). The main barrier was the inadequate knowledge about effective apps and reliable sources to access them (Byambasurem et al., 2019). The main solution proposed to overcome barriers to use mHealth app is an educational intervention on health apps through an online video or a webinar. Another solution is to provide a list of evidence-based apps that are safe and effective. The strengths of this study were the specificity of the survey, which provides more data on barriers and possible solutions, and a high completion rate. The limitations were selection bias and the small response rate from the HCPs (Byambasuren et al., 2019).

Literature Synthesis

mHealth and Lifestyle Changes

Healthy lifestyle factors are positively associated with reduction of all causes of mortality by 66% (Covolo et al., 2017). Behavior changes can be difficult to obtain, which is why researchers are focusing on different strategies to promote those changes (Cavero-Redondo et al., 2020). Self-monitoring is a strategy that encourages healthy behaviors (Gomez-Marcos et al., 2018) and increases awareness of fundamental behaviors such as food intake, meal quality, and physical activity among others (Cavero-Redondo et al., 2020). Behavioral interventions can be implemented through different channels such as mobile health.

According to the European Commission, mHealth may provide a solution to enhance patient participation, as well as responsibility towards their health and increased adherence to lifestyle changes (Covolo et al. 2017). A systematic review was conducted by Covolo et al. (2017) and found that there is low evidence that supports that use of mHealth to modify unhealthy behaviors, but the quality of the studies selected can damper those results, as can low

accuracy of the app content, or lack of a healthcare provider guidance. On the other hand, a systematic review conducted by Oosterveen et al. (2017) found that mobile health is an effective tool to promote behavioral changes that are directed to improve smoking rates, nutrition, obesity, physical activity, and alcohol consumption.

mHealth and Weight Loss

Weight loss management and maintenance are based on behavior modifications that promote healthy diet and physical activity. Technology, such as mobile health, aimed at self-monitoring can be an effective strategy in weight loss (Gomez-Marco et al., 2018) providing self-efficacy, adherence, and motivation (Cavero-Redondo et al., 2020), and providing a path for long term changes (Gomez-Marco et al., 2018). In a systematic review by Dounavi and Tsoumani (2019), mHealth apps were an effective approach for weight management and improvement of health outcomes. One important finding was the positive association of adherence with weight loss and the increasing use of this technology to provide behavioral interventions that target weight loss. These results were highly generalizable due to the characteristics of the participants, but an important limitation of the quality of the research was that it was not free of bias (Dounavi & Tsoumani, 2019).

The effectiveness of mHealth in weight loss is also seen in another systematic review and meta-analysis by Cavero-Redondo et al. (2020), where self-monitoring strategies promote weight loss and increased adherence while using mobile health technology. Another important finding in this systematic review is that smartphones are the most effective device in mobile health for weight loss (Cavero-Redondo et al., 2020). The work conducted by Cavero-Redondo et al. (2020) had its limitations due to risk of bias. Similarly, Bennet et al. (2018), compared the efficacy of primary care counselling for weight loss with an intervention where a smartphone app

that provided behavioral interventions for weight loss along with counselling for one year. In this randomized controlled trial almost half of the intervention group lost at least 5% of their starting weight and their level of engagement was high.

Finally, there is evidence suggesting that mHealth interventions combined with healthcare counselling offer excellent outcomes as seen in an RCT conducted by Bennet et al. (2018). When comparing bariatric surgery with medical weight loss programs, surgical ones are more successful at one year, but behavior modification practices are still needed for long term results. In an RCT conducted by Mangieri et al. (2019), an intervention was put in place to enhance weight loss in patients after surgery using mHealth. Patients in the intervention group obtained better results when compared to the control group and had stable weight loss over the next two years. The effectiveness of mHealth was not observed in an RCT conducted by Gomez-Marcos et al. (2018) in terms of weight loss, but body adiposity measures were lower after the intervention in women. Even though the BMI did not change, there were still health benefits to the patient's morbidity and mortality.

mHealth and Weight Maintenance

According to the National Weight Control Registry, in the United States only 20% of people who lose weight maintain their weight after two years (Brindal et al., 2019). If weight loss can be maintained for two to five years, long term success increases considerably. mHealth interventions are proven to be successful for weight maintenance (Brindal et al., 2019). In a systematic review done by Holmes et al. (2018), the effectiveness of mHealth in weight maintenance was assessed. It was found that digital technology may be effective for weight maintenance, especially in the first two years.

MotiMate was a smartphone application proposed for weight maintenance (Holmes et al., 2018). Brindal et al. (2019) developed an RCT using this application to assess weight maintenance. Most participants maintained their weight regardless of the app, but almost half of the participants experienced weight loss. In addition, positive attitudes such as awareness and support were reported.

mHealth and Healthcare Providers

Mobile health enhances health services through improvement of health delivery and providing support not only to patients but to health care providers as well. It also focuses on communication between patients and healthcare providers. Yet the success of mobile health interventions is driven by their adoption by providers (Gagnon et al. 2016). According to a systematic review by Gagnon et al. (2016), mobile health was perceived as easy to use, useful, supportive of patient empowerment, supports patient-health care provider relationships, and improves patient care. Barriers highlighted in the review were cost issues, disruption of workflow, and a greater workload (Gagnon et al., 2016).

In the quality study by Byambasuren et al. (2020), some of the barriers and facilitators noted were also found in the systematic review conducted by Gagnon et al. (2016). The main barrier noted was older age, not just from the provider but also from the patient. Other barriers were lack of knowledge and trustworthy sites to access apps, lack of educational interventions, time constrains to integrate the technology to the practice, poor app use, as well as safety and privacy issues. The ubiquity of smartphones promotes the use of mobile apps and the mobile applications perceived benefits (Byambasuren et al., 2020).

In another study by Byambasuren et al. (2019), the same barriers were found as in the quality study by Byambasuren et al. (2020). In the study conducted by Byambasuren et al.

(2019), an educational intervention was proposed to overcome those barriers, as well as a list of effective and evidence-based apps to HCPs to increase use of mHealth apps. Other facilitators found in a study conducted by Leigh et al. (2020) for mHealth use in practice include a recommendation by a government organization, recommendation by another healthcare provider, or a published study that supports the use of mHealth applications. The barriers found included mHealth app costs, healthcare, and patient age.

Gaps in the Literature

Even though most of the studies that were assessed were done in the last two years, there are still gaps in the literature about mHealth and weight management. Some of the limitations are the lack of quality of randomized controlled trials, samples sizes being too small, or studies that had a short duration. Another important point is that those applications or websites which were used for improving health delivery, care, and access, should be regulated by official entities to provide scientific literature that assesses validity and reliability of the data that has been provided by mobile health interventions (Covolo et al., 2017). During the literature search, several preliminary and clinical protocol studies with longer duration and bigger sample sizes were encountered, hoping that those studies help to close the gap in this issue (Boh et al., 2015; Cattivelli et al., 2018; Duncan et al., 2018; Evans et al., 2015). One of these protocols encountered was a randomized control trial that will examine the efficacy of mHealth in weight loss in overweight and obese patients. The study will use a multicomponent behavioral program that will target diet, exercise, and sleep through mHealth. This intervention will be delivered via an application, and it will be supplemented with text messages, email, and in-person counselling. The assessments will be done at baseline, six months, and 12 months (Duncan et al., 2018).

Purpose/PICO Clinical Question/Objectives

The purpose of this quality improvement project was to increase knowledge among staff about the use of mobile health in weight management and increase perceived competence to use this technology as it will be further implemented in the clinical setting. Therefore, the PICO question was: In a specialized bariatric clinic (P), does staff education (I) compared with no education (C), increase staff knowledge and perceived competence to integrate mHealth as part of standard patient care in weight management (O)?

The main goal of the project was to improve staff knowledge in Florida Bariatrics and Nutrition, LLC (FBN) and increase perceived competence regarding the use of mHealth. The objectives of this project were:

- To evaluate the knowledge of mHealth in the FBN staff with a pre-intervention survey within the first month of the project implementation.
- To appraise the staff perceived competence in using mobile health with a pre-intervention survey that would take 10- 15 minutes to complete.
- To provide three, 10 to 15-minute educational training sessions to staff on mHealth and its use in weight management over the course of a six-week period.
- To increase staff knowledge and perceived competence on the use of mHealth by 25% from the pre- to the post-educational phase two weeks after the training.

The expected outcome was to obtain an average of 90% or higher on post-assessment scores in staff knowledge and on perceived competence in the use of mHealth after an educational training provided in a six-week period. The long-term goal was to implement the use of this technology in the weight management program. This technology will be used to complement the in-person consultations and it will provide a cost-effective and patient centered care weight management program.

Definition of Terms

To provide clarity, terms are defined as follows:

- mHealth: Also called mobile health, mHealth is the use of mobile technology to improve health services. This technology can be short-distance, long-distance, or delivered through a device. Mobile technologies include smartphones, monitoring devices, personal digital assistants, tablets, and media players, among others (Gagnon et al., 2016).
- mHealth applications or apps: Software programs that are focused on health prevention and treatment that can be accessed on smartphones, tablets, or other devices (Dounavi & Tsoumani, 2019).
- Bariatrics: A medical field that focuses on the causes, prevention, and treatment of overweight and obesity (Davis, 2021).
- Body mass index (BMI): A tool that screens for weight categories and its based-on weight and height. It measures body fat indirectly (CDC, 2020).
- Underweight: Defined by a BMI less than 18.5 (CDC, 2020).
- Healthy weight: Defined by a BMI between 18.5 and 24.9 (CDC, 2020).
- Overweight: Defined by a BMI between 25 and 29.9 (CDC, 2020).
- Obesity: Defined by a BMI of 30 and above (CDC, 2020).
- Weight management: Behavioral interventions that are aimed to healthy diet, and physical activity that are conducive to weight loss (Gomez-Marcos et al., 2018).
- Weight loss maintenance: Defined as losing equal or more than 10% of one's body weight and maintaining that weight for at least one year (Holmes et al., 2018).

Conceptual Underpinning and Theoretical Framework

Nursing Theory serves to guide nursing practice, and it helps explain the phenomenon of interest through concepts and propositions that describe the relationship among them (Moran et al., 2019). There are grand theories, middle-range theories, and practice theories. Research validates theory and it can lead to additional development of theory. Theory and research aids in the process of informing practice (Moran et al., 2019). The nursing theory chosen as the conceptual underpinning for this project was that of Orem's Self-Care.

Theory Overview

Dorothea Orem's theory focuses on the ability of the individual to provide self-care. Self-care is defined as all the activities that help maintain health, life, and well-being. The self-care theory is composed of three theories: the theory of self-care, the self-care deficit theory, and the theory of nursing systems (Younas, 2017). The theory of self-care is a description of how human beings care for themselves and why. The theory of self-care deficit provides a clarification that those caring behaviors can be enhanced through the nursing profession. And lastly, the theory of nursing system explains the relationship between patients and nurses and the importance of those relations for quality care provision (Younas, 2017).

According to Orem (2015), there are two types of human beings, the ones who need nursing care and the ones who provide it (Younas, 2017). The first assumption that Orem has about human beings in general is that they have their own capacity, power, values, and ideas, while the second assumption is that human beings have their own needs, but also are responsible for their care and self-support. This theory explains that nursing provides the assistance needed in order to prevent disease, promote health, and support life (Younas, 2017). Nursing enables patients to increase skills related to self-care by improving their knowledge and willingness (Afrasiabifar et al., 2016).

Clinical Fit

The theory of self-care places importance over human beings and their need for self-maintenance and self-regulation that can be attained through self-care (Younas, 2017). Human beings can engage in self-care actions not only for themselves, but also for others. They are able to interact with others and their environment to develop self-care abilities for survival (Younas, 2017). Self-care includes actions that meet the needs of care. Knowledge of diseases or health issues is essential for self-care promotion (Riegel et al., 2019). Self-care is essential in prevention and treatment, as well. Those actions are called deliberate actions by Orem, and they are learned in life through communication and human interaction (Younas, 2017). Deliberate actions can be taken by patients once they are aware of the situation and have the capacity to manage it. Deliberate actions also can be taken by nurses in order to provide the knowledge and skills to patients that need them (Younas, 2017).

This theory fits the clinical problem because it places the responsibility on the patient and the importance to be actively involved and knowledgeable on the set of skills needed to treat or prevent obesity and overweight. In addition, nursing is not only there to provide the knowledge required to engage in self-care behaviors, but also to support, empower, and motivate patients. According to Riegel et al. (2019), there is evidence that self-care behaviors and interventions improve patient well-being, decrease morbidity and mortality, and decrease healthcare costs.

Theory Evaluation

Nursing theories promote patient centered care. Patients with chronic diseases such as obesity need motivation, goal setting, and tools that help them perform behaviors that maintain health, improve health outcomes, and increase their quality of life (Khademian et al., 2020). Self-care theory focuses on those concepts. This theory not only helps to enable patients to perform

self-care behaviors but helps care agents improve those skills. The self-care model also focuses on knowledge improvement, not only in patients, but in health care providers and staff, to increase their self-care agency (Afrasiabifar et al., 2016).

Theory Operationalization

Self-care theory is used to assess self-care knowledge, motivation, and needs. There are three nursing systems that can be used to fulfill those self-care needs: the wholly compensatory system, the partially compensatory system, and the supportive educative system (Mohammadpour et al., 2015). The supportive educative system was used for this problem and the nurse, staff, or healthcare provider acted as an educator, supporter, and counsellor. This knowledge in mHealth will increase self-care abilities and reduce self-care deficits to empower and teach others important skills regarding self-care directed to weight management. Mobile technology can be used as a tool to support self-care behaviors as well as helping to promote patient engagement (Riegel et al., 2017).

Theory Application

Orem's self-care theory is considered a grand nursing theory and can be applied to a variety of instances across nursing (McEwen & Wills, 2019). The main purpose of the self-care model is to assess self-care skills and identify any deficits in order to be able to fulfill them by either providing the care directly or through education of the patient (Afrasiabifar et al., 2016). This theory has been used mainly in rehabilitation and primary care (Mohammadpour et al., 2015). This theory has been applied to reduce morbidity and mortality, reduce healthcare costs (Afrasiabifar et al., 2016), and improve health outcomes (Mohammadpour et al., 2015).

Dorothea Orem's self-care theory is useful to guide nursing practice, research, education, and management (Younas, 2017). Picket et al. (2014) generated a middle range theory for weight

management out of Orem' self-care theory (as cited in Younas, 2017). This theory has been applied to a variety of different diseases, the majority of which were chronic in nature, such as congestive heart failure, asthma, end stage kidney failure, cystic fibrosis, and diabetes mellitus, among others (Afrasiabifar et al., 2016). Finally, a variety of colleges and schools of nursing have based their curricula on the self-care deficit nursing theory, as well as hospitals and ambulatory care centers using it as a foundation for their nursing care (McEwen & Wills, 2019).

Theory Performance

Orem's self-care theory has also been used in research in patients with chronic diseases. The effectiveness of this theory in quality of life and self-efficacy has been evaluated in a study conducted by Khademian et al. (2020), which showed that an educational intervention based on Orem's theory increased quality of life in patients with hypertension. Afrasiabifar et al. (2016) found that the use of the self-care model by Orem was significantly effective to reduce fatigue in patients with multiple sclerosis. According to Mohammadpour et al. (2015), Orem's self-care theory has been shown to be effective in improving patient outcomes. In a study conducted using an educational intervention based on the self-care theory of Orem, researchers showed that it was helpful for healthcare providers to identify and satisfy the healthcare needs of the patients (Mohammadpour et al., 2015).

Theory Relationship

The main goal in the management of chronic diseases is to increase quality of life and maintain or improve health (Borji et al., 2017). Obesity is considered a chronic disease and it is also the main contributor to a variety of other chronic diseases, including diabetes and hypertension (Wang et al., 2017). Self-care programs may improve quality of life, patient's well-being, and healthcare outcomes. These programs can further decrease morbidity and mortality, as

well as healthcare cost (Riegel et al., 2017). Self-care regulates factors on growth and performance related to life, health, and well-being (Borji et al., 2017).

According to Borji et al. (2017), self-care behaviors place responsibility on the patient, emphasizing their active role on their own health. The self-care model by Dorothea Orem provides guidance in planning and implementing the concept of self-care. The theory highlights the importance of self-care behavior in human beings and when this ability is lost, nurses play an important role in helping regain this ability through direct care or educational support (Borji et al., 2017). This theory will help guide education and training of healthcare providers and staff on technology and skills to treat obesity and overweight successfully.

Level Congruence

There are five assumptions in the self-care deficit theory by Orem. The first assumption is that human beings stay alive and functional through communications with others human beings and their environment (McEwen & Wills, 2019). Furthermore, human beings identify their needs and make judgements based on those needs. Additionally, if mature human beings have a deficiency of self-care, these may have consequences in function and life sustaining regulatory actions (McEwen & Wills, 2019). Moreover, human agency discovers, develops, and transmits to others how to identify their needs and provide advice to themselves and others. Last, a group of human beings can provide care for other human beings (McEwen & Wills, 2019). Orem's theory is congruent with the clinical problem which is obesity and overweight and its management. Increasing knowledge in staff and healthcare providers about the use of mHealth will help provide tools to help with patient self-care and improve outcomes. This theory helps empower the human agency but also the patients.

Theory Tools

There are no tools attached to the self-care deficit theory by Dorothea Orem (Barreto de Mendoza et al., 2017). Many tools in research have been formulated based on the self-care requisites that Orem defined to provide self-care. There are three categories of universal self-care, developmental self-care, and health deviation self-care requisites (Younas, 2017). Barreto de Mendoza et al. (2017) constructed and validated a self-care assessment instrument for patients with diabetes mellitus type two based on the health deviation self-care requisites. In another research study by Afrasiabifar et al. (2016), an assessment tool was created based on an evaluation of self-care needs that included self-care requisites and self-care agency. This study was conducted to determine the effect of the self-care model in patients with multiple sclerosis and fatigue (Afrasiabifar et al., 2016). While these tools cannot be used in the DNP project, they demonstrate how the theory has been operationalized into measurable tools.

Methodology

The purpose of this project, which was summarized by the PICO question, was to increase knowledge and perceived competence in using mHealth in weight management at Florida Bariatrics and Nutrition (FBN). This project used a pre/post intervention approach. A pre-intervention survey and a demographic survey was obtained before providing staff education. After the educational intervention, a post-intervention survey was given to participants to evaluate if an increase of knowledge and perceived competence was attained in staff completing or not completing the educational program.

Settings and Participants

The project was implemented at FBN, a medical bariatric office located in Miami Dade County, Florida. This practice is adjacent to Metro Med of Miami, which is a primary care practice, and patients are often referred in both directions. The practice employs two board

certified physicians and three board certified Family Nurse Practitioners. One of the physicians is board certified in Internal Medicine, Pediatrics, and is board eligible in the American Bariatric Society, while the other one is board certified in family medicine. The providers, as well as staff, serve both offices. There are approximately 15 to 20 patients seen per day at the FBN.

The practice is open Monday, Tuesday, Thursday, and Friday from 9:00 am to 5:00 pm and Wednesday from 11:00 am to 7:00 pm. The patients are evaluated weekly by the medical assistant, and they are seen by the provider on their first and second visit, once a month and whenever there is an issue with weight loss, the program, or medications. The office has its own lobby, front desk space, two consultation rooms, and a medication dispensary. There are three provider offices, as well as administrative space, and the manager's office. There is also a lab and an EKG room that is shared with Metro Med of Miami.

The participants in this project were the providers and staff from FBN. The eligibility criteria included adult employees over the age of 18 years who have direct contact with patients from FBN, are English speakers, and can be male or female. The exclusion criteria included staff that has indirect or no contact with FBN patients.

Description of Approach

The implementation of this project started by obtaining an Institutional Review Board (IRB) approval from Florida International University (FIU). The IRB protocol was submitted on January 30, 2021, to secure approval, which was granted on March 17, 2021. Appendix C includes the formal IRB letter indicating the approval of this study from the facility. In addition, the training program was created with mentor and project leader input during the first weeks of February 2021. The components of the training program included background information about the effectiveness of mHealth to support weight management, how mHealth can utilize behavior

modification strategies that are helpful in weight management, and a list of mHealth technology and its different uses in weight management. This information was based on the literature review. The educational training was divided into three sessions of 10 to 15 minutes each and was presented in a narrated PowerPoint presentation to participants. These sessions were emailed to participants.

During mid-April 2021, a conference was held with the project leader, stakeholders, and possible participants. This meeting took place through Zoom, the online platform, to ensure safety due to the COVID-19 pandemic. Potential participants were staff from Florida Bariatrics and Nutrition office who have direct contact with bariatric patients. During this meeting, a thorough description of the program was explained to potential participants. In addition, inclusion and exclusion criteria, participants' expectations, and potential risks were discussed. At the end of the meeting, the project lead allowed time for questions and provided contact information for further concerns.

For those participants who met the inclusion criteria and decided to participate in the project, a consent form via email was provided. The consent form delineated the purpose and duration of the study, the number of participants, and the risks and benefits of the study. Informed consent also assured participants about confidentiality and provided researcher and IRB contact information. The informed consent form can be found in Appendix D. After the consent was signed, a pre-intervention survey was provided to participants via SurveyMonkey, an online survey platform that can be accessed by participants through their mobile devices or their desktop or laptop computer, to assess knowledge on mobile health, and perceived competence to recommend mHealth to patients in weight management. In addition, a demographic survey link was also provided through SurveyMonkey. Those links were emailed to

participants. Instructions were outlined, and assistance was offered. Participants were given two weeks to complete the pre-intervention and demographic surveys.

After all the forms were filled out, an educational intervention that consists of three sessions of approximately 10-15 minutes each was sent to the participants during the month of June 2021. These educational sessions were delivered through a pre-recorded PowerPoint presentation sent via email to the participants. A follow-up email was sent reminding participants to watch the educational interventions and informing that a two-week period was provided to complete the sessions.

At the end of the two-week period, a post-intervention survey, available via SurveyMonkey, was emailed to the participants to measure knowledge of mHealth and perceived competence to recommend this technology. The project leader sent a reminder email, text messages and/or phone calls to those participants who did not complete the post intervention survey within one week. Tracking the participants by email, it was possible to see if any of the participants had failed to complete the assessment within the one-week time frame. The surveys and forms that were used in the implementation were based on the literature review with the assistance from the project advisor and project faculty advisor. These forms were reviewed and revised by three peers to ensure validity. The same assessment tool that was used to evaluate baseline staff knowledge was used for the post-intervention, with the questions rearranged to help reduce instrument exposure bias that may have influenced the results. Additionally, the demographic survey assessed participants' characteristics such as age, gender, race, and level of education. The data was analyzed during June and July 2021. Furthermore, results will be reported to stakeholders and participants during the Summer 2021, and later results will be disseminated to the community via conferences and/or journal publishing.

Protection of Human Subjects

In preparation for the DNP project, the project leader has completed the online Collaborative Institution Review Board (IRB) Training Initiative Program (CITI) for all researchers. Permission to complete this project was obtained from Florida International University's IRB (Appendix C). Further, participants were made aware that participation in the study was entirely voluntary, and they had the right to leave the project at any time without any repercussions to themselves or in their relationship with superiors. Risks and benefits from the project were discussed with participants. The informed consent form found in Appendix D outlines each of these issues.

The benefits to participants in this educational intervention included an increase of knowledge in mHealth and its use in weight management, and it also increased confidence in use of this technology. This project also supported their growth as professionals and empowered them to utilize technology, not only for its own sake, but in order to increase benefits and outcomes for their patients. Among the potential risks of the project to participants were loss of confidentiality and participant's privacy. Other risks may have included anxiety or stress due to underperformance, the loss of internet connectivity during the Zoom meetings, a feeling of embarrassment in needing to ask questions or clarify instructions, or thoughts of losing employment due to lack of participation in the project.

These issues were detailed in a letter of informed consent that was signed by all participants (Appendix D). All forms and surveys completed by participants were coded using a four-digit random code. This code was obtained while inputting participant data in an EXCEL spreadsheet and selecting the RANDBETWEEN function to obtain the four-digit random code. This information was stored in a password-protected laptop, as this helped protect participant's

confidentiality, privacy, and preservation of dignity. In addition, all other documents were stored in the same password-protected laptop, and participants did not have access to other participant's surveys.

Data Collection

There were two outcome measures: knowledge in the use of mHealth in weight management and perceived competence to recommend the use of mHealth to patients in weight management. The tools that measured these two outcomes were developed based on the literature review with help from the project advisor and project faculty advisor. These tools were reviewed and revised by three peers to ensure for validity (see Appendix E). In addition, participants characteristics were evaluated using a demographic survey which was obtained from the internet. This form assessed age, gender, race, and level of education in participants (see Appendix F).

Analysis of demographic data used descriptive statistics including mean, standard deviation, and frequency, employing a Mann Whitney U test, also called the Wilcoxon rank-sum test. This test served to compare the differences between two independent samples, especially when the samples are not normally distributed and the size is small (Moran et al., 2020). This test can find if there is a statistically significant difference between the pre- and post- intervention survey. The alpha used to determine the level of statistically significance was 0.05. This analysis would confirm if an educational intervention directed to the staff of a specialized bariatric practice improves knowledge and perceived competence in the use of mobile health in weight management.

Data Management

The data was de-identified as soon as it was collected by the project leader. A four-digit code was assigned to each participant to identify them throughout the project. The

documentation that linked the participant with the de-identifying number was stored in a password-protected laptop along with the other project data. This laptop remained in the possession of project leader, and participants did not have access to those documents at any time. Hard copy files were stored in the site administrator's office during the quality improvement project. After the project concluded, those hard copies were scanned into a digital file which was kept in the laptop. The hard copies were shredded immediately after scanning into this digital file. Five years after the implementation of the project, all digital files will be destroyed, by shredding and recycling the computer hard drive.

Discussion

The methodology selected for this quality improvement project provided a useful foundation for comparing the results obtained between those participating in the educational intervention and those not. Through the use of this particular methodology, it was possible to accurately determine if providing this type of educational intervention provides a significant difference for provider education and clinical knowledge. Demonstrating the significance of these results will provide further evidence to the medical community in their ability to effectively provide needed support for their patients in their weight-loss journey. Over the long term, this should lead to wider implications among the general population as the greater employment of mHealth as a part of standard patient care in weight management.

Results

With the implementation of this project, it was demonstrated that knowledge of the use of mHealth and the perceived competence to recommend mHealth for weight management increased among Florida Bariatrics and Nutrition staff members. After the intervention, it was expected that the participants will score 90% or higher in the post-intervention survey, and their

score was 96.75% higher than the pre-test. These outcomes will help lay a foundation to implement a cost-effective solution that enhances weight management programs for the foreseeable future. This project should improve outcomes in those patients that seek weight loss and provide a long-lasting solution to obesity and been overweight.

Demographic Data

The following sections detail how demographic data is presented for this project, including age, gender, and education level. Demographic information collected during this project is summarized in Table 1 below. The gender distribution was balanced, 50% female and 50% male (Figure 1). The data indicated that the age of participants ranged from 30-69 years of age, with the mean age of 45.5 years and a standard deviation of 9.94. Most of the participants fell on the 40-49 range of age (40%), followed by 30-39 (30%), 50-59 years of age (20%), and 60-69 years (10%) (Figure 2).

In terms of race, six options were provided to choose from: “White, Black, Asian/Pacific, Hispanic, Native American, I prefer not to answer”. Of the 10 participants, 8 (80%) selected Hispanic and 2 (20%) selected white (Figure 3). In terms of education, participants were asked to describe their level of education, the majority of the participants (40%) had a Master’s degree, 30% had an Associate’s degree, and the 30% remaining was divided among Doctorate degree, Bachelor’s degree, and some college (10% each) (Figure 4).

Table 1

Demographic Characteristics of Program Participants

Descriptor	Group (n= 10)
Gender	
Male	5 (50%)

Female	5 (50%)
Age	45.5 (s.d. 9.94)
Race	
White	2 (20%)
Black	0
Asian/Pacific Islander	0
Hispanic	8 (80%)
Native American	
Level of Education	
High School	0
Some College	1 (10%)
Associate degree	3 (30%)
Bachelor’s degree	1 (10%)
Master’s degree	4 (40%)
Doctorate degree	1 (10%)

Figure 1 Gender

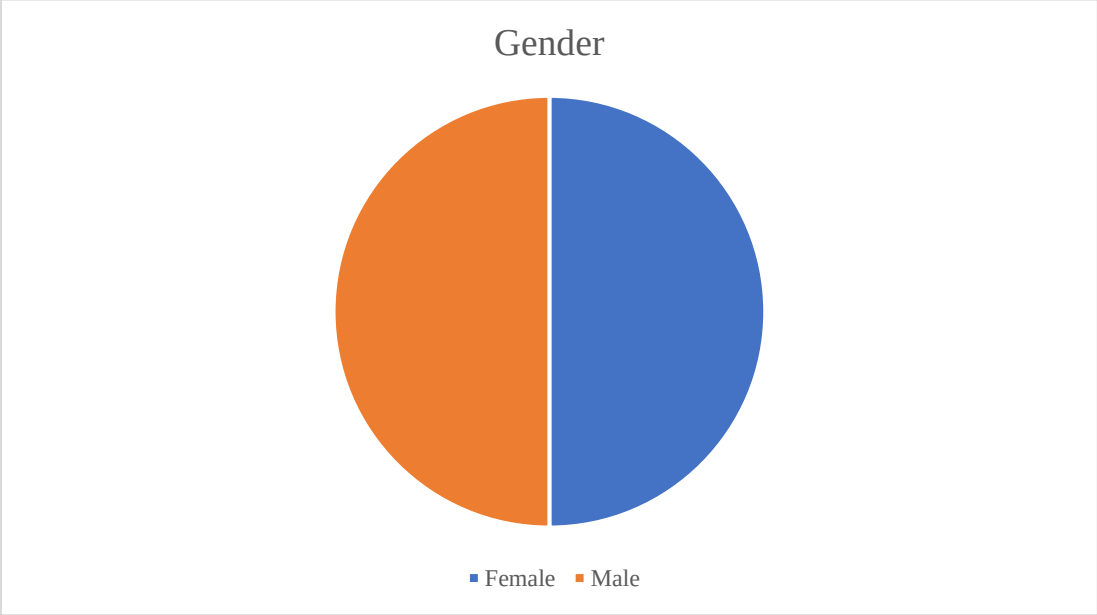


Figure 2 Age

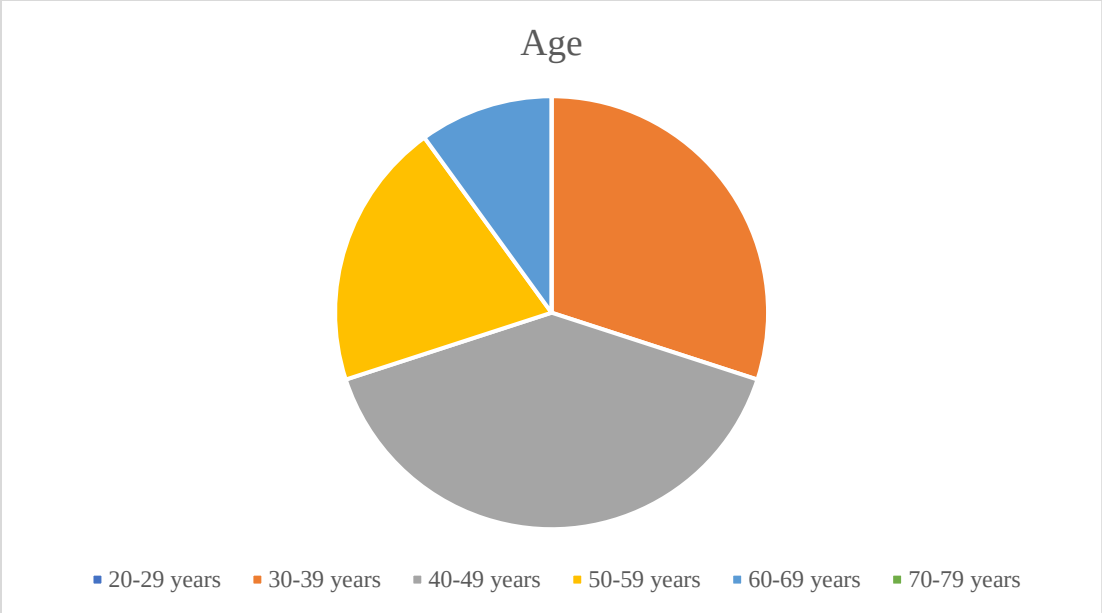


Figure 3 Race

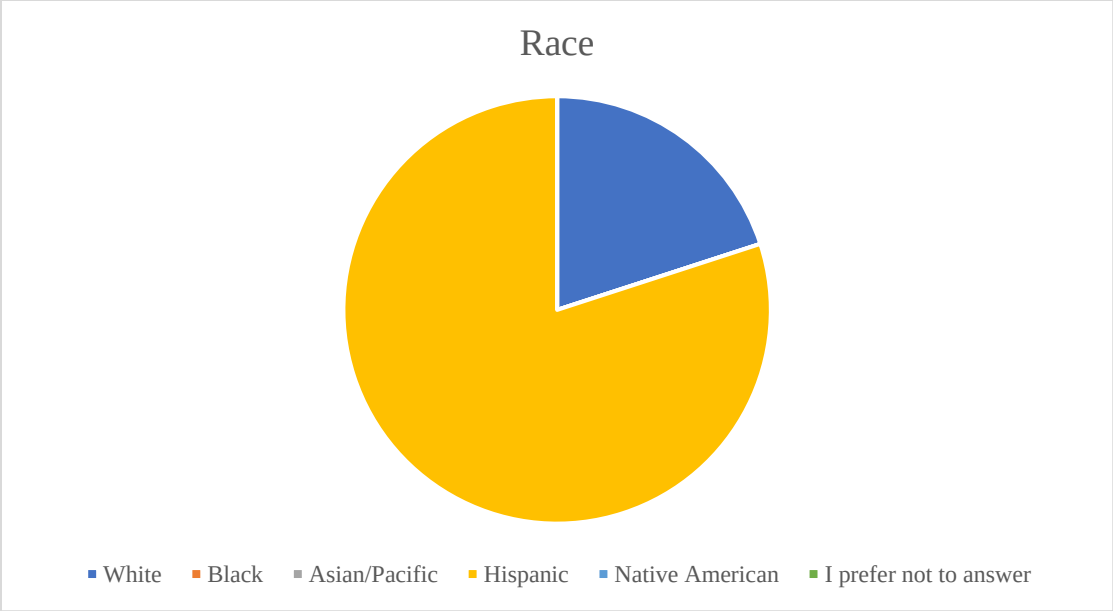
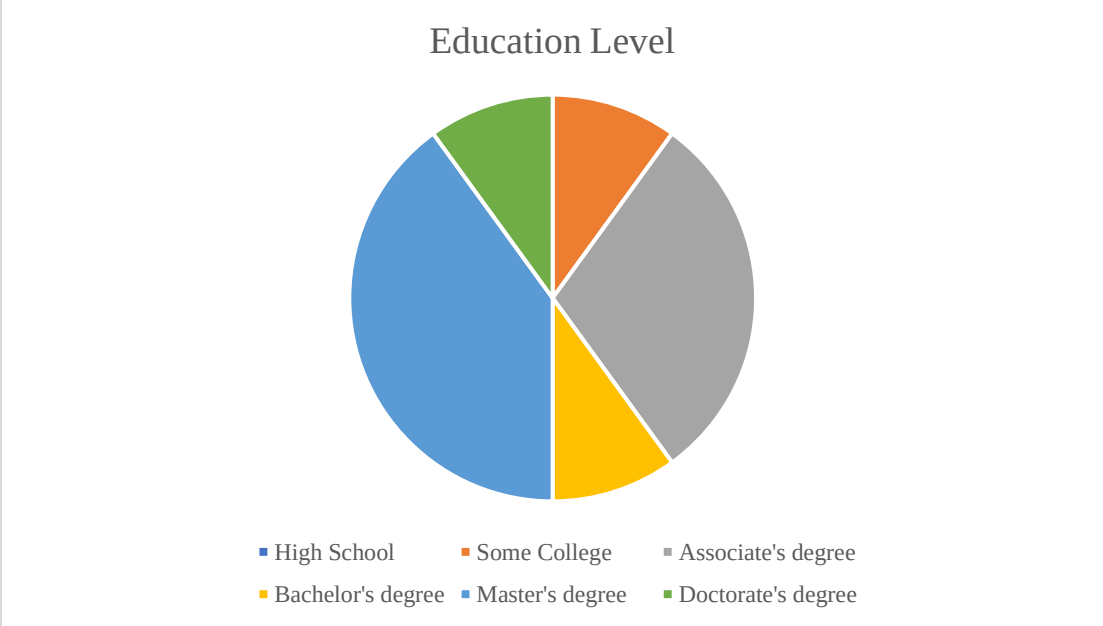


Figure 4 Education Level



Additional descriptive data from the project included the mean scores from the pre- and post-assessment scores. The mean scores for the pre-intervention assessment showed a mean of 31.5 with a standard deviation of 7.749. The mean scores for the post-intervention assessment revealed a mean of 38.7 with a standard deviation of 2.668. Table 2 below includes a review of

the mean scores obtained from both tests. There was an increase in knowledge scores between the pre- and post-intervention test by 18%. The post-test intervention was at 96.75%.

Table 2

Mean Knowledge Scores for Participants Before and After Education

	Participants (n = 10)
Mean Pre-Intervention Knowledge Scores	31.5 (s.d. 7.749)
Mean Post-Intervention Knowledge Scores	38.7 (s.d. 2.668)

Each of the eight items of the knowledge and competence survey were analyzed individually (pre-and post-intervention) to assess which areas the educational intervention was most helpful. The items will be analyzed and discussed separately and includes:

1. I know what mHealth means.
2. I am able to describe the different mHealth technologies that can be used in weight management.
3. I know the efficacy of mHealth in weight management.
4. I know how mHealth support weight management.
5. I feel confident in my skills to use mHealth technology in my daily work.
6. I am confident in communicating the benefits and advantaged in using mHealth in weight management.
7. I feel confident explaining to patients in the medical bariatric practice how mHealth will support weight loss.
8. I feel confident recommending mHealth to patients in weight management.

Each item asked participants to rate their confidence level using a Likert scale of extremely confident (5), very confident (4), somewhat confident (3), not very confident (2), no confident at all (1).

Item 1. The first item stated, "I know what mHealth means". A U value was calculated comparing the responses pre-and post-intervention. The U-value was 24, the critical value of U at $p<0.005$ is 23, therefore the result is not statistically significant. The z-score was -1.9276 and the p-value was 0.0536, and not significant at $p<0.005$. The mean for the pre-intervention response was 4.2 with a standard deviation of 0.7888. The mean for the post-intervention response was 4.9 with a standard deviation of 0.3162 (Figure 5).

Item 2. The second item stated, "I am able to describe the different mHealth technologies that can be used in weight management". The U-value was 18, the critical value of U at $p<0.005$ is 23, therefore the result is statistically significant. The z-score was -2.38118, and the p-value was 0.01732, which is significant. The mean for the pre-intervention response was 3.7 with a standard deviation of 1.159. The mean for the post-intervention response was 4.9 with a standard deviation of 0.3162 (Figure 6)

Item 3. The third item stated, "I know the efficacy of mHealth in weight management". The result of the U-test was not statistically significant (U-value=26, z-score=-1.77643, p-value at 0.07508). The pre-intervention response had a mean of 3.9 with a standard deviation of 1.100. The mean for the post-intervention response was 4.8 with a standard deviation of 0.4216 (Figure 7).

Item 4. The fourth item stated, "I know how mHealth support weight management". Based on the U-value of 23.5 it was not statistically significant, but on the z-score of -1.965, the p-value is at 0.04884 which is significant. The mean for the pre-intervention response was 4 with a standard deviation of 1.0540. The mean for the post-intervention response was 4.9 with a standard deviation of 0.3162 (Figure 8).

Item 5. The fifth item stated, "I feel confident in my skills to use mHealth technology in my daily work". The results were not statistically significant (U-value=27, z-score=-1.70084, p-value=0.08914). The mean for the pre-intervention response was 4.1 with a standard deviation of

0.8755. The mean for the post-intervention response was 4.8 with a standard deviation of 0.4216 (Figure 9).

Item 6. The sixth item stated, "I am confident in communicating the benefits and advantaged in using mHealth in weight management". The U-value was 21, the critical value of U at $p<0.005$ is 23, therefore the result is statistically significant. The z-score was -2.1544, and the p-value was 0.03156, which is significant. The mean for the pre-intervention response was 3.8 with a standard deviation of 1.0327. The mean for the post-intervention response was 4.8 with a standard deviation of 0.4216 (Figure 10).

Item 7. The seventh item stated, "I feel confident explaining to patients in the medical bariatric practice how mHealth will support weight loss". Based on the U-value of 26, z-score of -1.77643 and the p-value of 0.07508, it was not statistically significant. The mean for the pre-intervention response was 3.9 with a standard deviation of 1.10050. The mean for the post-intervention response was 4.8 with a standard deviation of 0.4216 (Figure 11).

Item 8. The last item stated, "I feel confident recommending mHealth to patients in weight management". The U-value was 26, the critical value of U at $p<0.005$ is 23, therefore the result is not statistically significant. The z-score was -1.77643, and the p-value was 0.07508, which is not significant. The mean for the pre-intervention response was 3.9 with a standard deviation of 1.10050. The mean for the post-intervention response was 4.8 with a standard deviation of 0.4216 (Figure 12).

Figure 5 Item 1

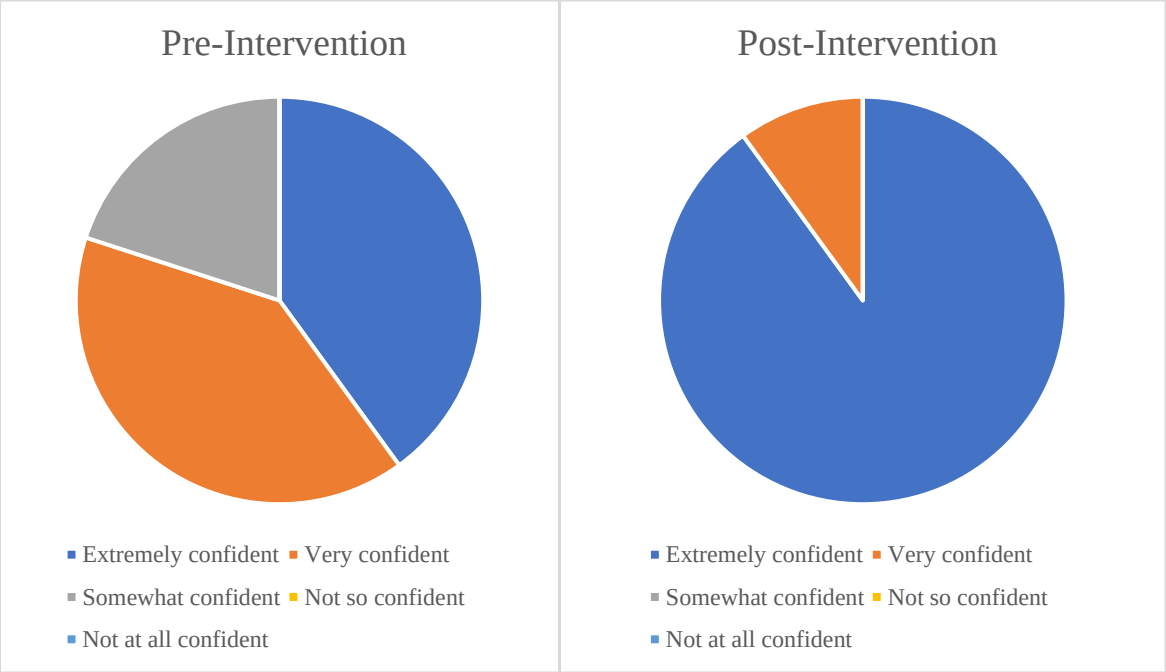


Figure 6 Item 2

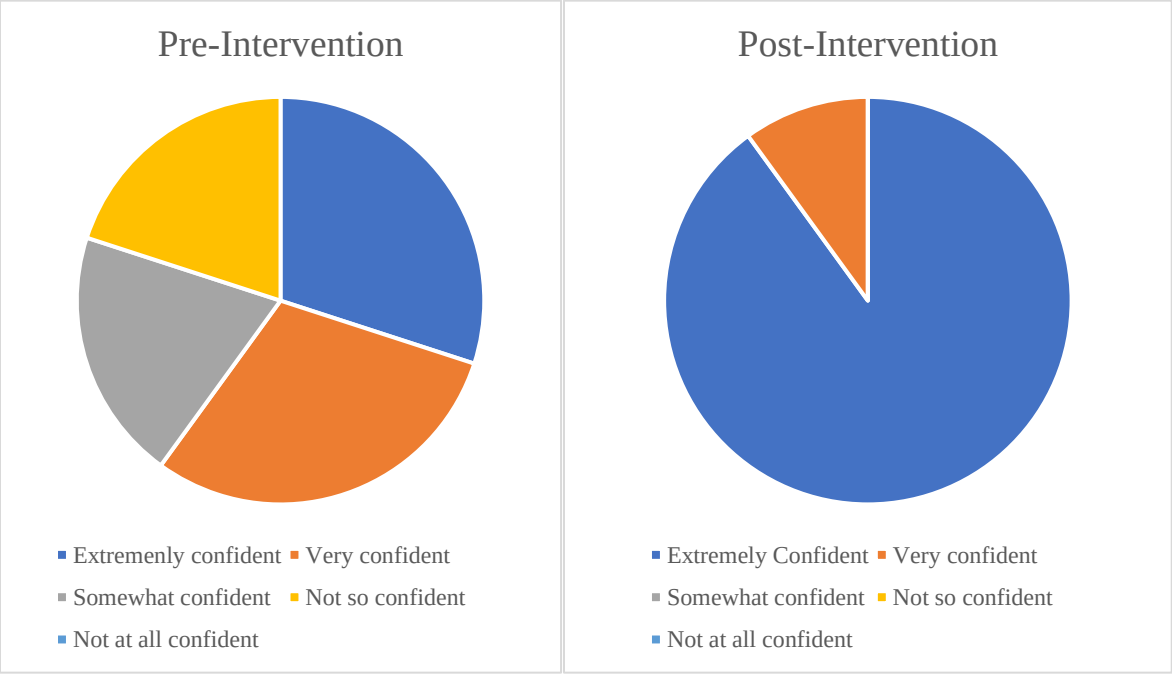


Figure 7 Item 3

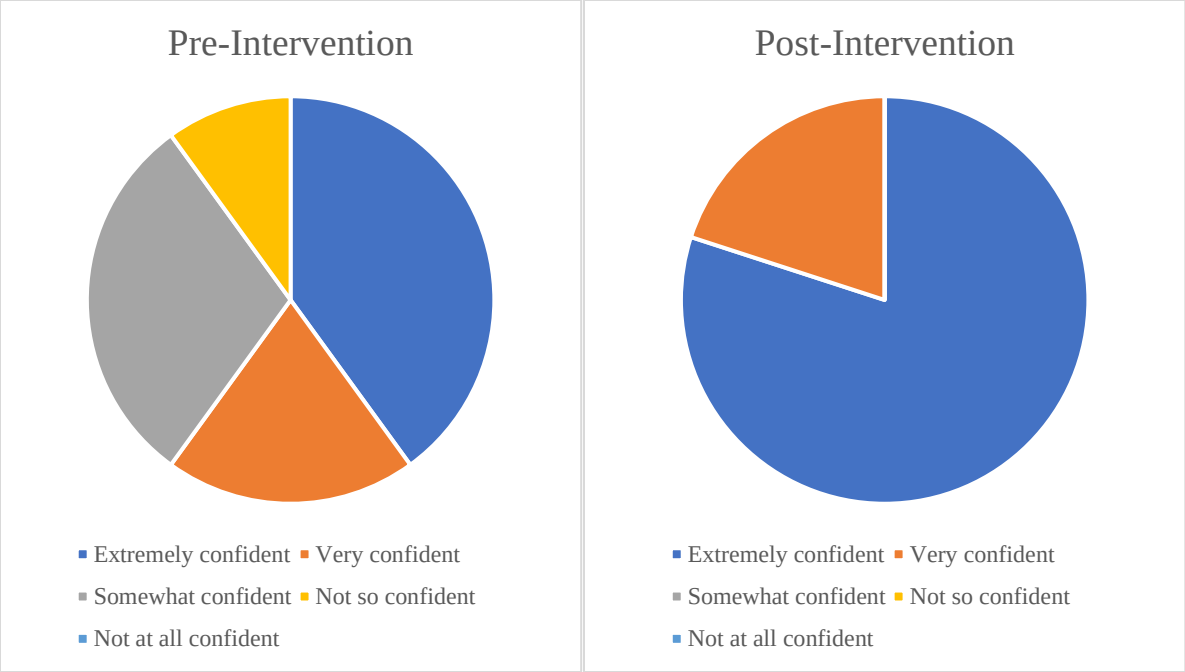


Figure 8 Item 4

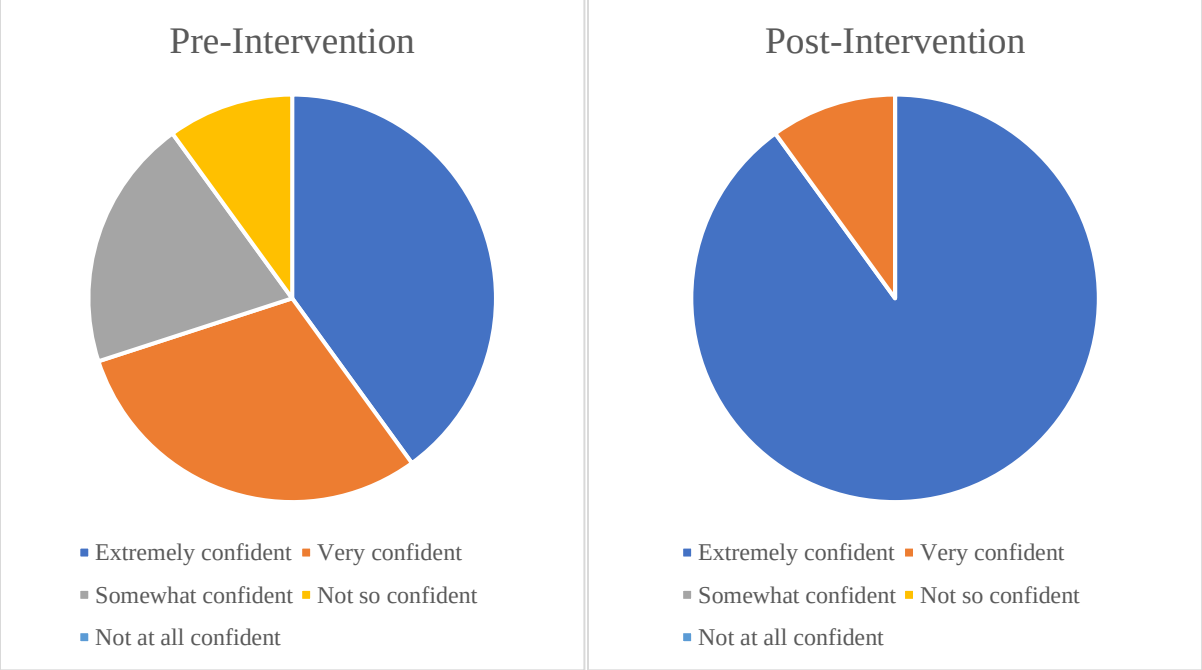


Figure 9 Item 5

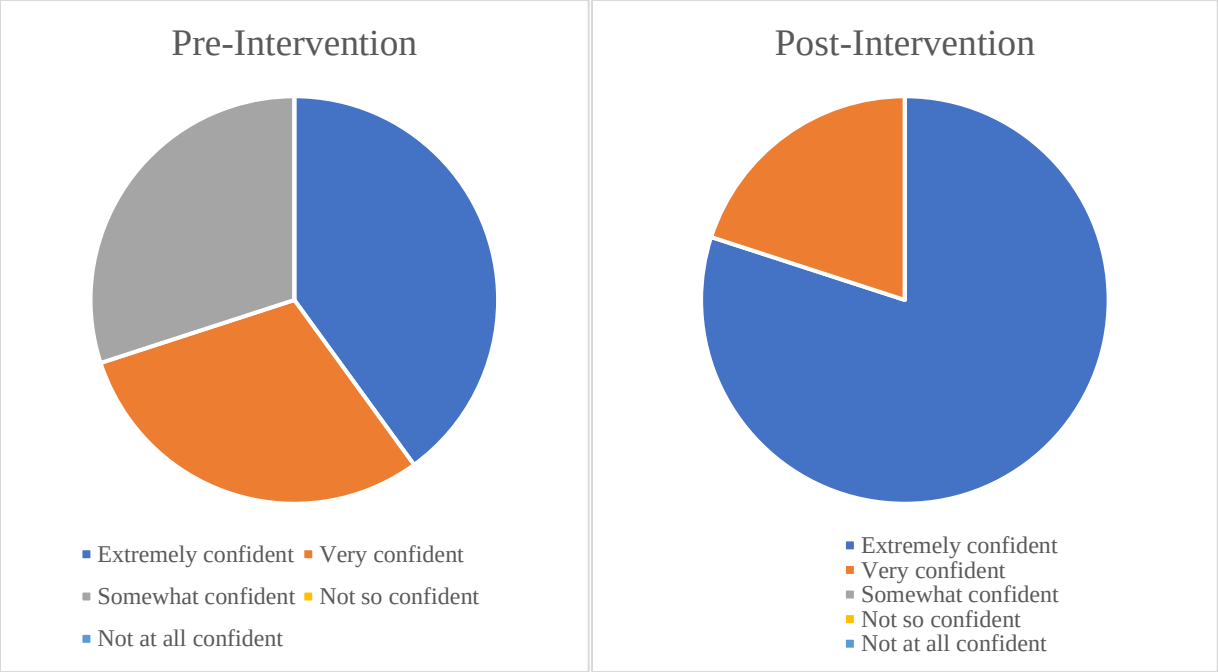


Figure 10 Item 6

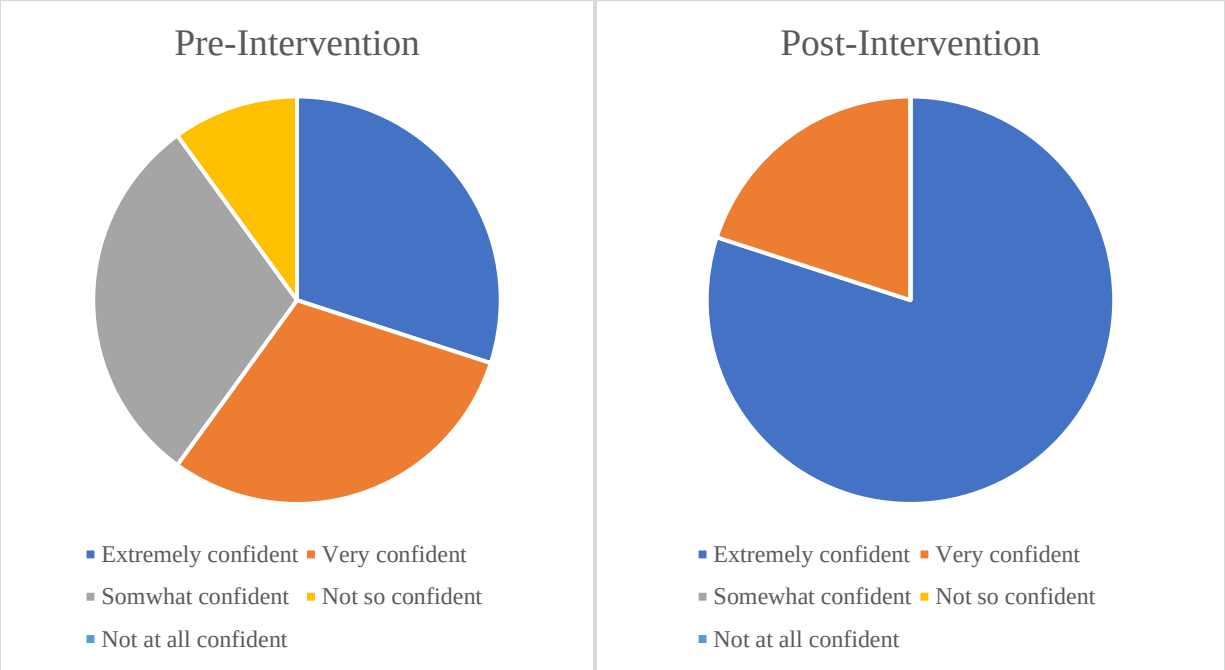


Figure 11 Item 7

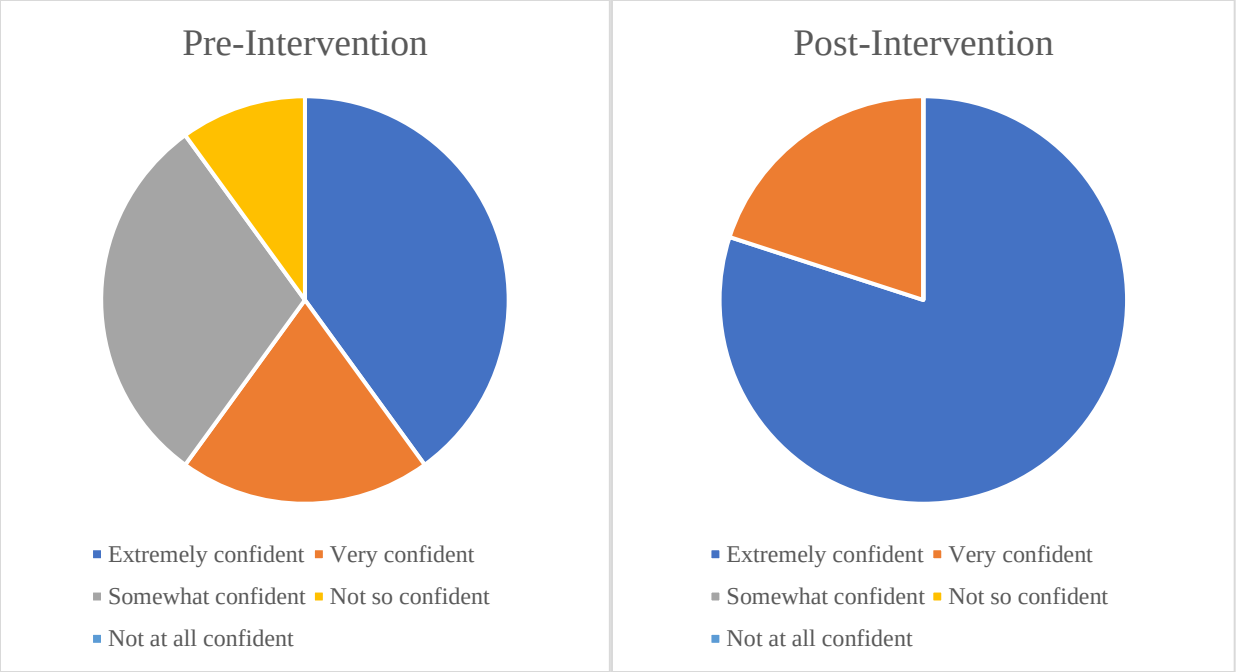
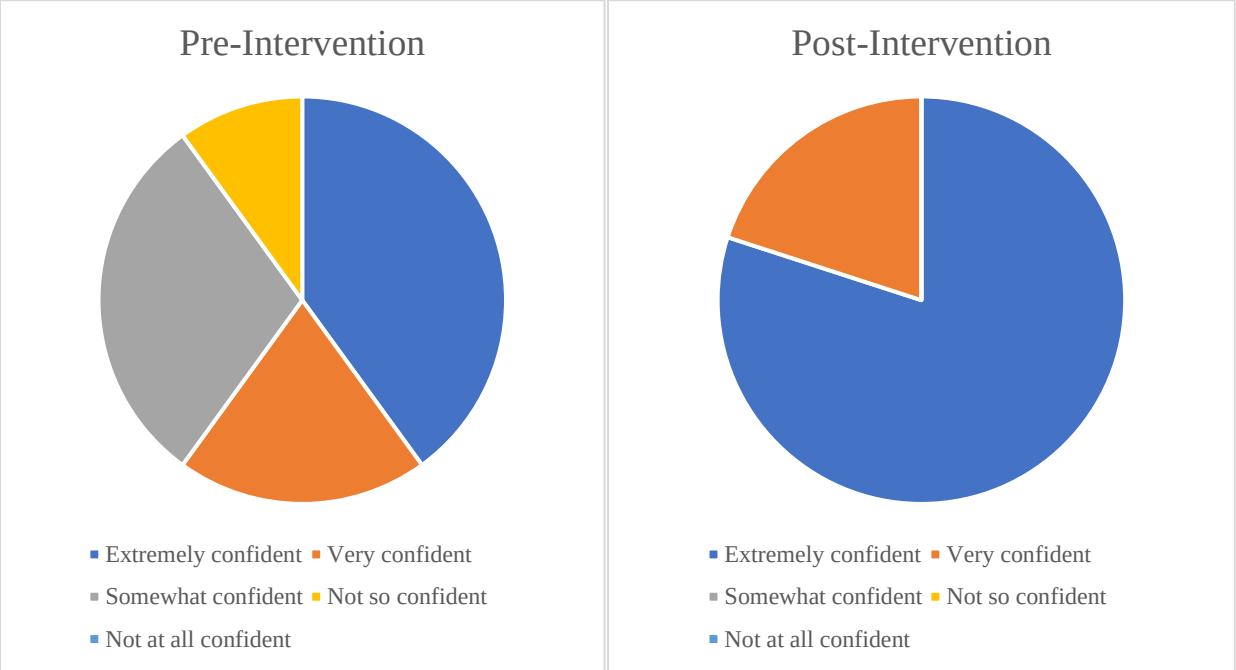


Figure 12 Item 8



Inferential Data

Inferential data that was collected for the project includes the results of a Mann Whitney U test. The test was conducted to compare the difference between the pre- and post-intervention

knowledge scores within the group. The U value was 23 and the Z score was -2.00321. The p-value was 0.0455. The result is significant at $p<0.05$. Based on the results presented in Table 2, that there was an increase in knowledge, and this increase was statistically significant ($P < 0.05$). The data was scored based on the total Likert scale report by each participant, ranging from 1 (not confident at all) to 5 (extremely confident). This means that the participant's total score ranges from 5, the least confident, to 40, the most confident.

Discussion

This project examined the influence of an educational intervention to increase knowledge and perceived competence in the use of mHealth in weight management. According to Gagnon et al. (2015), mHealth is a cost-effective option to promote, prevent, and treat patients while improving healthcare outcomes. The adoption of this technology is a useful strategy to focus on the patient's participative role, increased engagement, and providing responsibility over their own health (Covolo et al., 2017). There is evidence that mHealth can be effective in weight loss, since mHealth interventions are aimed at lifestyle and behavioral changes by increasing adherence, self-monitoring, and empowerment (Cavero-Redondo et al., 2020). By thoroughly reviewing these results, it is possible to evaluate the project outcomes to determine if this practice change should be kept as a standard of care. This section, therefore, will discuss these results, areas for future research, recommendations, and plans for disseminating these results.

Results Discussion

The PICO question of this quality improvement project was: In a specialized bariatric clinic does staff education compared with no education, increase staff knowledge and perceived competence to integrated mHealth as part of the standard patient care in weight management? The purpose of this project was to increase FBN staff knowledge and perceived competence in

the use of mHealth in weight management. The results showed an increase of 18% on these two outcomes in the participants instead of the 25% that it was expected. This can be explained by the unexpected high scores on the pre-test in some of the participants. The post-intervention test was higher than 90% as expected (96.75%). In addition, the comparison between the pre-and post-intervention test was statically significant. This was accomplished after the educational intervention and measured with the surveys designed by the project manager.

Even though there is widespread use of smartphones and tablets and an increasing numbers of health applications, the use of mHealth by healthcare professionals remains low (Covolo et al., 2017). The findings of the quality improvement project matched with those found in the literature. According to Byambasuren et al. (2019), the main barriers are the lack of knowledge about mHealth and confidence on how to implement this technology in the practice. Education about the benefits and how to use mobile health technology are proven to increase the adoption of mHealth (Gagnon et al., 2016). By increasing staff knowledge and perceived competence in the use of mHealth at FBN, a foundation is laid for further implementation of a cost-effective solution that supplements weight management programs. This implementation may improve outcomes and provide a long-term answer to the obesity epidemic.

The demographic description of the sample included in Table 1 demonstrated that these samples were consistent and well-matched in terms of gender, age, race, and level of education. The results also indicate that knowledge levels were similar before the intervention, except for four participants that scored higher in the pre-test. These numbers were expected, given the lack of adoption of mHealth by providers in this area. However, results also indicate that significant knowledge gains were made as the result of this educational intervention.

Implementation Discussion

The implementation process was outlined with the help of stakeholders at Florida Bariatrics and Nutrition, LLC, Dr. Hernandez, and Florida International University faculty Dr. Gonzalez. Before the implementation, a timeline of how the project was discussed with stakeholders and mentor via Zoom. During this meeting, facilitators and barriers of the project were discussed as well as benefits at short-term and long term. Next, the project was presented and explained to potential participants as well as a description of the implementation process. Due to the COVID 19 pandemic, this meeting had to be conducted via Zoom. Some of the potential participants could not be present during the scheduled meeting, and a second meeting was held to accommodate them. During the discussion of the implementation process, some possible participants were resistant to change, but after exposing the benefits of the project and with the support of stakeholders, participants were able to overcome this barrier.

Influencing Factors

One of the main facilitators in the project implementation was the strong leadership that Florida Bariatrics and Nutrition exhibits. The stakeholders were aware that changes are needed to improve not only the bottom line, but patient centered and evidence-based care. Another influencing factor to this project were the effective communication channels among stakeholders and staff. During the implementation of the improvement project at FBN, communication channels were not only open with stakeholders, but with potential participants to explain the purpose of the study, objectives, benefits, and risks, and to provide insight if doubts or concerns arise. And lastly, participants were receptive to the project and showed a high level of commitment during the project implementation, and readiness to change to implement those learned concepts in the practice.

Monitoring

Through the project implementation process, the communication channels were open via email or by phone calls. Multiple reminders were sent via email during the implementation process and always advised participants to reach out if there were any questions about the process. The stakeholders were also available if any questions or doubts arose at the site. The stakeholders also helped with adherence of the project timeline and objectives.

Project Maintenance

After the process of implementation was finalized, an evaluation of the process and outcomes took place. The results of the project were presented and discussed with not only stakeholders, but participants as well. A discussion took place where staff and stakeholders from FBN exposed their ideas and future use of the outcomes learned. In addition, some mHealth applications were discussed for further implementation in the practice. This will serve as a foundation to implement the use of mHealth in the weight management program along with face-to-face visits.

Limitations

One of the limitations of the project implementation was the fact that the educational intervention was done via email due to the COVID-19 pandemic. Even though communication channels were open during the study for questions or doubts, if the intervention would have taken place face to face, the interaction and engagement would have been higher. This could have negatively impacted the project and caused an unwanted outcome. Another limitation was the smaller sample size, which would make it harder to be generalized into other practices. And lastly, all participants received the same intervention, and participants may have different levels of knowledge about mHealth.

Areas for Future Research

An educational intervention on the use and effectiveness of mobile health in weight management can be the answer to adopt this technology and provide a solution that is cost effective to supplement weight management programs. An important consideration would be the expansion of a program that includes providers at different locations, or from different areas of the country would be useful in determining if this project can be useful in larger settings. This project is currently limited by the small sample size. By increasing the sample size through greater levels of recruitment, the generalizability of these findings would concurrently increase.

As evidenced in the literature review, an important drawback in the use mobile health is the lack of knowledge and technology literacy by its potential users. More research should be focused on adding competence-based curricula to provide healthcare students with a minimum level of technology literacy. This will increase the use of mobile health as an aid in prevention, promotion, and treatment of chronic diseases by healthcare providers (Amdie & Woo, 2020).

There are other areas that also need further research such as regulation of mHealth technology in terms of safety and quality, such as mHealth applications, either by governmental, private sector, or professional organizations. In addition, there is the need for organizations to provide guidance to healthcare professionals at the time of choosing mHealth apps to assist patients in their clinical practice.

Recommendations

This educational intervention will provide a steppingstone for the adoption of mobile health technology in weight management, but it also can serve for other practices, such as primary care, in the treatment and management of diabetes mellitus, hypertension, and other conditions. This project helped improve knowledge in mHealth and increase perceived

competence to use and promote the use of this technology in the FBN staff. By increasing knowledge in mHealth, adoption practices will increase as well at FBN.

The integration of mHealth in the practice will help provide patient centered care as well as evidence-based knowledge into the practice. Based on the results of this project, mHealth applications should be adopted as part of the standard of care in weight management programs. mHealth interventions helps empower patients, increases healthcare access, increases adherence to chronic diseases management, while decreasing staff workload (Amdie & Woo, 2020). A similar quality improvement project can be utilized in primary care for management of chronic diseases such as diabetes mellitus, hypertension, asthma, and COPD. The adoption of mobile health technology not only can increase access of care but also can reduce morbidity and mortality and provide an innovative delivery of care (Amdie & Woo, 2020).

Interpretation of Findings

This quality improvement project's aim was to increase knowledge in the use of mHealth in weight management and increase competence to use this technology in the practice. mHealth technology is a powerful and supportive tool that will help provide evidence based and patient centered care to patients that attend the medical bariatric practice. mHealth incorporates behavioral components as well as technology features that helps patients achieve goals. This technology focus on self-monitoring, adherence, and empowerment, while boosting traditional weight management interventions.

mHealth and Patient Care

The main outcome of this quality project was to increase knowledge and perceived competence in the use of mHealth in weight management. One of the main barriers in the use of the technology is the lack of knowledge, this quality improvement project will lay the foundation

to adopt this mobile health in the treatment of obesity along with face-to-face encounters. Mobile health has been shown effective in obesity treatment as it targets self-monitoring, goal setting, counseling, feedback, and support (Wang et al., 2020). This project will provide a cost effective, innovative solution for weight management in the medical bariatric office.

Transferability of Results

The results can be transferable to other weight management programs as well as primary care practices that focus on chronic disease management. This intervention was designed to increase knowledge in staff and healthcare providers in the use of mobile health. mHealth helps advance patient education, share decisions, engagement, and access of care. This technology can complement face-to-face weight management programs to make them more effective with long lasting results.

Cost-Effectiveness

The cost related to this quality improvement project were minimal when compared with the benefits that have not only on the staff at the FBN, but to the patients once it is implemented. This project is cost-effective, the implementation provided the staff with knowledge to make their work more effective in terms of weight management. The team members that are part of this project are not getting compensated for their work since they are volunteering their time. This quality improvement project has the potential to increase adherence, engagement, provide support, while increasing self-monitoring. This project can help improve weight management outcomes and can make a huge impact at different levels not only individual but at the society too.

Recommendations

In terms of recommendations, the knowledge and perceived competence in the use of mHealth in the staff has the potential, once it is implemented in the practice, to make the program cost-effective, and long lasting. After this quality improvement is completed, a new program must be initiated to implement this technology the weight management program. One of the suggestions to this program is to narrow down to a specific type of mHealth such as phone applications for an easier implementation in the practice.

Plans for Dissemination

The results of this improvement project were shared with participants and stakeholders of Florida Bariatrics and Nutrition through an internal presentation held via Zoom. The results will also be disseminated to a larger scale, and it can be submitted to peer-reviewed journals such as *The Journal of American Association of Nurse Practitioners*, the *American Journal of Nursing*, or *American Nurse* for publication. These journals promote the best practices and address clinical work, education, and research. The project will also be presented at the DNP Symposium that is held annually at the Nicole Wertheim College of Nursing and Health Sciences at Florida International University. The objectives of this event are to identify evidence-based practices and incorporate them into practice and communicate quality improvement strategies to be implemented in healthcare delivery.

Implications for Advanced Nursing Practice

The overall goal of this improvement project was to increase knowledge in the Florida Bariatric and Nutrition staff and to improve perceived competence in the use of mHealth. This project demonstrated a statistically significant improvement in the knowledge of mHealth and increase in the perceived competence in the use of mHealth in weight management in the staff of

FBN. In the following section, the applicability of this project in different areas will be discussed.

Clinical Practice

The implications of this project in the practice are focused on creating a long-lasting change in patient care. It is clear that mHealth interventions can change how healthcare providers tackle lifestyle modification prescriptions. Mobile health is an effective technology to be used along with medical care and coaching in weight management. The use of mHealth will help increase patient self-management, provide feedback, goal setting, counseling while promoting motivation to make lifestyle changes (Wang et al., 2020). Clinical practice guidelines can be created, adding mHealth technology that will provide an effective solution for chronic diseases management to both patients and providers (Cavero-Redondo et al., 2020).

In addition, mHealth technology can increase effectiveness, decrease cost, and increase adherence while improving outcomes when combined with weight management programs (Dounavi & Tsoumani, 2019). This technology will provide patient centered care that is evidence based, and it will help deliver a cost-effective solution for the problem of obesity. Mobile health technology, along with behavioral components, may provide a powerful instrument that help patients and providers as well achieve their objectives (Dounavi & Tsoumani, 2019). mHealth interventions not only help to increase health care access but it also has provided a solution during the COVID-19 pandemic where face to face contact had to be limited (Cavero-Redondo et al., 2020).

Research and Leadership

This quality improvement project was successful in increasing knowledge and perceive competence in the use of mHealth in weight management in staff at a medical bariatric practice.

These findings can add to the body of evidence and may help in the creation of clinical guidelines and policy changes for obesity management. This project can also enhance the evidence that is available and serve as a foundation to future research in designing technology-based interventions in weight management. These interventions help optimize outcomes and decrease healthcare costs.

Education

Regarding education, the project improves the knowledge in the use of mHealth in participants, empowering them to provide patient centered care that is evidence based and effective in obesity treatment. Mobile health use is proven to improve education in the health sector. This project will potentially empower patients, increase patient choice, and will help shift the role of patients from recipients to partners of care. This will help reduce illness burden, promote independence, and increase quality of life.

Administration

The educational intervention increases the knowledge about mHealth and perceived competence, in the staff of the medical bariatric practice, which may improve work performance, decrease staff overload, as well as promote communication, and teamwork. It provides a patient centered care that improves outcomes, while decreasing healthcare costs. Also, once implemented in the practice, mobile health can assist delivering care and providing a faster feedback and support to patients.

Conclusion

Obesity has reached epidemic proportions in America. As obesity continues to comprise an increasing share of the population, there will be a corresponding increase in obesity-related health conditions such as cardiovascular disease and type 2 diabetes. Conventional weight loss

programs may offer a partial solution, but they are often costly and fail to provide a long-term solution for patients. Given the need to adopt multiple strategies to combat this multifaceted problem, the adoption of mHealth may provide a necessary solution.

A thorough search of the literature reveals that the necessary behavioral changes required of obese patients can be aided by the adoption of mHealth applications, as they have been demonstrated to increase participation with programs and lead to longer-term gains. Technology, in this case, can be used to increase self-efficacy, adherence, and motivation among patients, supporting their efforts over the long term. One of the more significant findings is that smartphones, now nearly ubiquitous, may indeed be the most effective mHealth tool available. However, numerous providers continue to have gaps in knowledge and barriers that prevent their adopting mHealth with their patients.

The use of Orem's self-care theory provides the theoretical foundation for this project, as Orem's theories regarding self-care deficit demonstrate an opportunity to enhance caring behaviors on the part of healthcare professionals to promote healing. Deliberate actions on the part of healthcare providers demonstrates the ways in which nurses not only directly treat the patient's conditions, but also help to educate the patient towards their own level of self-efficacy.

The utilization of an educational intervention at a bariatric clinic in South Florida has exhibited statistical significance towards improving the knowledge of mHealth and increasing perceived competence in the use of mHealth in weight management. As such, the results from this study will be disseminated through professional channels to the larger scientific community. Results indicated the potential for increasing patient adherence to weight loss goals when mHealth is adopted by staff as a part of care. This increased knowledge cannot but help to increase provider knowledge, which will, in turn, deliver substantial benefits to patients, working

to decrease the epidemic of obesity in our communities. By aiming on creating a long-term solution for weight management, this quality improvement focused on initiating a clinical practice change to provide patient centered and evidence-based care. Hopefully, this educational intervention project can become a foundation for other specialties for the management and treatment of other chronic diseases.

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Appendix

Appendix A:

Data Abstraction Table

Databases	Articles Found	Articles Excluded	Articles Screened	Articles Included
CINAHL	42	36	6	1
Cochrane	66	65	1	1
OVID	11	07	4	4
ProQuest	12	10	2	2
PubMed	73	68	5	5

Appendix B:

Literature Matrix

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
Cavero-Redondo. 2020	Systematic Review & Meta-Analysis	Effect of behavioral interventions on weight loss using mHealth	Search strategy on EMBASE, MEDLINE, Cochrane, Web of Science. Till 2020 n=20 RCTs=17 Non RCTs=3 Inclusion criteria: general population, mHealth self-monitoring Exclusion criteria: duplicates and type of study	Smartphone PDA Web based	The use of mHealth provides moderate weight reduction. Smartphone applications are more effective in adults and in weight management. Effect is deeper short term. Higher adherence with mHealth	Level II B: good quality
Dounavi 2019	Systematic Review	Efficacy of mHealth apps in weight management	Search in Ovid MEDLINE and Ovid PsycINFO 2012-2017 n=39 RCTs=22 Non RCTs=17 Inclusion criteria: adults,	mHealth apps	mHealth is effective in weight reduction and improvement of health indicators. Positive association among engagement,	Level II B good quality

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
			primary study. Exclusion criteria: <18 years, intellectual disability, underlying conditions		adherence and weight loss are seen.	
Mangieri 2019	RCT	Comparison between standard weight loss and the use of mHealth after bariatric surgery	Intervention cohort=28 Control cohort=28. Inclusion criteria: 18-89 years old. Gastric sleeve with 1 year. English speaker Exclusion criteria: Pregnancy/ Postpartum	Smartphone app called my fitness pal	Intervention cohort had better %EWL and %EBL than control. Smartphone apps shown to be effective and successful to improve weight loss after bariatric surgery.	Level I B good quality
Gomez-Marcos 2018	RCT	Effectiveness of smartphone app in a behavior modification weigh loss	n=833 Control group=418 Intervention group=415 Inclusion criteria: 18-70 years old. Exclusion criteria: not able to exercise	Smartphone app to promote diet and exercise	No benefits in weight loss while using mHealth. Noted decreased of WC and BF% in women without BMI changes	Level I B good quality
Bennet 2018	RCT	Compare effectiveness of	n=351 Intervention group=176	Smartphone app: Track to self-monitor behavior changes	Show effectiveness of the app in the	Level I B good quality

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
		counselling and smartphone app on weight loss for 12 months	Control group=175 Inclusion criteria: English speaker, own mobile phone. Exclusion criteria: pregnancy and postpartum		intervention group. Positive association between engagement and weight loss. Significant decrease of blood pressure	
Brindal 2019	RCT	Evaluate a behavioral based mobile app on weight maintenance	n=88 Intervention group: 45 Control group: 43 Inclusion criteria: adults, lost >5% of weight in the past 2 years, access to scale, own a smartphone. Exclusion criteria: pregnancy, cancer and type 1 diabetes	Mobile application MotiMate	Did not have additional benefits for weight maintenance. Life satisfaction and weight loss noted. Most of the participants-maintained their weight	Level I B good quality
Holmes 2018	Systematic Review	Effectiveness of mHealth and telehealth on weight maintenance	Search on MEDLINE, EMBASE, PubMed 2006-2018 n=7 RCTs Inclusion criteria:	Internet based system, text messages, E-mail	Effectiveness of technology in weight maintenance (>50% of studies).	Level I B good quality

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
			English articles, maintenance. Exclusion criteria: focused on other issues. N=1939 participants.			
Covolo 2017	Systematic Review	Evaluate effectiveness of mobile apps to promote healthy behavior	Search on PubMed, EMBASE, and Google Scholar Up to 2016 n=40 Inclusion criteria: RCTs, English written, full text. Exclusion criteria: evaluation of mHealth in disease management and mental disease.	Mobile app Text messages E-mail Websites Devices	Only 25% of studies showed significant effects in lifestyle modification	Level I C Low quality
Gagnon 2016	Systematic Review	Evaluation of factors and barriers with the use of mHealth by healthcare providers	Search on PubMed, EMBASE, CINAHL, and PsycINFO. 2000-2014 n=33	Smartphone Tablet Remote monitoring system Text messages	Facilitators: Usefulness, easy to use, empowers patients, accessible, improves interaction between	Level II B good quality

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
			Inclusion criteria: written in English, French or Spanish, empirical design. Exclusion criteria: studies focus on students.		providers and patients. Barriers: expensive, increase workload, changes workflow	
Ooster-veen et al., 2017	Systematic Review	Evaluation of effectiveness of mobile health behavioral interventions to improve smoking rates, alcohol consumption, exercise, nutrition, and obesity	Search on MEDLINE, MEDLINE in process, PsycINFO, Science Citation Index, CINAHL, Cochrane Library. n=45 RCTs n=15,243 participants. Inclusion criteria: written in English, young adults, RCTs. Exclusion criteria: co-morbidities, pregnancy, mental illness, eating disorders	Websites, e-mails, text messages, devices, and smartphone apps.	Mobile health interventions are more effective than control groups.	Level I B good quality

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
Byam-basuren et al. 2020	Qualitative Study	Assessment of barriers and facilitators to prescribe mobile apps.	n=35 20 healthcare providers and 15 patients	Mobile health application	Facilitators: found to be beneficial, prevalence of smartphone ownership, trustworthy source. Barriers: age, workflow changes, time constraint, lack of education, issues with safety and privacy.	Level III B Good quality
Leigh et al., 2020	Discrete Choice Experiment	Identification of barriers and facilitators of app use in healthcare providers (HCPs)	n=222 HCPs Inclusion criteria: nurses, general practitioners, secondary care physicians, and allied health professionals	Mobile app	Facilitators: stamp of approval of a government organization, published studies, and recommend-dation by another HCPs. Barriers: cost and age	Level III B Good quality
Byam-basuren et al. 2019	Qualitative study	Exploration of knowledge and the use of mobile apps, barriers and facilitators, and possible solutions	n=1014 Median age=51 years Inclusion criteria: general practitioners: trainees, fellows;	Mobile app	66% use health apps. 50% recommend. app Main barriers are no knowledge on effective apps and no known.	Level III B Good quality

First Author/ Year	Study Design	Purpose of Study	Sample	Intervention	Findings	Level of Evidence
			practice managers and owners currently practicing.		reliable sources. Possible solution: more training	

Appendix C:

IRB approval letter

FIU | FLORIDA INTERNATIONAL UNIVERSITY

Office of Research Integrity
Research Compliance, MARC 414

MEMORANDUM

To:	Dr. Arturo Gonzalez
CC:	Katherine Ganem
From:	Maria Melendez-Vargas, MIBA, IRB Coordinator
Date:	March 17, 2021
Protocol Title:	"Improving Staff Knowledge and Competence in the Use of mHealth in Weight Loss Management: A Quality Improvement Project"

The Health Sciences Institutional Review Board of Florida International University has approved your study for the use of human subjects via the **Expedited Review** process. Your study was found to be in compliance with this institution's Federal Wide Assurance (00000060).

IRB Protocol Approval #:	IRB-21-0088	**IRB Approval Date:**	03/17/21
TOPAZ Reference #:	110026	**IRB Expiration Date:**	03/17/24

As a requirement of IRB Approval you are required to:

1) Submit an IRB Amendment Form for all proposed additions or changes in the procedures involving human subjects. All additions and changes must be reviewed and approved by the IRB prior to implementation.
2) Promptly submit an IRB Event Report Form for every serious or unusual or unanticipated adverse event, problems with the rights or welfare of the human subjects, and/or deviations from the approved protocol.
3) Utilize copies of the date stamped consent document(s) for obtaining consent from subjects (unless waived by the IRB). Signed consent documents must be retained for at least three years after the completion of the study.
4) **Receive annual review and re-approval of your study prior to your IRB expiration date.** Submit the IRB Renewal Form at least 30 days in advance of the study's expiration date.
5) Submit an IRB Project Completion Report Form when the study is finished or discontinued.

HIPAA Privacy Rule: **N/A**

Special Conditions: **N/A**

For further information, you may visit the IRB website at http://research.fiu.edu/irb.

MMV/em

Appendix D:

Informed Consent

FIU IRB Approval:	03/17/2021
FIU IRB Expiration:	03/17/2024
FIU IRB Number:	IRB-21-0088

FIU | FLORIDA INTERNATIONAL UNIVERSITY

ADULT CONSENT TO PARTICIPATE IN A RESEARCH STUDY
Improving Staff Knowledge and Competence in the Use of mHealth in Weight Loss Management

SUMMARY INFORMATION

Things you should know about this study:

- **Purpose:** The purpose of the study is to increase knowledge on mobile health and its use in weight management.
- **Procedures**: If you choose to participate, you will be asked to answer a survey before and after watching three PowerPoint sessions on mobile health.
- **Duration:** This will take about 2 hours.
- **Risks**: The main risk or discomfort from this research is potential lack of privacy or issues with confidentiality.
- **Benefits:** The main benefit to you from this research is to increase your knowledge and confidence to recommend mHealth.
- **Alternatives:** There are no known alternatives available to you other than not taking part in this study.
- **Participation:** Taking part in this research project is voluntary.

Please carefully read the entire document before agreeing to participate.

PURPOSE OF THE STUDY

The purpose of this study is to increase your knowledge in the use of mHealth and increase your confidence to recommend this tool in weight management.

NUMBER OF STUDY PARTICIPANTS

If you decide to be in this study, you will be one of 10 people in this research study.

DURATION OF THE STUDY

Your participation will involve 8 weeks in total, and out of those weeks the time spend will be about 2 hours.

PROCEDURES

If you agree to be in the study, we will ask you to do the following things:

FIU IRB Approval:	03/17/2021
FIU IRB Expiration:	03/17/2024
FIU IRB Number:	IRB-21-0088

1. Fill out a pre intervention survey and a demographic survey on an online platform.
2. Watch a PowerPoint presentation that will be sent to your email.
3. Fill out a post presentation survey on an online platform.

RISKS AND/OR DISCOMFORTS

The study has the following possible risks to you: First potential lack of privacy; Second, potential lack of confidentiality. A list of measures has been taken into consideration to decrease the likelihood of these risks.

BENEFITS

The study has the following possible benefits to you: increase knowledge, support growth and development as a professional and empower participants. Benefits for the society will be increasing access of care as well as provision of patient centered care.

ALTERNATIVES

There are no known alternatives available to you other than not taking part in this study

CONFIDENTIALITY

The records of this study will be kept private and will be protected to the fullest extent provided by law. In any sort of report, we might publish, we will not include any information that will make it possible to identify you. Research records will be stored securely, and only the researcher team will have access to the records. However, your records may be inspected by authorized University or other agents who will also keep the information confidential.

USE OF YOUR INFORMATION

- Your information collected as part of the research will not be used or distributed for future research studies even if identifiers are removed.

COMPENSATION & COSTS

There are no costs to you for participating in this study.

RIGHT TO DECLINE OR WITHDRAW

Your participation in this study is voluntary. You are free to participate in the study or withdraw your consent at any time during the study. You will not lose any benefits if you decide not to participate or if you quit the study early. The investigator reserves the right to remove you without your consent at such time that he/she feels it is in the best interest.

FIU IRB Approval:	03/17/2021
FIU IRB Expiration:	03/17/2024
FIU IRB Number:	IRB-21-0088

RESEARCHER CONTACT INFORMATION

If you have any questions about the purpose, procedures, or any other issues relating to this research study you may contact Katherine Ganem at 305 431 7006, kgane002@fiu.edu.

IRB CONTACT INFORMATION

If you would like to talk with someone about your rights of being a subject in this research study or about ethical issues with this research study, you may contact the FIU Office of Research Integrity by phone at 305-348-2494 or by email at ori@fiu.edu.

PARTICIPANT AGREEMENT

I have read the information in this consent form and agree to participate in this study. I have had a chance to ask any questions I have about this study, and they have been answered for me. I understand that I will be given a copy of this form for my records.

_____ _____

Signature of Participant Date

_____

Printed Name of Participant

_____ _____

Signature of Person Obtaining Consent Date

Appendix E:

Knowledge and Competence Survey for mHealth

Please rate how confident you are about mHealth knowledge and perceived competence based on the following Likert scale.

Not confident at all 1 point

Not very confident 2 points

Somewhat confident 3 points

Very confident 4 points

Extremely confident 5 points

1. I know what mHealth means.

   Not confident at all Not very confident Somewhat confident

   Very confident Extremely confident

2. I am able to describe the different mHealth technologies that can be used in weight management.

   Not confident at all Not very confident Somewhat confident

   Very confident Extremely confident

3. I know the efficacy of mHealth in weight management.

   Not confident at all Not very confident Somewhat confident

   Very confident Extremely confident

4. I know how mHealth can support weight management.

   Not confident at all Not very confident Somewhat confident

   Very confident Extremely confident

Perceived Competence survey for mHealth

1. I feel confident in my skills to use mHealth technology in my daily work.

   Not confident at all Not very confident Somewhat confident

   Very confident Extremely confident

2. I am confident in communicating the benefits and advantages in using mHealth in weight management.

Not confident at all Not very confident Somewhat confident

Very confident Extremely confident

3. I feel confident explaining to patients in the medical bariatric practice how mHealth will support weight loss.

Not confident at all Not very confident Somewhat confident

Very confident Extremely confident

4. I feel confident recommending mHealth to patients in weight management.

Not confident at all Not very confident Somewhat confident

Very confident Extremely confident

Appendix F:

Demographic Survey

Please fill out survey:

Gender

- Female
- Male
- I prefer not to answer.

Age

- 22-29 years old
- 30-39 years old
- 40-49 years old
- 50-59 years old
- 60-69 years old
- 70-73 years old

Race

- White
- Black
- Asian/Pacific
- Hispanic
- Native American
- I prefer not to answer.

Level of Education

- High school
- Some college
- Associate degree
- Bachelor’s degree
- Master’s degree
- Doctorate’s degree