5-14-2019

The Effects of a Mobile Fitness Application on Weight Management and Physical Acticity Amongst University Students

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THE EFFECTS OF A MOBILE FITNESS APPLICATION ON WEIGHT MANAGEMENT AND PHYSICAL ACTICITY AMONGST UNIVERSITY STUDENTS

by

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EVIDENCE-BASED PRACTICE PROJECT REPORT

Submitted to the College of Nursing and Health Professions

of Valparaiso University,

Valparaiso, Indiana

in partial fulfillment of the requirements

For the degree of

DOCTOR OF NURSING PRACTICE

2019

Erica Deenihan 5-13-19

Student Date

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DEDICATION

To my parents, family and friends. Your endless support throughout this journey mean more than you will ever know.

ACKNOWLEDGEMENTS

This project could not have been completed without the continual support of Dr. Julie Koch, DNP, RN, FNP-BC, FAANP and Dr. Lindsay Munden, DNP, RN, FNP-BC. I am lucky to have had the opportunity to receive guidance from two advisors at various times throughout the completion of this project. Your combined knowledge, expertise and impeccable organizational skills have been crucial in not only the development, implementation and analysis of this project, but also the development of me as a DNP student as well. You both have well exceeded the expectations of acting as great advisors and I am forever grateful.

Additional gratitude must be given to Kelley Eshenaur, MSN, CNS, RN, FNP-C and the entire staff of the Valparaiso University Student Health Center for their incredible support and guidance during my project. Your continual acceptance of my presence and project ideas cannot be thanked enough.

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ABSTRACT

The prevalence of obesity, and obesity related diseases throughout America, specifically in regard to the college student population has steadily climbed over the course of the last forty years, due largely in part to the increase in sedentary lifestyle behaviors, amongst other factors (Swanson, 2016). Physical activity has been widely recognized as a valid means of combatting obesity and weight gain while promoting health related quality of life (Swanson, 2016). Therefore, implementing strategies aimed at increasing physical fitness in attempt to control weight management is imperative to promoting improved health outcomes. The purpose of this evidence-based project was to examine the effects that the mobile fitness application "My Fitness Pal" had on weight management and prevalence of physical activity amongst university students. Theoretically, the project was designed with aid of the Health Belief Model to promote self-efficacy of participants and motivate them to engage in physical activity to achieve health benefits. A convenience sample of undergraduate students was drawn from a Midwestern Lutheran University. Participants provided baseline information regarding their physical activity and bodyweight measurement and then were presented with an educational intervention that promoted the use of a mobile fitness application, along with customized exercise tips and resources available on the university campus to encourage them to participate and log physical activity. In order to ascertain the effectiveness of the exercise promotion intervention, paired sample t-tests will be utilized to compare participant's caloric expenditure, BMI, and exercise self-efficacy scores both pre and post intervention. The software program Intellectus Statistics will be utilized to complete all statistical analysis with a statistical significance level set at $p < 0.5$. Implications for practice will be further discussed.

CHAPTER 1

INTRODUCTION

Background

To appreciate the need for this evidence-based practice (EBP) project, it is crucial to understand the complex and multifaceted clinical problem known as obesity. According to the Centers for Disease Control and Prevention (CDC), obesity is defined as having an excess amount of body fat and a body weight that is higher than what is deemed healthy for a given height. (CDC, 2016). Body mass index (BMI) is a standardized screening tool used to measure obesity, as it indirectly calculates body fat based on weight in relation to height. BMI values that fall between 18.5 and 24.9 are considered within normal limits or “healthy weight”, values between 25.0 and 29.9 are considered overweight, and a BMI of 30.0 and higher is considered obese. Obesity is often subdivided into categories with stage 1 obesity consisting of having a BMI between the ranges of 30.0 and 3.49; stage 2 obesity is considered having a BMI 35.0 to 39.9; and stage 3 or “severe” obesity consists of a BMI of 40 or higher (CDC, 2016).

Clinically, BMI values are of significance as obesity, specifically a BMI value of 30.0 or higher is associated with increased risk of developing one or more of a variety of chronic diseases (U.S. Department of Health and Human Services [USDHHS], 2013; World Health Organization [WHO], 2013). Comorbidities (i.e., hypertension, coronary artery disease, high cholesterol, diabetes, cerebrovascular incidents, osteoarthritis, gallbladder disease, sleep apnea, depression, and some cancers) are all considered to be obesity related diseases, many of which are the leading causes of preventable death (CDC, 2018). In addition to increasing morbidity and mortality, obesity-related diseases also have the potential to negatively impact overall quality of life, increase health care costs, and deplete medical resources (Swanson, 2016). Unfortunately, over the course of the last several decades, obesity within the United States has reached a level of epidemic proportions; according to national health center statistics, obesity now affects approximately 93.3 million Americans, with a prevalence rate of roughly 39.8% across a variety of age groups (Swanson, 2016; Centers for Disease Control, 2018). Fortunately, weight loss in obese individuals is associated with a lower incidence of such health complications and even premature death (Moyer, 2012). Therefore, research aimed at developing interventions that combat obesity and obesity related illnesses are at the forefront of today's healthcare agenda.

Obesity is a clinical problem that is multifaceted in nature as there are many causes that directly as well as indirectly contribute to the issue. According to the CDC (2014), factors such as health behavior, environment and genetics are among the main contributors linked to the complexity of the topic. Despite being recognized as a multifactorial condition, there is a multitude of strong evidence that suggests that physical activity is crucial in terms of implementing changes in body composition and ultimately preventing obesity and therefore obesity related disease (Swanson, 2016). Consequently, the purpose of this evidence-based project is to examine and implement the best evidence for promoting physical activity in an effort to combat obesity.

Statement of the Problem

The prevalence of obesity throughout America has steadily climbed over the course of the last forty years, due largely in part to the increase in sedentary lifestyle behaviors, amongst other factors (Swanson, 2016). Although the condition spans nationwide, prevalence maps over time consistently show that obesity rates tend to be greater in the Midwestern region of the country compared to other locations respectively, as approximately 30-35% of the population of these twenty states within the area are considered to be obese (Centers for Disease Control, 2016). More specifically, in regards to this evidence-project, the obesity prevalence in the Midwestern state of Indiana is of special concern. As of 2016, approximately 32.5% of Indiana adults aged eighteen and older were considered obese, while 34.7% of those adults were considered overweight with an elevated BMI.

In addition to location, age is also a factor that is studied when researching obesity trends as well. As established, throughout the United States obesity is well documented within each age group; however, one particular population has received much attention in regards to the phenomenon of weight gain, college students. The topic of weight management is often of great concern to college students as there is frequently an association between college attendance and weight gain. Although to date, no research supports the veracity of the "freshman fifteen" stigma, the paradox continues to receive much attention as multiple studies have concluded that college students do tend to gain weight during each subsequent year of their undergraduate coursework (Fedewa, Das, Evans & Dishman, 2014).

College attendance undoubtedly is a time of transition for many young American adults. This transition phase can be quite overwhelming for many students and can essentially affect their weight management abilities. It is projected that such weight gain in college students may be attributed to several lifestyle changes that students attending a university setting often undergo (e.g., changes in dietary habits, financial limitations, increased stress, priority constraints, and an overall lack of health promotion awareness) (Swanson, 2016). It is not uncommon for university students to engage in increased sedentary behaviors related to study obligations and ultimately experience barriers to exercise and physical activity. For example, reading, studying, sitting in a classroom setting, and increased use of the computers, tablets and electronic devices are all sedentary activities that are promoted during college years to maintain successful academic standing. These sedentary behaviors do not promote engagement in physical activity and can lead to weight gain. (Das & Evans, 2014).

These factors are of utmost concern as a significant portion of college attendees report shifting from a normal weight status prior to college to that of being overweight or even obese during their college years. Alarmingly, approximately one third of college students are considered overweight or obese at this time. (Das & Evans, 2014). These students ultimately pose a public health risk as it is well documented that young adults who are overweight in college are at a greater risk of becoming obese adults who experience negative obesity related health consequences and increased risk of chronic disease. (Sarcona, Williams, Kovacs & Wright, 2017).

Data from Literature Supporting Need for the Project

Physical activity has been widely recognized as a valid means of combatting obesity and negative weight gain while promoting health related quality of life (Swanson, 2016). Therefore, implementing strategies aimed at increasing physical fitness in attempt to control weight management within college students can essentially promote preventative health practices amongst young adults and potentially lead to a decrease in the overall presence of preventable chronic disease later in life (Swanson, 2016). Despite the well documented benefits of regular physical activity, research indicates that participation in regular physical activity often declines during young adulthood. In 2008, in attempt to maximize the potential for young adults to achieve health benefits stemming from physical activity participation, the Physical Activity Guidelines (PAGs) for Americans were developed. According to these guidelines, young adults are encouraged to complete either 150 minutes of moderate-intensity aerobic physical activity per week, or 75 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate/vigorous-intensity physical activity. In addition to aerobic exercise, young adults are also encouraged to complete muscle-strengthening activities that target major muscle groups on a biweekly basis (Farren, Zhang, Martin & Thomas, 2017). Unfortunately, referring back to the statement of the problem, even though PAGs are well established, the National Center for Health Statistics reported that in 2014, only 31.1% of young adults aged 18-24 years met both aerobic and anaerobic recommendations, while nearly 39% did not meet any PAG requirements at all (Farren et al., 2017).

Although college students perceive several barriers to engaging in exercise, including increased use of technology (prolonged inactivity during screen time);, ironically, technology-based interventions have been developed and shown to promote increased physical activity amongst users (Lee & Cho, 2017). One such fitness application that is popular amongst mobile health users, is a product known as "My Fitness Pal." "My Fitness Pal" is a mobile device application which helps users track their dietary and exercise habits to determine optimal caloric intake and physical activity goals according to participant's individualized goals (Under Armour, 2018). The product utilizes gamification elements to engage users and motivate their participation in keeping track of their physical activity and diet in a diary/log type of manner. Participants are able to use the product by either scanning barcodes of the various foods they consume or manually entering them into their database, along with manually entering the type and duration of physical activity they have engaged in. After entering their data manually, the application automatically calculates the number of calories burned and accommodates this figure into the participant's daily agenda. The product, although somewhat dependent on self-reported user entry, also works in conjunction with over 50 wearable devices including FitBit and Garmin to help participants synchronize their health data for accuracy and mobility purposes (Under Armour, 2018). The product was initially developed by Mike and Albert Lee in 2005, but was then sold to the athletic apparel company Under Armour in 2015. At the time of the transaction, the mobile application had approximately 80 million users. The application has been described as user friendly, and has been ranked as the best free program according to a Consumer Reports diet rating (Consumer Reports, 2013). Promoting use of this specific intervention, "My Fitness Pal", in attempt to increase physical activity amongst the target population of this EBP project was deemed appropriate, as a majority of college students are familiar with apps and engage in smartphone/tablet use on a regular basis (Miller, Chandler & Mouttapa, 2015).

Data from the Clinical Agency Supporting Need for the Project

The EBP project will be implemented at a facility in which a need for an obesity management related intervention has been established. That particular facility is a post-secondary educational institution located in the Midwestern region of the United States in which we will refer to as, University X. University X is a private university that offers liberal arts as well as professional training and graduate studies (University X website). The university student body is comprised of approximately 3,255 undergraduate students 802 graduate students from all 50 states and over 30 countries. Full time undergraduate as well as graduate students at University X are required to carry medical insurance that typically allows them to be cared for by healthcare providers employed by the university at the student health center, located on campus. The student health center is staffed by one full time nurse practitioner, a part time nurse practitioner, a part time physician and a full time medical assistant and registered nurse who see approximately 12-15 student patients daily on a Monday-Friday basis.

The student health center director is particularly focused on wellness initiatives across campus and has recently expressed the need to develop an intervention in which addresses obesity. According to snapshot of clinical data obtained from the electronic medical records system at University X from September 2017, obesity prevalence was examined. The month of September was chosen for review due to the fact that it was the only full month during the fall semester in which students had full access to the student health center without a break in the academic calendar and therefore provided the most data. Of the 493 students seen during the month of September 2017, BMI data was available for 312 students. Such demographic data is obtained for students who seek medical attention from the health center and have a chief complaint that warrants that vital signs be taken. For example, students who present to the health center for allergy shots or visits consistent with obtaining various vaccinations, do not have their vitals including weight status/BMI assessed.

Of the 312 students, 81 students were determined to be overweight with BMI values ranging between 25-30 kg/m2 according to the Center for Disease Control guidelines. In addition, 45 students were considered obese with a BMI greater than 30 kg/m2 according to the Center for Disease Control guidelines. Therefore, 25.96% of student patients were determined to be overweight and 14.42% of students were determined to be obese, meaning that a total of nearly half of all students seen in the clinic during that particular time frame (40.38%) were either overweight or obese. According to the student health center director, this data is representative of data seen on a regular basis. These results were also determined to be approximately 10% higher than the national average for obesity prevalence amongst college students but is overall consistent with adult obesity trends nationwide.

As mentioned, the director of the health center is newly focused on wellness initiatives across campus. However, despite being aware that obesity is quite prevalent at the institution, the director admitted that there are currently no practices in place at the health center to address the issue. Obesity may be addressed if weight gain/weight management is of particular concern to a student patient or related to their chief complaint at the time of the visit and healthcare providers may recommend a multidisciplinary approach that relies heavily on self-initiated strategies to address the issue, there are no evidence-based interventions set in place and follow up is inconsistent at best.

Purpose of the Evidence-Based Practice Project

Compelling Clinical Question

The director of student health center at University X has become increasingly aware of national health statistics regarding the prevalence of obesity in the college student population. Given the nature of this modifiable health related complication, she has therefore expressed intent to develop university based wellness initiative programs through the health center that aim to focus on the benefits of exercise for the purpose of weight management. In accordance with the promotion of such wellness initiative programs, an intervention to address obesity by promoting physical activity for weight maintenance or reduction is needed. Therefore, developing an evidence-based project which included a thorough review of current practice standards and guidelines as well as identifying barriers to maintaining or initiating healthy weight behaviors in college students led to the development of a compelling clinical question: What are the best strategies for increasing exercise in college students?

PICOT question

Melnyk & Fineout-Overhold (2011) noted that once awareness of compelling clinical inquiry has been initiated, a clinical question can then be developed. To guide the development of this project, the PICOT (patient population, intervention of interest, comparison intervention or status, outcome and timeframe) format was used. Utilizing this PICOT format led to the development of the question for this project:

The purpose of this evidence-based practice project is to examine "What is the effect of using the mobile fitness application "My Fitness Pal" (I), as compared to current practice of provider recommendation (C) on weight management (O) in university college students (P) over the course of a 5-month period (T)?

CHAPTER 2

THEORETICAL FRAMEWORK, EBP MODEL, AND REVIEW OF LITERATURE

Theoretical Framework

Overview of Theoretical Framework

Evidence suggests that theory-based interventions are more effective than atheoretical approaches when it comes to attempting to implement a health practice change (Plotnikoff, Costigan, Karunamuni & Lubans, 2013). Theories provide a systematic approach to understanding the underlying basis for predicting certain health related behaviors, developing interventions to promote health behaviors, evaluating outcomes of such interventions and lastly, describing relationships amongst modifiable factors associated with such health behaviors (Thomas, Hart & Burman, 2014). Therefore, in order to effectively implement this EBP project which focuses on the promotion of increasing physical activity in order to combat obesity and obesity related disease, the Health Belief Model (HBM) was selected as the guiding theoretical framework.

The HBM, which falls into the construct of “social cognitive theories”, was developed in the 1950s by social psychologists in an attempt to understand why individuals did or did not participate in health-related behaviors (George, 2011). It is essentially a conceptual framework that aims to identify perceptions regarding the degree in which individuals are willing to engage in, as well as maintain, health promotion behaviors (McArthur, Riggs, Uribe & Spaulding, 2018). The model is motivational in nature and is comprised of several key factors including: perceived susceptibility, risk severity, benefits to action, barriers to action, self-efficacy, and cues to action (McArthur et al., 2018). The HBM postulates that individuals will engage in health behavior to promote wellness and combat disease if they regard themselves as susceptible to a related disease (perceived susceptibility) or if they believe the disease will have potentially severe consequences (risk severity). The model also suggests that individuals are likely to take health behavior action if they believe that the particular health behavior will benefit them and potentially reduce susceptibility and/or severity of certain disease (perceived benefits), and if they foresee minimal negative attributes related to the health action (perceived barriers). In addition, the HBM also recognizes that self-efficacy (or the belief that one can successfully engage in a behavior despite identifiable barriers to action) is important when considering whether or not health behaviors will be maintained. Lastly, the HBM theorizes that specific cues to action such as social, environmental and even physical factors may act as motivators for individuals to adopt favorable behavioral changes as well (McArthur et al., 2018). Essentially the HBM suggests that individuals will “achieve optimal behavior change if they successfully target perceived barriers, benefits, self-efficacy and threat” (Jones, Jensen, Scherr, Brown Christy, & Weaver, 2015, p.566).

Application of Theoretical Framework to EBP Project

The HBM can be useful for predicting and explaining individual health behaviors, such as physical activity. The main goal of this EBP project was to increase physical activity participation amongst college students. By utilizing the principles of the HBM, healthcare professionals can identify college students perceived susceptibility of becoming overweight or developing obesity related diseases and the severity of such consequences. They can also use the theoretical model to gauge the students perceived benefits of engaging in physical activity as well as identify barriers as to why physical activity participation amongst the target population is low. In this circumstance, the HBM may also be utilized to promote self-efficacy and show students that their participation in physical activity does have the potential to lead to positive health outcomes, such as weight management and prevention of obesity. Lastly, the HBM can identify motivational factors to engaging in physical activity and promote cues of action. Based on this information, the HBM was chosen as an applicable theoretical model to guide the development and implementation of an evidence-based intervention that aims to foster positive health changes and promotes increased physical activity amongst college students.

Strengths and Limitations of Theoretical Framework for EBP Project

Within the HBM is an assumption that individuals' perceptions and beliefs about health guide their actions regarding health behaviors. The model can help explain why individuals chose to engage in high-risk health behaviors, as well as why they may choose not to participate in preventative health measures. The broad-spectrum nature of the model allows it to be applied to a wide range of health behaviors and is simplistic to understand. In addition, the straightforward nature of the theoretical model allows health care professionals to promote health and well-being in a patient specific manner by attempting to understand patient subjective viewpoints regarding social and psychological determinants of health behavior (Abraham & Sheeran, 2005). By utilizing this model, health care professionals can work congruently with patients to help identify patient values regarding health and develop specific intervention plans that aim to encourage individuals to participate in positive health changes. Lastly, the model compels individuals to become aware of their thoughts and feelings regarding specific health behaviors, and empowers them that health changes can be beneficial (Abraham & Sheeran, 2005).

Despite the fact that there are many benefits of using the HBM to elicit positive health behaviors, it should be noted that the model has limitations. Although the HBM identifies several components that lead an individual to an outcome behavior, it is a flaw of the model that relationships between the identified components are not well defined. The model does not clearly differentiate whether or not each component that it is comprised of operates independently, or in tandem with the other components; this leads to ambiguity in how the HBM is applied. This ambiguity leaves room for open interpretation of the model, allowing some researchers to argue that one component such as perceived susceptibility, for example, may be more important in eliciting health behavior changes as opposed to another component (e.g., self-efficacy). Although this factor of the HBM is what allows the model to be applied to such broad range spectrum of health behavior, it is important for researchers to identify relationships between the model components to apply the model effectively and analytically (Jones et.al., 2015).

Evidence-based Practice Model

Overview of EBP Model

In addition to a theoretical model, an evidence-based practice model was consulted for development purposes of this evidence-based project as well. Evidence-based practice is utilized within health care to ensure that the best possible interventions are incorporated into clinical practice so that the best possible health outcomes may be achieved. Throughout the evidence-based process, evidence-based models are used as guidelines in order to facilitate smooth transition between knowledge acquisition and clinical practice (Melnyk & Fineout-Overholt, 2015). The Stetler Model of Evidence-Based Practice guided the development and implementation of this EBP project to facilitate research regarding increasing physical activity amongst college students into clinical practice.

The Stetler Model was originally published in 1976 in attempt to encourage nurses to adopt research findings and apply them at the bedside. The model has since undergone revisions and was last updated in 2001 in order to facilitate evidence-based practice (Stetler, 2001). The Stetler Model guides healthcare professionals through a step by step process which allows them to integrate research findings into practice. In addition to providing instruction for evidence-based application, the model encourages the use of critical thinking, promotes use of evidence-based practice in the everyday clinical setting, and helps to alleviate some of the errors that are often made in the healthcare decision making process (Stetler, 2001). The model is comprised of five phases: preparation, validation, comparative evaluation/decision-making, translation/application and evaluation. Each of these phases were utilized within the development of this EBP project.

Application of EBP Model to EBP Project

Preparation: The preparation phase of the model encourages healthcare professionals to be clear about the purpose of incorporating evidence-based practice into the clinical setting. It assumes that healthcare professionals are first starting with a clinical problem, and then affirming, and identifying the degree and priority of that particular problem based on what established literature states regarding the issue. This phases also allows healthcare professionals to identify measurable outcomes to the clinical problem and encourages them to seek out and sort through relevant evidence pertaining to the topic (Melnyk & Fineout-Overholt, 2015).

After meeting with the director of the Student Health Center at University X where the EBP project will take place, it was established that a need for a wellness initiative program that addressed weight management and obesity prevention existed. This discussion led to a literature review pertaining to the topic of obesity prevention in the college student population and ultimately helped to formulate the previously stated PICOT question: “What is the effect of using a mobile fitness application (I), as compared to current practice of provider recommendation (C) on weight management (O) in university college students (P) over the course of a 5-month period (T)? In attempt to answer the PICOT question, a search for relevant available literature occurred within several scholarly electronic databases, and the best possible evidence was obtained.

Validation: The purpose of the second phase, validation, is to analyze the evidence gathered in the preparation phase and critically appraise it. By critically appraising the literature pertaining to the topic of interest, healthcare professionals are able to determine the credibility, quality, applicability, clinical and statistical significance of the evidence and eliminate non-credible sources of information (Melnyk & Fineout-Overholt, 2015).

After the electronic database search was completed, the pertinent literature was reviewed and critiqued to determine its applicability and usefulness for this EBP project. In order to complete this systematic process, the Melnyk and Fineout-Overholt (2015) Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions was used to classify the literature by various levels of evidence. According to this system, the levels of evidence rank between Level I, which is the highest and best level of evidence to Level VII, which is considered the lowest form of evidence. Once the articles were categorized by level of evidence, they were further reviewed using the Critical Appraisal Skills Programme Checklist (CASP). Use of the CASP checklist will be further discussed in the “Appraisal of Relevant Evidence” section.

Decision-Making: In this phase of the EBP process, healthcare professionals are expected to condense and organize the evidence that they have gathered and reviewed. This step also allows individuals to attribute meaning to the collected evidence and determine what pieces should be used to facilitate practice changes (Melynk & Fineout-Overholt, 2015). During this step, decisions were made regarding what evidence should be used for the purpose of this EBP project. Selected evidence was used based on feasibility and usefulness in regard to the use of “My Fitness Pal” and other similar electronic/mobile fitness tracking applications to increase physical activity amongst university students. At the close of this step, 12 articles were chosen for the utilization of this EBP project.

Translation/Application: During the translation phase of the EBP process according to Stetler (2001), healthcare personnel must translate research findings into a plan and then effectively implement that plan into practice. This procedure requires factoring how the evidence will be communicated, disseminated, and applied. For the purpose of this EBP project, with aid of the project advisor and the site facilitator, it was determined that the project would be introduced to University X students during designated university class sessions at the beginning of the 2018 Fall semester. After the introduction to the project, students will be made aware that the project will be made available through the University X student health center and voluntary participation is welcomed.

Evaluation: The last and final phase of the Stetler Model serves to evaluate the outcomes of the change in practice and analyze the implementation movement. This step also helps healthcare professionals determine if the goals of the project were met, and allows for revisions and improvements to be made to the intervention if necessary (Stetler, 2001). By the completion of this EBP project, it is the hope that the intervention is successful and therefore may be integrated into practice as part of a health and wellness initiative program that University X continues to promote.

Strengths and Limitations of EBP Model for EBP Project

As established, the Stetler Model can be quite applicable when attempting to implement evidence-based research into the practice setting. Particular strengths of the model include: it's ability to be applied to a wide variety of research topics, and unique design that encourages the use of critical thinking to combat potential barriers to evidence-based research implementation (Stetler, 2001). It should also be noted that the model has in fact been in place since 1976, has undergone regular updates and does seemingly follow a logical step-wise progression that allows healthcare professionals to evaluate and re-evaluate their EBP decision making.

Despite the many pros of utilizing the Stetler Evidence-Based Practice Model, it should be noted that no professional model exists without limitations of it's use. A particular weakness of EBP models in general is that, although they often contain logical progression, and are designed to rely on objective data, it is inevitable that there is often room for individual interpretation and personal preferences to obscure the implementation process. This potential limitation of the model can lead to practitioner biases and therefore may guide mis-use of structured evidence-based models (Melynk & Fineout-Overholt, 2015).

Literature Search

Sources Examined for Relevant Evidence

As is necessary when attempting to implement EBP research, after the need for the EBP project was established, which is thoroughly discussed in the introduction section, a literature search pertaining to the topic of interest: the best possible methods for increasing physical activity amongst college students, was performed in order to identify best practices. Although there is much evidence regarding several different methods in which have been utilized to promote physical activity amongst college students in the past, a majority of the found literature was suggestive that in the new era of technology, mobile type fitness applications and devices may be quite helpful when it comes to encouraging younger generations to engage in exercise related behaviors. In collaboration with a research librarian, and with guidance from the project advisor, several university based electronic databases were utilized to complete the literature search process. In an effort to maximize the most relevant search results, inclusion and exclusion criteria were developed with the use of limiters to refine the search results. Once the literature search was completed using search engine terms with limiters, the evidence was classified and then critically appraised.

Search engines/Key words/Limiters

The databases utilized to complete the search included: Cumulative Index to Nursing and Allied Health (CINAHL), Medline via EBSCO, PsychINFO, and the Cochrane Collaboration Library. Within CINAHL, a search containing the search terms and major headings, (MM "physical activity") OR (MM "Exercise") OR ("physical fitness") AND (MM "World Wide Web Applications+") OR "applications" OR (MM "Mobile Applications") OR (MM "app*) OR (MM "device*) OR (MM "tracker*) OR (MM "smartphone*) OR "fitness tracker" OR "mobile fitness apps" OR "cell phones" was utilized. Specific limiters to this search required that results be scholarly reviewed, be published between the years 2013-2018, and be available in the English language. Given such limiters and search terms, this particular search yielded 108 results, 4 of which were determined to be relevant to the EBP project.

According to a search within Medline via EBSCO, the search terms and MESH headings, "Mobile Fitness Apps" OR "cell phones" OR "mobile application*" AND (MM “weight management”) OR “weight loss” OR “weight reduction” OR "physical activity" was utilized. Limiters included full text, abstract available, publications between 2013-2018 and written in the English language. This particular search yielded 157 results, 7 of which were determined to be relevant.

A search of the database PsychINFO containing the key words and thesaurus terms, (MM "physical activity") OR (MM "Exercise") OR ("physical fitness") AND (MM "World Wide Web Applications+") OR "applications" OR (MM "Mobile Applications") OR (MM "app*) OR (MM "device*) OR (MM "tracker*) OR (MM "smartphone*) OR "fitness tracker" OR "mobile fitness apps" OR "cell phones" with the limiters, scholarly reviewed, written in the English language and published between 2013-2018 yielded 136 results, 3 of which were deemed relevant.

Within the Cochrane Collaboration Library, the key term “fitness tracker” was searched and a total of 53 results were obtained. Several of the search results yielded information regarding the use of fitness trackers to promote increased physical activity; however, much of the literature obtained through this method was not relevant to the college student population and was more specific as a means to treat patients with co-morbidities and chronic diseases in a tertiary sense. In regard to the target population, 0 studies were found to be relevant. A summary of the literature search is represented in Table 2.1 for review.

Table 2.1: *Review of Literature Search*

Database	**Results**	**Reviewed**	**Duplicates**	**Accepted**
CINAHL	92	19	0	3
MEDLINE	157	27	2	6
PsychINFO	136	19	1	3
Cochrane	53	8	1	0
Totals	438	73	4	12

Levels of Evidence

Utilizing the Melynk and Fineout-Overholt (2015) Rating System for Hierarchy of Evidence for Intervention/Treatment Questions, the relevantly selected articles were critiqued to determine the level of evidence. According to this particular tool, evidence categorization ranges from Level I (highest form of evidence) to Level VII (lowest form of evidence). Level I evidence is considered evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCTs). Level II evidence is obtained from well-designed RCTs. Level III evidence is consistent with evidence obtained from well-designed controlled trials without randomization. Level IV evidence contains well-designed case-control and cohort studies. Level V evidence is from systematic reviews of descriptive and qualitative studies. Level VI evidence comes from single descriptive or qualitative studies and lastly, Level VII evidence is obtained from the opinion of authorities and/or reports of expert committees. The EBP project utilized seven level I articles, four level II articles, one level III article and three level VI articles for a total of fifteen articles. A summary of the levels of evidence, and the study designs of the reviewed literature is represented in Table 2.2.

Table 2.2: ***Levels of Evidence/Study Design***

Level	**Included**	**Design**
I	6	Systematic Reviews & Meta-Analyses
II	2	Randomized Control Trials
III	1	Cohort Studies
VI	3	Descriptive Survey Designs

Level I Evidence

The level I evidence for this EBP project was obtained from six systematic reviews and one meta-analysis of the current literature pertaining to the use of mobile application devices to increase physical activity.

Aguliar-Martinez et al. (2014).

Aguilar-Martinez et al. (2014) conducted a systematic review of ten studies that examined the use of mobile phone associated applications as tools for weight loss promotion. Using the Johns Hopkins appraisal tools, this systematic review was rated as high quality. The review focused on studies in which the primary aim was to achieve weight loss or promote weight loss maintenance and therefore reported data about weight change. Participants within the included studies ranged from 19 to 534 individuals with mean BMIs varying considerably between 22-36 kg/m2. A majority of the studies lasted approximately two to four months in duration, with one study lasting one year. All of the studies within the review addressed measuring bodyweight changes pre- and post-implementation of app interventions. Changes in bodyweight measurements were frequently complemented by other data as well (e.g., waist circumference, BMI, body fat %, participant satisfaction, level of exercise and program use.

According to summarization results of the included studies, researchers in seven articles found that bodyweight values in the intervention group had decreased by 1.6 to 4.5 kg. One study (Castelnuovo et al. 2011) found no significant changes in weight between the two groups at 12 months; however, a within group analysis of data revealed significant reductions from initial weight at 3 months (-8kg from starting weight) and at 6 months (-11kg from starting weight). Studies that examined changes in BMI found that values in the intervention group had decreased by 0. 6kg/m2 and 0.78kg/m2 respectively. Articles that examined waist circumference data found that values in the intervention group decreased by 2.3 to 6.3 cm. Upon analysis of the review, it appeared that there was a proportional relationship between app use and weight loss as participants with higher self-recording activity managed to achieve greater weight loss.

In addition to measuring anthropometric outcomes, authors of the articles within the review were also interested in examining acceptance of use of the application. A pilot study by Morak et al. (2008) examined the acceptance of a proposed app intervention amongst a group of obese participants. Morak et al. group found that the intervention was overall welcomed and well accepted and was linked to a significant and almost immediate weight loss and waist circumference reduction.

In conclusion, the work by Aguilar-Martinez et al. (2014) supported this EBP project as the proposed intervention will incorporate a mobile application intervention that utilizes self-monitoring and social support over the course of a 5-month period. The documented weight loss, timeframe for use, and acceptance rates were particularly applicable to this DNP/EBP project.

Bort-Roig et al. (2014).

Bort-Roig et al. (2014) reviewed evidence on smartphone viability for measuring and influencing physical activity. Using the Johns Hopkins tools, this article was rated as high quality.

Within the systematic review conducted by Bort-Roig et al. (2014) two independent reviewers selected 26 articles that met inclusion criteria and focused on measuring physical activity using native mobile phone features, or an external device that was linked to a mobile application. Of the articles included in the study, 17 evaluated a smart-phone based intervention in regard to physical activity effects, and within 10 of those articles, the researchers quantified findings. During the review process various application type technologies, application strategies and mechanics, and theoretical frameworks that the selected studies examined were reviewed. When synthesizing such literature, researchers focused on three key findings: a) physical activity/health effects, b) participant perception, and c) engagement.

Seven of the relevant studies focused on weight-related outcomes. Study participants in these seven studies ranged from 17-124 individuals, and interventions lasted from 1 week to 6 months, utilizing either single group pre-test/post-test design or solely post-test designs. Researchers within four of these studies, reported statistically significant improvements in body weight and body fat reduction. In addition, five intervention studies focused on reporting physical activity effects by utilizing step counts. These studies had 12 to 200 participants, with intervention lengths lasting between 2 weeks to 6 months and utilized pre-test/post-test design or case control study designs. Of these studies, three reported positive intervention effects as mean physical activity increases, ranging from 800 to 1,104 steps per day. Some of the research findings evaluated or reported by Bort-Roig et al. (2014) overlapped as some individual studies reported both on weight related outcomes as well as physical activity.

In regards to reporting participant perception and engagement of the smartphone-based app, twelve studies examined such perspectives. Within the research included in the systematic review, most users of the smartphone-based app signified that monitoring their physical activity profile, receiving feedback, linking to social networking, accessing expert consultation support, enhancing usability, and goal setting were key features that encouraged them to engage in physical activity.

A study completed by Lee et al. (2010), which was included in the systematic review, found that measures of body composition such as BMI (-3.6 kg/m2, $p < .05$),fat mass (-2.9 kg, $p < .05$), and overall weight (-3.6 kg, $p < .05$) significantly decreased for the intervention group ($n = 17$) that utilized a mobile fitness application that provided feedback on caloric expenditure and created and displayed a 3-dimensional image representing the users' weight changes. Results were compared to the control group ($n = 19$), whose weight did not significantly change over a 6-month period. In regards to engagement, 75% of the intervention group used the application once a week, 8% used it daily, 58% intended to use it in the future and 67% stated they would recommend it. Approximately 58% of the intervention group agreed that the app was easy to utilize as the contents were interesting. In an additional study included in the systematic review, Mattila et al. (2010) examined how a fitness application that provided graphical feedback based on wellness variables, represented data in a calendar view and sent personal information from the application to an expert via multimedia messages affected weight related outcomes. Mattila et al. found that amongst individuals that lost weight ($M = -2.94$ kg, $p < .01$) and those who did not (*M* = +.193 kg), the physical activity duration after the 12-week intervention increased from 65 minutes to 132 minutes respectively. Participants reported the app was easy to use, and it motivated them to be more active. The average number of daily entries was 5.32; users who lost more weight tended to have higher entries within the application. In conclusion, Bort-Roig et al. (2014) provided support of the use mobile fitness applications to enhance physical activity and support favorable health outcomes as the reviewed literature reported either a significant increase in physical activity or a significant decrease in body composition measurements. Therefore, this piece of literature supports the use of the intervention and intended outcomes of this EBP/DNP project.

Flores et al. (2015).

Flores et al. (2015) completed a systematic review and meta-analysis of high quality according to Johns Hopkins tools, to compare the efficacy of mobile phone apps with other approaches to promote weight loss and increase physical activity levels.

Flores et al. (2015) included 12 articles that assessed a mobile phone app intervention with weight related health measures (i.e., body weight, BMI, waist circumference, or physical activity levels). Flores et al. reported that Compared to the control group, participants that were involved in intervention groups that utilized mobile phone apps to promote weight loss and encouraged physical activity noticed significant yet favorable changes in body weight (-1.04 kg, 95% CI [1.75, -.34; *I*2 = 41%) and BMI (-.43 kg/m2, 95% CI [.74, -.13]). Although not statistically significant, the Flores et al. also noted a difference in physical activity between the control and intervention groups (standardized mean difference .40, 95% CI [-.07,87].

Ultimately, Flores et al. (2015) noted that these results suggest that mobile app interventions, compared with other control interventions, produced a significant reduction in body weight of -1.04 kg, a significant reduction of BMI by .43 kg/.m2, and an increase in physical activity with an *SMD* of .40. Also, it is important to note that within this meta-analysis, although the overall reductions in body weight and BMI were significant yet modest at best, the comparative control groups were also receiving various yet different weight loss interventions as well and were not solely comprised of strict control groups that received no intervention. Therefore, it would not be expected that a single intervention for weight loss (mobile phone apps) would cause clinically significant weight reductions compared to other interventions. The findings suggest that mobile phone apps may be beneficial tools for weight loss and therefore provide supportive evidence for this EBP project.

Levine et al. (2015).

Levine et al. (2015) conducted a systematic review of 16 studies that examined the effects of technology-assisted weight loss interventions. According to the Johns Hopkins tool , the quality of the study was determined to be of high quality. The review focused on studies that measured outcomes in terms of kg lost and reviewed interventions that lasted in duration from 3 to 36 months. Compared to the control group, participants within the technology assisted (including apps) intervention group lost weight at the end of the intervention period. Recorded weight loss ranged from .008 to 5.4 kg reductions (.8%-5.8% of initial bodyweight). Within the studies included in the systematic review, the percentage of participants that lost at least 5% of their initial body weight ranged from 5% to 45%. Levine et al. opined that interventions that utilized clinician support with feedback along with mobile technology promoted the greatest amount of weight loss, as 86% of these studies showed significant results. In contrast, interventions that were considered fully automated and did not provide any feedback were less likely to demonstrate significant weight loss, as only 33% of studies within this category demonstrated statistically significant results.

In conclusion, the work by Levine et al. (2015) supports the use of this EBP project as the systematic review showed favorable outcomes in terms of using mobile technology to assist in weight loss.

Muntaner, Vidal-Conti, and Palou (2015).

Muntaner, Vidal-Conti, and Palou (2015) completed a systematic review to summarize existing literature on increasing physical activity through mobile device interventions. The quality of the review was determined to be high according to the Johns Hopkins appraisal tool.

Muntaner et al. included 12 research articles that either examined indirect measures to assess physical activity (i.e., self-reported minutes of physical activity, self-reported frequency of physical activity, or self-reported questionnaires) or direct measures to assess physical activity (i.e., accelerometers or pedometer data). Included studies consisted of eight randomized control trials, two pilot studies, a feasibility study, and a matched case-control trial with sample sizes ranging from 45-210 participants. Outcomes for the majority of the studies were measured as pre-test/post-test results for both intervention and control groups. Within the review, Muntaner et al. (2015) summarized intervention results in a table. Six of the 12 included studies showed significant increases in physical activity levels status post utilizing mobile device interventions.

A case control trial completed by Kirwin et al. (2012) that was included in the review was particularly pertinent to this EBP project. Kirwin et al. aimed to measure the potential of smartphone applications to improve health behaviors among members of a website physical activity group known as “10,000 steps.” Participants within the intervention group utilized the iStepLog application on their mobile phone devices and logged their steps accordingly. Members of the control group also logged their steps but did not have access to the mobile application device. Kirwin et al. reported that members of the intervention group maintained their daily goal of 10,000 steps throughout the intervention; however, members of the control group logged a significantly lower number of steps (M = 6274.73, p < .001).

The findings from Kirwin et al. (2012) and other articles included within the Muntaner et al. (2015) systematic review indicated that use of mobile physical activity applications can be successful at allowing individuals to meet physical activity guidelines. Therefore, this systematic review provides additional supportive evidence for this EBP project.

Schoeppe et al. (2016).

A systematic review of high quality according to the Johns Hopkins appraisal tool, completed by Schoeppe et al. (2016) examined the efficacy of apps to improve diet, physical activity, and sedentary behavior. Researchers were interested in measuring changes in health behaviors and health related outcomes such as but not limited to, fitness, body weight and quality of life. A total of 27 articles meeting inclusion criteria, mostly consisting of randomized control trials (*n* = 19), were selected. Sample sizes of the selected articles ranged between 17 and502 participants, with the duration of the interventions varying from 1-24 weeks. Of the 27 articles, 23 studies targeted physical activity outcomes, as opposed to dietary habits/sedentary behaviors, and will therefore be the focus of this review as it pertains to the EBP project. In addition to physical activity levels, 11 of those studies also reported changes in body weight status. Of the 23 studies targeting physical activity outcomes, 13 studies reported a significant increase in physical activity, one study reported an improvement in sedentary behaviors, four studies reported significant weight reductions, and one study reported an improvement in fitness levels. Of the studies reporting significant changes in outcomes, nine studies detected between-group differences in physical activity, and two studies detected differences between weight status in favor of the group that received the app intervention.

Within the evidence reviewed by Schoeppe et al. (2016), the studies that showed significant between-group improvements in favor of the group that received the app intervention tended to incorporate multi-component interventions with sample sizes greater than 90 participants and intervention durations greater than eight weeks. Apps that demonstrated efficacy in regard to significant improvements in behavior and health outcomes included goal-setting, self-monitoring, and performance feedback. Some efficacious interventions also utilized techniques such as social support from peers as well. In addition, 11 studies reported statistics regarding app usage, with three studies specifically examining associations between app usage and behavior change outcomes. All three studies that examined this effect found that higher app usage was associated with improvements in physical activity levels.

A study within the review, conducted by Patridge et al. (2015) was particularly applicable to this EBP project. Patridge et al. found that after a 12-week intervention in which participants in the intervention group utilized a mobile fitness app, there was a significant difference among physical activity levels and weight change status between the intervention and control groups. At 12 weeks, the intervention group had increased their total physical activity level by 1.3 days/week (95% CI [0.5,2.2], p = .003) compared to the control group. At the same time frame interval, the intervention group also lost 2.2 kg more than the control group (95%CI [0.8,3.6], p = .005) with a -.5 kg/m2 change in BMI comparatively as well (95%CI [0.1-1.0], p = .02). Follow up completed at 9 months status post the intervention showed that significant between group improvements in weight status were maintained.

Schoeppe et al. (2016) summarized their findings in a table within the article and concluded that apps can be effective tools at implementing health behavior changes, such as decreasing body weight or increasing physical activity levels. These findings consequently supported the aim of the EBP project.

Level II Evidence

Level II evidence was obtained from two randomized control trials. Both studies were evaluated using the Johns Hopkins appraisal tool and were found to be of high quality. The studies were both determined to be consistent, allowed the reader to draw definitive conclusions, and maintained adequate control within their respective experimental designs.

Allen et al. (2013).

Allen et al. (2013) conducted a pilot study that aimed to evaluate the feasibility, acceptability, and efficacy of theoretically based behavioral interventions delivered by smartphone technology. The study recruited a total of 68 obese (BMI between 28-42 kg/m2) individuals via a variety of strategies including physician referrals, consulting a list of existing volunteers from previous weight loss studies, and flyers. Participants were randomly assigned to receive one of four interventions over the course of 6 months: 1) intensive counseling intervention, 2) intensive counseling plus smartphone intervention, 3) a less intensive counseling plus smartphone intervention and 4) smartphone intervention only. Each group was informed that their goal was 5% weight loss and at least 150 minutes of moderate or greater intensity physical activity per week. Individuals in the intensive counseling intervention group received healthy eating tips and exercise counseling from a nutrition coach throughout the intervention (weekly for the first month then biweekly for the remainder of the 5 months). Individuals in the less intense counseling group received nutrition and exercise tips as well, but less frequently (twice during the first month, then monthly for the remainder of the intervention). Participants in the smartphone only group received one session on basic nutrition through the application itself. The app promoted self-management and provided real time feedback motivators ad opportunities for social media support and engagement.

Allen et al. (2013) were interested in measuring outcomes such as weight, BMI, waist circumference, and self-reported physical activity and did so during baseline assessment and then again at completion of the 6-month intervention. In addition, utilization and satisfaction with the smartphone app were assessed. Allen et al. reported that 64% of individuals in the intensive counseling plus self-monitoring smartphone group and 40% of the less intensive counseling plus smartphone group decreased their body weight by 5% or greater. Approximately 25% of the counseling only group and 20% of the smartphone only group achieved the 5% weight loss goal. More specifically, at the conclusion of the intervention: the intensive counseling group exhibited a change of -2.5 kg in body weight, a -.8 kg/m2 change in BMI, and on average 3 cm reduction in waist circumference. The intensive counseling plus smartphone app group exhibited a change of -5.4 kg in body weight, a -1.8kg/m2 reduction in BMI, and on average 6 cm reduction in waist circumference. The less intensive counseling plus smartphone group exhibited a -3.3 kg change in body weight, a -1.1kg/m2 difference in BMI, and -5 cm difference in waist circumference. Lastly, the smartphone only group exhibited a -1.8 kg weight loss, a -0.7kg/m2 change in BMI, and a 2cm decrease in waist circumference. The smartphone only group showed an increase in self-reported physical activity as well.

Although, each group did exhibit a reduction in anthropometric body measurements that were clinically significant, no data was statistically significant. The lack of statistical significance is believed to be due in part to study limitations that include a relatively small sample size, overall attrition rate of 37%, and unequal attrition rates between intervention groups. However, despite these results the pilot trial has shown that combination of personalized counseling and self-monitoring by smartphone app to be an acceptable form of weight loss intervention.

The study provides preliminary support for using smartphone application for self-monitoring but also stresses the importance that the role of counseling in addition to use the of such applications may play in allowing individuals to achieve successful weight loss and or increase their physical activity levels. Within the study, researchers also provided insight into the importance of recruiting a larger sample size to add power to the statistical analysis. This evidence was considered important in the planning of this EBP project.

Faning et al. (2017).

Faning e al. (2017) conducted a 12-week randomized factorial intervention to determine the impact of a self-monitoring smartphone app on moderate-to-vigorous physical activity (MVPA) and application usage between 2015-2016 in Champaign-Urbana, IL. Healthy, but low active individuals (*N* = 116) were recruited to participate in the study via convenience sampling and social media advertising. The study design was a four-arm factorial trial meaning that participants received either 1) the basic self-monitoring app (*n* = 30), 2) the basic app plus goal setting (n=31), 3) the basic app plus points-based feedback (n=26) or 4) the basic app plus both modules (n=29). The basic app in which all individuals had access to included tracking, instant feedback, and biweekly feedback. Individuals that had access to the goal setting feature were counseled on a goal setting process that incorporated SMART goals principles (Specific, Measurable, Action-Oriented, Adjustable, Realistic, and Timely) and social cognitive theory driven procedures. Goals were matched according to public health recommendations regarding physical activity i.e., 30 minutes of aerobic MVPA five days per week and 30 minutes of strengthening exercises twice per week. Individuals that had access to the points-based feedback module received instant social cognitive theory-based feedback and obtained incremental rewards in the form "program points." When enough program points were accrued, participants were able to move up "levels" and receive "badges" of recognition within the app. All individuals within the study were required to wear provided accelerometers that measured their physical activity levels throughout the intervention as well.

After completion of the 12-week intervention, researchers recorded outcome measurements: physical activity levels (via accelerometers), self-efficacy (via the Barriers Specific Self-Efficacy Scale), perceived barriers to physical activity (via the Perceived Barriers Scale), outcomes expectations (via the Multidimensional Outcomes Expectations for Exercise Scale) and goals (via the Exercise Goal Setting Questionnaire). Of the 116 initial participants, 103 completed follow-up questioning, and 96 individuals returned the accelerometers with sufficient data for analysis. As Results showed a mean increase in daily MVPA from 34.88 to 46.77 minutes (+11.90 increase, ($p < .01$) across the intervention. Additionally, the analysis demonstrated that individuals with access to the points module engaged in an additional 5.94 minutes of activity per day (p =.05). In regard to various psychosocial principles such as self-efficacy and barriers to physical activity, ANOVA scores identified a significant interaction effect between program points and time spent engaging in physical activity (p = .01). The remaining effects were not significant. The three-way interaction between time, points and goals was also found to be statistically significant (P=.01). Additionally, those individuals who received the points module exhibited greater perceived goal setting ability than those who did not receive points (p = .01).

Faning et al.'s (2017) findings demonstrated the effectiveness of a mobile app for increasing physical activity and provided evidence to support specific features within apps as a means of further engaging participants These results support the implementation of this EBP project, as the goal is to increase physical activity with the use of a smartphone application. In particular, this study reflects the benefit of additional engagement of participants, which will be considered in the strategic planning of the implementation phase of this project.

Level III Evidence

Level III evidence was obtained from a cohort study conducted by Bond et al. (2014). This study was appraised once again using the Johns Hopkins appraisal tool and was found to be of high quality. Bond et al. (2014) tested a smartphone-based intervention to monitor and decrease sedentary time (SED) in overweight/obese populations over a 4-week period between September 2012 and December 2013. Researchers named the study "B-MOBILE" and recruited a convenience sample of 30 overweight/obese individuals (BMI > 25 kg/m2) to participate in the intervention after advertising via social media outlets, local newspapers and a hospital-network affiliated intranet website. At the start of the study, all participants provided demographic data via questionnaires, underwent body composition measurements, and were provided with a multi-sensor armband with accelerometer that objectively measured time spent in sedentary actions. Participants were instructed to wear the arm band sensor for a period of seven consecutive days in order to provide researchers with baseline data about their time spent engaged in sedentary, as well as physical activity behaviors. After the 7-day baseline data was obtained, participants returned for a second study visit in order to receive 10 minutes of in-person education regarding rationale for reducing sedentary behaviors. Such rationale included but was not limited to, defining sedentary behavior, describing risks of sedentary behavior, and identifying potential health benefits of reducing sedentary behavior.

Participants were then provided with a smartphone equipped with the B-MOBILE application, were given a tutorial on how to use the device and were instructed that the application utilized physical activity break conditions such as a 3-minute break after 30 continuous sedentary minutes, 6- minute break after 60- minute continuous sedentary minutes or a 12-minute break after 120 continuous sedentary minutes in counterbalanced order. The three physical activity break goals were used in conjunction with the accelerometer data from the smartphone to prompt physical activity breaks when the device noticed that the participant had spent the maximum number of minutes engaging in continuous sedentary behavior. For example, when the smartphone device detected that a participant had spent 30 minutes of continuous sedentary behavior without taking a physical activity break of at least 3 minutes, the smartphone application provided the user with an audible prompt and on-screen text reminder of the physical activity break goal and encouraged participation in physical activity. When the prompt alerted, participants had the option of performing a physical activity break, silencing the prompt, or delaying the prompt for another 30 minutes. Real-time accelerometer data was then used to determine whether participants were compliant with such prompts to complete physical activity, and received complimentary messages praising their accomplishment. Participants were randomized to each of the three physical activity break protocols for 7 consecutive days, before receiving new randomization with a different protocol for the following 7 days for a total of 21 days in which they received the intervention. At the conclusion of the last protocol, participants completed a survey designed to access acceptability of the application and received printouts from the monitor that displayed sedentary behavior times as well as different intensities of physical activity that participants engaged in.

Data from the study was then analyzed to compare how time spent in sedentary behaviors, as well as time spent engaging in light and moderate-to-vigorous physical activity, differed during the baseline period and each of the 3 physical activity break condition periods. Bond et al. (2014) found that percentage of time spent in sedentary behavior was significantly decreased during all three physical activity break conditions of the intervention compared to baseline data ($p < .005$). Planned pairwise comparisons revealed that the 3-minute activity break condition produced significantly greater reductions in sedentary time compared to the 12-minute physical activity break condition (p = .04).

In regard to acceptability of the application, participants rated the degree to which they felt the application display and feedback increased their motivation to engage in physical activity via a Likert scale with 1 representing “strongly disagree” and 5 representing “strongly agree”. Participants also rated whether or not they felt that the time they spent in sedentary behaviors decreased as result of the intervention. Twenty-seven of the 30 participants (90%) rated the application with either a 4/5 or 5/5 on the Likert scale for the two aforementioned categories, indicating that they felt the application significantly increased their motivation to participate in physical activity as well as decreased their sedentary behaviors overall.

This smartphone-based intervention significantly reduced sedentary behavior time, indicating that frequent short activity breaks may be an effective way to promote physical activity in overweight/obese individuals. Therefore, Bond et al (2014) supports the use smartphone-based applications to promote physical activity, thus providing evidence to support this DNP project.

Level VI Evidence

Level VI evidence was obtained from 3 qualitative or descriptive studies. All studies provided insightful interpretation, reported on transparency, and allowed the reader to engage in self-reflection, and were therefore considered to be of high quality according to the Johns Hopkins appraisal tool.

Aroni et al. (2017).

Aroni et al. (2017) conducted a descriptive study to explore the degree to which smartphone-based fitness applications helped people start and maintain a regular physical activity regimen. The study was completed across North America, South America and Europe, and consisted of 904 participants that were recruited via convenience sampling from social media outlets. Participants were sent a signed consent form and then directed to complete a survey questionnaire. Survey questions included: five demographic questions (age, gender, and continent/country/city of residence), eight closed-ended questions regarding their current physical activity (frequency, duration, intensity and type of physical activity, use of physical activity apps, what types of apps ever used, which app feature do you consider most beneficial in helping you begin and maintain physical activity) and two Likert scale questions (belief that any of the physical activity apps help to initiate or maintain physical activity).

Aroni et al. (2017) analyzed response data and formulated a physical activity index (PA Index) in which they assigned to participants based on survey answers. Researchers found that approximately 63.6% of respondents had utilized a fitness application either currently, or in the past. Of these app users, approximately 34.7% felt that "tracking calories burned" was the most important feature of the fitness app as it helped them maintain their physical activity regimen. In terms of use of the fitness app, the study found that individuals who downloaded and used the app had significantly, higher PA Index than those who refrained from its' use F (1,901) = 28.82, p < .01. Researchers also found that individuals who believed that the app helped them to begin exercising showed a higher PA Index as well, $F(4,899)=3.57$, $p < .007$. Similar results were seen for individuals who felt that the app helped them to maintain their exercise regimen, $F(5,897)= 5.24$.

These results reveal that individuals who download physical activity apps tend to have higher physical activity indexes and engage in more physical activity than individuals who do not. This data supports the use of this EBP project, specifically in the sense that the app that participants of the project will be utilizing does in fact have a feature that allows individuals to track calories burned.

Litman et al. (2015).

Litman et al. (2015) conducted a descriptive study that aimed to examine whether the use of exercise apps was associated with increased levels of exercise and improved health outcomes. The researchers recruited 726 participants through an online marketplace.

Participants were surveyed about their use of exercise apps and placed into one of three categories based on their responses: 1) individuals who have never used an exercise app, 2) individuals who have used exercise apps in the past but are not currently using at this time and 3) individuals who currently use exercise apps. In addition, participants were also asked about their long-term levels of exercise as well as their exercise level from the previous week using the International Physical Activity Questionnaire (IPAQ).

Approximately 75% of current app users reported being more active compared to 50% of previous and non-users. The IPAQ results also showed that current app users had total higher leisure time metabolic equivalencies (METs), including walking and vigorous exercise (1169 METs), compared to their counterparts who had either never used an exercise app (577 Mets), or had discontinued use (612 METs). These results meant that individuals who currently engage in exercise app use tended to be more physical active, creating a higher caloric expenditure even when they were completing “leisure” activities, than individuals who did not currently use an exercise app. Importantly, the results of the study also showed that individuals who currently used an exercise app had a lower BMI than past app users and non-app users. (25.16 vs. 26.8 vs. 26.9 respectively).

These results showed that individuals who utilize exercise apps are more likely to engage in physical activity during leisure times compared to individuals who do not utilize exercise apps, essentially meeting the goal that many exercise apps were designed to accomplish. Since the aim of this EBP project is to encourage physical activity through use of a mobile exercise app, these results added to the body of evidence supporting this project.

Sarcona et al. (2017).

Sarcona et al. (2017) conducted a cross-sectional study to evaluate the differences in health-related behaviors such as diet and physical activity levels between users and nonusers of mobile health applications among college students. The researchers ultimately aimed to determine if there was a relationship between mobile health application use and lifestyle and physical activity. A convenience sample of 401 participants was obtained through advertising at two campuses: one suburban and one urban university. Participants completed informed consent at the time of recruitment and then were asked to complete a survey about their mobile health application use via the software Survey Monkey Inc. The survey utilized validated questionnaires to assess lifestyle behaviors/attitudes, frequency of physical activity and behaviors associated with weight loss/management.

For individuals who had a history of either previous or current mobile health application use, most participants reported positive feelings in regard to their use of mobile health and fitness apps. These participants (n =185) reported that using the app helped them keep track of their exercise habits (n = 125), helped them manage their weight (n = 60), motivated them to increase their physical activity (n = 91), and maintain a positive body image (n = 44). These results indicate a 4:1 positive to negative response regarding how participants felt about their use of the app. In order determine what the relationship between mobile health app use and lifestyle and physical activity level was, a one-way multivariate analysis of variance (MANOVA) was used. The dependent variables consisted of lifestyle scores as well as physical activity scores, while the independent variable was mobile health app use. According to results of this analysis, there was a statistically significant difference between mobile app users and nonusers on the combined lifestyle and physical activity scores variables (F (3,393)= 3.93, p = .009).

Sarcona et al (2017) concluded that app use was positively related to an overall improvement in lifestyle behaviors. These findings provided additional evidence to support the use of mobile health applications to promote physical activity.

Construction of Evidence-based Practice

Synthesis of Critically Appraised Literature

After the review and appraisal of literature was completed, several commonalities among the current literature were identified and particular themes were developed to aid in constructing a best practice guideline. The evidence was synthesized so that the EBP PICOT question could better be answered. The common themes identified throughout the literature will be synthesized as follows accordingly.

Duration of Intervention

A majority of the synthesized research that analyzed the effectiveness of using a mobile application to improve weight related outcomes and/or increase physical activity noted that duration of the study intervention was of importance (Aguliar-Martinez et al. 2014; Allen et al. 2013; Bond et al. 2014; Bort-Roig et al. 2014; Fanning et al. 2017; Levine et al. 2015, Schoeppe et al. 2016). However, this duration varied among the examined literature; Each of the studies within the literature review that utilized an intervention did so over the duration range of 1 week to 36 months. Although all of the studies were efficacious in terms of accomplishing the goals they set, it appears that the studies that elicited the best results were the ones that took place for a duration of greater than 8 weeks (Schoeppe et al. 2016. In addition, BMI has found to be negatively correlated with the length of app usage, meaning that individuals who use the app for longer periods of time, tend to have BMI values that decrease consequently (Litman et al. 2015). These factors will be considered when determining best practice for the EBP project.

Acceptance of App Use

The field of telehealth, the paradigm that utilizes concepts of health in conjunction with the use of technology as tools in health services, has observed exponential growth in recent years. Thanks to advances in the fields of technology and communications, the use of mobile health services (mHealth) i.e. utilizing mobile applications, has become a new and popular concept, specifically pertaining to health and fitness (Allen et al. 2013; Aroni et al. 2017; Bort-Roig et al. 2014; Fanning et al. 2016; Litman et al. 2015; Muntaner et al. 2015; Sarcona et al. 2017; Schoeppe et al. 2016). Users of such mobile fitness applications perceive the apps as easy to use, rank their usefulness as high in terms of motivating them to engage in physical activity, find the technology to be helpful in terms of tracking their fitness goals, and would recommend use of such apps to others (Aguilar-Martinez et al. 2014;Allen et al. 2013; Bond et al. 2014; Bort-Roig et al. 2014; Fanning et al. 2016; Sarcona et al. 2017). The results of these studies suggest that mobile fitness applications have high acceptance rates amongst users and are generally well perceived.

Self-Efficacy

Another commonality that was noted during the review of literature, was that of self-efficacy. Self-efficacy, according to the purpose of this EBP project, refers to an individual's confidence in their ability to engage in exercise for the purpose of health promotion and/or weight management/reduction. Interventions that are successful at increasing exercise levels also inevitably empower individuals to recognize the health benefits they can receive from such actions (Allen et al. 2013; Fanning et al. 2016; Litman et al. 2015). Self-efficacy has also been shown to be positively correlated with measures of physical activity and negatively correlated with BMI values (Litman et al. 2015). The results of these studies show that increasing exercise self-efficacy can promote individuals to achieve more favorable exercise related outcomes.

App Use: Favorable Outcomes

Although all selected quantitative articles included within the literature review demonstrated favorable outcomes in terms of increasing physical activity levels or decreasing anthropometric body measurements with the use of mobile fitness applications to some degree or another, some studies examined the relationship between these favorable outcomes and the frequency of the app use more closely than others. More specifically, upon further assessment of the topic it was concluded that there appears to be a directly proportional relationship between fitness app usage and favorable physical outcomes (Aguliar-Martinez et al., 2014; Muntaner et al. 2015). This positive correlation between the two factors is further evident as it is shown that individuals that engage in higher self-recording activities or greater app usage managed to achieve greater weight loss results (Aguliar-Martinez et al. 2014; Bort-Roig et al. 2014; Schoeppe et al. 2016).

Features of efficacious interventions

Within the literature review several articles identified common features of fitness-based smartphone applications that were found to accompany successful intervention outcomes in regards to increasing physical activity and/or decreasing body weight/BMI. These recurrent characteristics include self-monitoring, goal setting, social support and feedback. The concept of self-monitoring, which is a popular feature of most mobile fitness apps, is an evidence-based element that has been effective when promoting behavior change ((Bond et al.2014; Levine et al. 2014). As this concept is based on established evidence, it is appropriate to include it in an intervention that attempts to promote behavior change such as encouraging physical activity to maintain healthy bodyweight status. In addition, goal setting was identified as a recurrent commonality of successful physical activity/weight loss interventions as well (Bond et al.2014; Bort-Roig et al. 2014; Fanning et al. 2017). The feature was identified by participants as being a favorable characteristic that helped them to process their intentions and address their ambitions. Social support was also identified as a key feature that facilitated physical activity engagement (Aguliar-Martinez et al. 2014; Allen et al. 2013; Bort-Roig et al.2014; Sarcona et al. 2017; Schoeppe et al. 2016). Users of smartphone apps who were successful in achieving favorable intervention outcomes reported that the social support feature allowed them to engage in friendly competition with their peers (Sarcona et al. 2017), acted as a motivational tool (Aguilar-Martinez et al. 2014) and provided them with the support they felt was necessary to continue using the application (Allen et al. 2013; Bort-Roig et al. 2014; Schoeppe et al. 2016). Lastly, interventions that included feedback, specifically from clinicians or guided software promoted more weight loss amongst individuals who utilized the app compared to individuals who did not have access to this feature. ((Allen et al. 2013; Bond et al. 2014; Bort-Roig et al. 2014; Levine et al. 2014; Muntaner et al. 2015).

Best Practice Model Recommendation

Utilizing the aforementioned appraised literature as the foundation for this EBP project best practice recommendations were developed. The DNP student facilitator along with the project advisor and the clinical site coordinator were presented with the evidence synthesis so that such best practice recommendations could be tailored to the specific needs of the project facility. The review and synthesis of the best available literature provided a solid foundation so that the PICOT question: “What is the effect of using the mobile fitness application (I), as compared to current practice of provider recommendation (C) on weight management (O) in university college students (P) over the course of a 5-month period (T)? could be answered.

How the Best Practice Model will Answer the Clinical Question

Results of the summarized evidence and literature synthesis detailed above provided the structure for the development of a wellness initiative intervention that aims to increase physical activity to promote healthy bodyweight status amongst university students. After completion of the literature synthesis and with thorough consideration, it was decided that the smartphone application “My Fitness Pal” would be the intervention in which was utilized to complete the EBP project. Educational materials including, benefits of physical activity, introduction to the “My Fitness Pal” application and fitness “fun facts” that were personalized to the setting of the University X campus were developed via an online presentation in order to be disseminated to project participants.

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

Physical activity guidelines (PAGs) are created to encourage young adults such as university students, to participate in exercise as a form of primary prevention of obesity related diseases. Despite these recommendations set forth by governing bodies and agencies aimed at targeting the obesity epidemic throughout the United States (US), participation of regular physical activity amongst college students remains low (Farren et al., 2017). In addition to low individual participation in physical activity, wellness initiatives that are designed to promote physical activity across college campuses are lacking at best. In accordance with following the steps of the Stetler Model for evidence-based practice that was used to help guide this EBP project, Chapter 3 will discuss the fourth phase of the model, which is the segment known as translation. The translation phase of the Stetler Model is used to introduce a plan for implementation of best practice recommendations and will describe the participants and setting, outcomes measured, the intervention, planning, data collection procedures, and the methods of ensuring protection of human subjects.

Participants and Setting

The setting for this EBP project was a student health center at a private Lutheran university campus located in the Midwestern region of the US, which will be referred to within this document as “University X.” The student health center provides comprehensive care to full-time undergraduate and graduate students. The health center is staffed full time by an advanced practice nurse director, a nurse and a medical assistant, while a physician and other various nurse practitioners treat patients on a part time basis as well. The health center facility has scheduled appointments from 8AM-4PM Monday through Friday during the academic year and 8AM-12PM during the summer sessions. The facility began billing insurance services for the care provided in 2016, and students are required to purchase insurance through a group plan organized through the university or have comparable coverage of a personal policy that includes the health center staff and approved providers. Although students may be seen for management of acute and chronic health conditions, the health center director has recently begun integrating wellness initiatives (Valparaiso University Student Health Center, 2018).

Targeted participants of the EBP project were full-time undergraduate University X students who were currently enrolled in their freshman, sophomore, junior or senior year at the institution who were eligible to establish care at the student health center. Although enrollment in the project was open to undergraduate students of all majors with access to the university health center, the project did incorporate a specific recruitment focus amongst undergraduate nursing students due to greater accessibility to this population by the project coordinator.

Outcomes

The goals of this EBP project were to increase caloric expenditure, encourage physical activity participation, and promote healthy bodyweight status/weight maintenance amongst university students. The measured primary outcomes of this project include bodyweight management measured as body mass index (BMI) and caloric expenditure. Secondary outcomes of the project are to evaluate the effect of using a mobile fitness application on self-efficacy as it pertains to exercise. Baseline data including BMI and a exercise self-efficacy screening score were obtained immediately prior to the intervention, with follow up data regarding BMI collected at 6 weeks mid-intervention, and again at the conclusion of the 12 week intervention. A post intervention exercise self-efficacy screening score was obtained at the 12 week intervention as well.

Planning and Intervention

In order to effectively plan for the implementation phase of the EBP project, the steps of the Stetler EBP model were reviewed and taken into consideration. In review, step 1 (preparation) of the model included identifying the need to increase physical activity and reduce prevalence of obesity amongst university students and incorporated a review of relevant literature. Step 2 (validation) of the model included critiquing the reviewed literature for applicability to the EBP project. During step 3 (decision-making) the literature was synthesized to discover commonalities and a decision was made to establish best practices for the proposed intervention. Step 4 (translation), which as mentioned is the basis for the current Chapter 3, included assessing the available population, and determining the best methods for implementing the EBP project through the health center at University X to undergraduate university students.

The review of literature revealed that mobile fitness applications were successful in regard to increasing physical activity and promoting healthy bodyweight status amongst individuals (Aguliar-Martinez et al., 2014; Allen et al., 2013; Aroni et al., 2017; Bond et al., 2014; Bort-Roig et al., 2014; Faning et al., 2017; Flores et al., 2015; Lee & Cho, 2017; Levine et al., 2015; Litman et al., 2015; Muntaner, Vidal-Conti, and Palou, 2015; Sarcona et al., 2017; Schoeppe et al., 2016). Although the literature review did not specify which particular mobile fitness application was the most effective in promoting favorable physical outcomes, it did in fact allow for synthetization and identification of features of fitness applications that have been successful. Successful features of such mobile fitness application interventions include: duration of application usage greater than 8 weeks mobile applications that promoted self-efficacy, and applications that included self-monitoring feedback options, social support and goal setting. Consequently, in attempt to incorporate the efficacious features of successful reviewed interventions, this particular EBP project was designed to last 12 weeks in duration and will focus on the usage of the application known as “My Fitness Pal,” which allows users the option to utilize all of the aforementioned effective attributes of successful studies.

In order to recruit undergraduate nursing students for possible participation, a list of undergraduate nursing courses offered during the Fall 2018 semester, including professor information and date/meeting times were obtained for review through correspondence with the assistant dean of the undergraduate nursing program. Once the list was reviewed, 3 separate courses that targeted sophomore, junior and senior nursing students were identified as a means to recruit participants within each cohort. Undergraduate freshman nursing students were excluded in terms of recruitment as these students were not as easily accessible to the project coordinator due to scheduling of freshman courses outside of the college or nursing and health professions building. Nursing faculty of such courses were contacted via e-mail by the project coordinator of the EBP project in attempt to arrange a meeting with the students during designated class time and introduce the EBP project in hopes of enrolling interested participants accordingly. All 3 nursing faculty were agreeable in regards to the project coordinator request to present EBP project information to their students and a meeting time for the project coordinator to present a PowerPoint presentation explaining the project was arranged during the Fall 2018 semester.

PowerPoint materials provided students with background information regarding the need for the project, an introduction to the "My Fitness Pal" application, and details and requirements including a timeline of the project duration. After conclusion of the brief informative session, interested participants were invited to stay after class to complete a consent form and received instructions on how to proceed with downloading the "My Fitness Pal" application and creating a unique username. Enrolled participants were informed that they would download "My Fitness Pal" and begin using the application to log their normal daily physical activity for a one-week time period. Participants were instructed that during this one-week time frame they were not to change anything about their normal daily physical activity as this information would serve as baseline data. Students were instructed that if they participated in physical activity of any kind, they would log it within the application, and if they did not participate in any exercise, they simply would not log any activity at all. Participants were then informed that the project coordinator would return to the class meeting time one week later to have participants complete a demographic form, pre-intervention exercise self-efficacy screening, obtain a baseline bodyweight measurement and receive a helpful tool in the form of an informative brochure that was designed to aid project participants in increasing their physical activity, specifically while on campus at University X. The brochure included information on remote parking passes to encourage increased ambulation on campus, the Zagster application to promote use of the Valparaiso Velocity Bike Share program, facts relating to steps between campus buildings, activities offered by the university recreational sports fitness center such as group fitness classes, club sports information and facts pertaining to the health benefits of physical activity. From that point on, participants were instructed to consult the helpful exercise tip brochure that they received and continue logging their physical activity within the application.

The project coordinator added participants to the social media account known as DNPfit2018, a user name designed specifically for the purpose of the EBP project. It is from this account that participant physical activity and caloric expenditure was monitored, tracked and calculated on a weekly basis to be used for comparison pre-and post-intervention. In addition to monitoring physical activity and log ins, the project coordinator was also able to communicate and correspond with participants through the social media aspect of the mobile application to remind participants of weigh ins, request they add their baseline physical activity from the beginning of the project so comparisons could be made, or answer questions that participants may have had regarding how to log a certain type of physical activity. While participants continued to log their physical activity on a weekly basis, they were also made aware that they would then return to campus in 6 weeks to obtain a mid-intervention weight, and at the conclusion of the 12-week intervention to provide a final weight and complete the same self-efficacy screening post intervention.

In order to recruit university students from other various undergraduate majors, a brochure containing the same information as the PowerPoint presentation delivered to nursing students was designed and made available for all undergraduate students who presented to the university health center for a multitude of chief complaints throughout November 2018. Brochures were not passed out to students by the student health center staff during the principal investigators absence from the clinic. Brochures were passed out to the students at the conclusion of their visit by the project coordinator approximately one day per week during the month of November and interested participants filled out a consent form and received instructions on how to proceed with downloading the “My Fitness Pal” application. Participants recruited through the health center were given the same instructions as nursing students in regards to logging baseline physical activity data through the application for the first week of the intervention. They were then given an appointment reminder card with a date for the following week to return to the health center in order to complete a demographic sheet, pre-intervention exercise self-efficacy screening, obtain a baseline bodyweight measurement and receive the same informative brochure designed to help students increase their physical activity as described in the previous section. From that point on, health center participants were instructed to consult the helpful exercise tip brochure that they received and continue logging their physical activity within the application in the same fashion as the nursing students were. Follow up to obtain the 6-week mid-intervention and 12-week post-intervention weights and repeat exercise self-efficacy screening at the conclusion of the project would then occur at the health center accordingly. Participant log in and caloric expenditure would be monitored, tracked and calculated on a weekly basis within the application.

Data

Measures

The ultimate unit of measurement for this EBP project will be reported as change in participant BMI throughout the course of the 12-week intervention as measured on 3 separate occasions including a baseline BMI, a 6-week mid-intervention BMI and a 12-week post intervention BMI. Participants were weighed clothed but barefoot as to not account for heavy footwear in which they may be wearing. Another outcome of the project, the caloric expenditure was reported as kilocalories expended on a weekly basis. Calories expended during the baseline data collection week was compared to the weekly calories burned throughout the 12-week intervention. Self-efficacy was measured by utilizing the Exercise Self-Efficacy Screening Tool (Appendix C). This particular tool was developed by Neupert, Lachman and Whitbourne (2009) as a modified version of Bandura's Exercise Self-Efficacy Scale (Bandura, 1997). The screening tool contains 9 items which are answered in a Likert type manner and contain responses including: very sure, pretty sure, a little sure and not sure at all. Established reliability of the screening tool is expressed as the mean score across the nine items is equivalent to a coefficient alpha of .88. The validity of the tool is expressed as a higher score on this scale indicates greater exercise related self-efficacy. The total score of the scale is calculated by summing the responses to each question, with responses ranging anywhere from 9-28 (Neupert, Lachman & Whitman, 2009). Written permission to utilize the scale was obtained by the project coordinator and author of the tool on September 14, 2018 via email communication (Appendix D). Additional participant measures in which was examined from a demographic survey form include: height, university major, grade level (freshman, sophomore, junior or senior, age (years), gender, sex, self-reported amount of weekly physical activity (minutes), and the use of campus fitness resources.

Collection

Explanation of project materials, including enrollment and collection of project consent data was obtained at the college of nursing and health professions building at University X or the University X student health center. For the nursing student participants, the demographic data form and self-efficacy questionnaire were completed at the time in which the baseline weight was obtained. The measured weights for such participants throughout the intervention were collected using a standard digital scale available in the virtual learning center at the college of nursing and health professions building after scheduled class time by utilizing a private section of the laboratory which is designed to mimic a private medical exam room setting present with wall dividers and a door. Only the participant themselves and the project coordinator were present in the exam room. Participant weights were recorded on a section of the demographic form, and the demographic sheets were then stored in a locked cabinet located in the office of the director of the university student health center. Students also received an anonymous randomized number which assists the project coordinator in identifying each participant but keeps their identify unknown otherwise. Such information will also be stored in the locked cabinet within the university student health center director's filing cabinet. Participants who sign up to participate through the university health center will have their weights obtained on a standard scale located within the health center, but information will be collected and stored in an identical fashion to the method explained above. Height for all participants will be self-reported on the demographic form collected at the beginning of the project.

Management and Analysis

Descriptive data pertaining to demographic information of participants, as well as body mass index (BMI), caloric expenditure, and exercise self-efficacy scores were examined and assessed using a statistical analysis software program known as Intellectus Statistics. An ANOVA test was utilized to compare differences between BMI values throughout the intervention, while paired samples t-tests were utilized to analyze differences between caloric expenditure and exercise self-screening scores. The results of such statistical analyses will be further discussed in Chapter 4.

Protection of Human Subjects

When implementing an intervention in which human subjects are involved, it is imperative and in fact mandatory to provide for protection of such subjects. Therefore, for this EBP project several various methods were utilized to protect the rights of the participants. The project coordinator of the project successfully completed the National Institutes of Health (NIH) protection of human rights training on April 8, 2018. The project advisor also completed NIH protection of human rights training on March 30, 2015. The EBP project proposal was presented to the IRB committee at University X, where the project took place and the project coordinator is a Doctor of Nursing Practice student as well. IRB approval was granted on October 19, 2018. Participation in this EBP project was strictly voluntary, and participants were made aware via the written consent form of the nature and details of the project, as well as the fact that they could discontinue their participation without consequences at any time throughout the intervention. Information pertaining to data collection was kept confidential as explained previously, and such information was stored in a locked filing cabinet within the office of the director of the student health center’s office. Information was transferred solely by the project coordinator to a password protected computer in which only that individual had access to.

CHAPTER 4

FINDINGS

"The Effects of a Mobile Fitness Application on Weight Management and Physical Activity Amongst University Students" was an EBP project developed to provide an evidence-based approach to motivate college students to engage in physical activity for the promotion of health-related benefits, including weight management and/or weight loss. The project manager developed the particular project to determine the effects of a mobile fitness application intervention on physical activity engagement and weight management amongst college-aged individuals. The primary outcome measures evaluated for this project were body mass index (BMI) and weekly caloric expenditure from physical activity, while a secondary outcome included evaluating exercise self-efficacy. The following data analyses provide details about the project outcomes and in turn describes the effectiveness of the mobile fitness application intervention within the selected population. The data analysis also compares project outcomes to the previous standard of care, which consisted of no formal weight management intervention amongst the university student population.

Participant Characteristics

University nursing students ranging from sophomores to seniors at a private Midwestern Lutheran university were recruited for this project. As previously mentioned, university students from other majors were recruited for the project through the university student health center as well. However, although such students expressed interest in participating, they did not attend the initial project meeting to collect baseline data or follow up accordingly. Therefore, the data collection for this EBP project will focus solely on the undergraduate nursing student participants. The descriptive nature of the sample size and demographics will be further described as follows. In total, 141 male and female nursing students signed consent forms agreeing to participate in the project. Of these participants, 83 were sophomore level students, 47 were junior level students, and 11 were senior level students. One week after the project began, participants were invited to return to the private Midwestern Lutheran University College of Nursing to complete a demographic form, fill out a self-efficacy exercise questionnaire, and obtain an initial weigh in to calculate BMI. Of the initial 141 participants that filled out consent forms, 89 returned to continue participation. Of the returnees, 43 participants were sophomores for a response rate of 51%, 35 were juniors with a response rate of 74%, and 11 were seniors with a response rate of 100%. As the project progressed, participants were asked to continue to log their physical activity within the My Fitness Pal© mobile application, and then return 6 weeks later to complete a mid-project weigh in, and then again at 12 weeks to complete a final weigh in and the post-intervention self-efficacy screening. Several participants throughout the project were lost to attrition. More specifically, of the 43 sophomores that began the project, only 7 returned for all 3 weigh-ins and completed the pre/post self-efficacy screenings, meaning 36 sophomores were lost to attrition. Of the junior student population, 10 participants completed all aspects of the project, while 15 students completed the initial and 6 week weigh-in, but failed to return for the final weigh-in and post self-efficacy screening, meaning 22 juniors were lost to attrition at the 6 week point, and 37 were lost in total. Lastly 4 seniors completed all project tasks, meaning that 7 were lost to attrition. In total, 21 participants completed all aspects of the project and were therefore accounted for in regards to statistically analyzing the project outcomes (*n* = 21). Fragment data from the participants lost to attrition was not included for analysis (*n* = 68).

Participant characteristics were analyzed following the completion of a demographic questionnaire. Such demographics included university major, academic grade level, age, sex, self-reported minutes of weekly physical activity, utilization of campus center fitness classes, willingness to share information with the principal investigator, and height. The sole university major of all participants was deemed to be that of “nursing” (*n* = 21, 100%). Grade level varied between sophomore (*n* = 7, 33.3%), junior, (*n* = 10, 47.6%) and senior level participants (*n* = 4, 19%). The mean age of those who completed the project was 22.95 (*SD* = 6.83). The majority of participants were female (*n* =19), while the male participation was found to be less (*n* = 2). The average height (in inches) of the participants was 64.45 (*SD* = 3.35) while the average pre-intervention BMI was 23.70, (*SD* = 3.19). The mean number of self-reported minutes of physical activity prior to the intervention implementation was 190.48 minutes (*SD* = 163.75). All participants (*n* = 21) reported they did not utilize on-campus fitness center group classes, but they were willing to share fitness and exercise information with the principal investigator.

Changes in Outcomes: Statistical Testing and Significance

The primary aim of this EBP project was to promote physical activity amongst university students with the goal of maintaining BMI values within a normal healthy range between 18.5 and 24.9 (CDC, 2016). The outcomes of the EBP project included assessing BMI values, weekly average minutes of physical activity and exercise self-efficacy scores. To evaluate the effectiveness of the primary outcomes of this EBP project, various statistical analysis tests were calculated to compare participants' BMIs, weekly caloric expenditure, and exercise self-efficacy scores pre and post intervention implementation. The software program Intellectus Statistics was utilized for all statistical testing and statistician support offered through this software company guided analysis methods and interpretation. Statistical significance was set at $p < .05$ for all analyses. The physical activity intervention which promoted the use of a mobile fitness application and aimed to encourage exercise across campus to university student participants revealed significant improvements in participant exercise self-efficacy scores but did not demonstrate significant results when comparing caloric expenditure or BMI values pre and post intervention. The statistical analysis of such variables will be further explained throughout this chapter.

Body Mass Index (BMI)

The mean BMI of participants pre-intervention implementation was 23.70 (*SD* = 3.19) kg/m2. The mean BMI of participants at mid-intervention 6-week follow up was 23.80 (*SD* = 3.14) while the mean BMI at the conclusion of the intervention was 23.80 (*SD* = 3.26) (see Table 4.1). Prior to running statistical analysis, Kolmogorov-Smirnov tests were conducted in order to determine normality and evaluate whether the distributions of participant initial BMI, 6-week BMI and final BMIs were significantly different from a normal distribution. According to results, the following variables did not significantly differ from normality: initial BMI (D = 0.26, p = .105), 6-week BMI (D = 0.23, p = .209), and final BMI (D = 0.16, p = .627).

After normality of the data was confirmed, a repeated measures analysis of variance (ANOVA) with one within-subjects factor was conducted to determine whether significant differences existed between participant BMIs at the initiation of the project, the 6-week mid-intervention point, and at the 12-week conclusion of the intervention. Such analysis confirmed that no significant within-subjects differences existed between the BMI variables pre and post intervention implementation (F= .32, p >.05) (see Figure 4.2). Post-hoc analyses were not conducted as there was no significant within-subjects effects.

In addition, two-tailed paired samples t-tests were conducted to examine whether significant differences existed between participant initial BMI values and those at the 6 week point, as well as between the 6 week point and the final BMI evaluation. The result of the first two-tailed paired samples t-test was not significant, (t(20) = - 0.88, p >.05) suggesting that the true difference in the means of participant initial BMI values and those at the 6 week point were not statistically different from zero (see Table 4.3, Figure 4.1). The result of the second two-tailed paired samples *t*-test was not significant as well (t(20) = - 0.00, p >.05) suggesting that the true difference in the means of participant 6-week BMI and final BMI values was not significantly different from zero (see Table 4.4, Figure 4.2).

Physical Activity Caloric Expenditure

A two-tailed paired samples t-test was conducted to examine whether the difference between weekly average caloric expenditure prior to the intervention, and weekly average caloric expenditure was significantly different from zero. A Shapiro-Wilk test was conducted to determine whether normality of the sample could be assumed, and the difference could have been produced by a normal distribution. Results of the Shapiro-Wilk test (W =0.88, p =.017) suggest that normality could not be assumed, however this could be due to the fact that a few individual participants of the project increased their physical activity extensively from pre-and post-intervention, while some individuals did not engage in any exercise throughout the project at all. In addition, Levene's test for equality of variance was used to assess whether the homogeneity of variance assumption was met. The homogeneity of variance assumption requires the variance of the dependent variable be approximately equal in each group. The result of Levene's test was not significant, $F(1, 40) = 0.09$, $p = .765$, indicating that the assumption of homogeneity of variance was met.

The result of the two-tailed paired samples t-test was not significant, ($t(20) = -1.00$, $p > .05$), suggesting that the true difference in the means of pre-intervention weekly caloric expenditure and post-intervention weekly caloric expenditure was not significantly different from zero (Table 4.5).

Exercise Self- Efficacy

In order to assess exercise self-efficacy scores, participants completed the Exercise Self-Efficacy questionnaire pre and post intervention authored by Neupert, Lachman and Whitbourne (2009). The reliability of the screening tool was determined to be .88 according to the coefficient alpha (Neupert, Lachman & Whitbourne, 2009). The total score of exercise self-efficacy was calculated by summing responses to each of the nine questions. The scale had a range of total scores from 9-28, where as a lower score indicated a higher self-efficacy for exercise. The total sum of the questionnaire scores were statistically analyzed to evaluate overall exercise self-efficacy. In order to determine whether there was a statistically significant difference between pre-intervention exercise self-efficacy scores and post-intervention exercise self-efficacy scores, a two-tailed paired samples t-test was conducted. The assumptions of normality and homogeneity of variance were maintained by utilizing a Shapiro-Wilks and Levene's tests. The result of the two-tailed paired samples t-test was significant, ($t(20) = 2.09$, $p < .05$) suggesting that the true difference in the means of the pre-intervention exercise self-efficacy scores and the post-intervention exercise self-efficacy scores was significantly different from zero. The mean of pre-intervention exercise self-efficacy scores ($M = 23.52$) was significantly higher (indicating lower exercise self-efficacy) than the mean of the post-intervention exercise self-efficacy scores ($M = 21.43$), indicating that participants had increased exercise self-efficacy after implementation of the mobile fitness application intervention (see Table 4.6, Figure 4.3).

Table 4.1

Means Table for Within-Subject Variables

Variable	*M*	*SD*
Initial BMI	23.70	3.19
6-week BMI	23.80	3.14
Final BMI	23.80	3.26

Table 4.2

Repeated Measures ANOVA Results

Source	*df*	*SS*	*MS*	*F*	*p*	η_p^2
Within-Subjects						
Within Factor	2	0.15	0.08	0.32	.727	0.02
Residuals	40	9.55	0.24			

Table 4.3

Two-Tailed Paired Samples t-Test for the Difference Between Initial BMI and 6-week BMI

Initial BMI		6-week BMI				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
23.70	3.19	23.80	3.14	-0.88	.388	0.03

Table 4.4

Two-Tailed Paired Samples t-Test for the Difference Between 6-week BMI and Final BMI

6-week BMI		Final BMI				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
23.80	3.14	23.80	3.26	-0.00	1.000	0.00

Figure 4.1

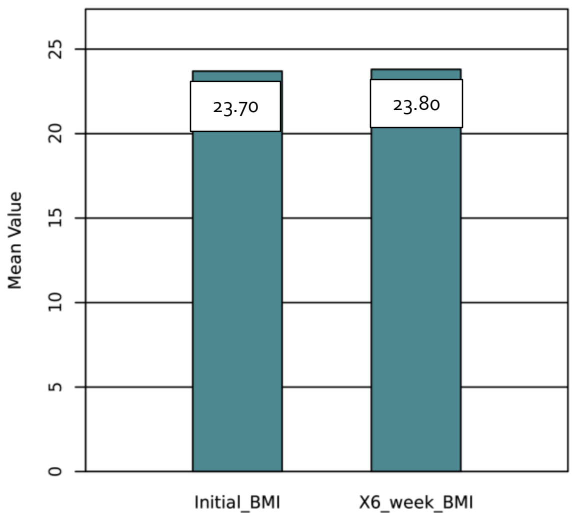


Figure 4.2

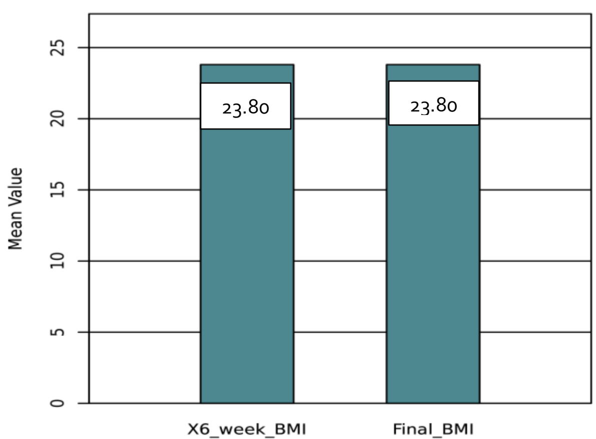


Table 4.5

Two-Tailed Paired Samples t-Test for the Difference Between Pre-Intervention Caloric Expenditure and Post-Intervention Average Caloric Expenditure

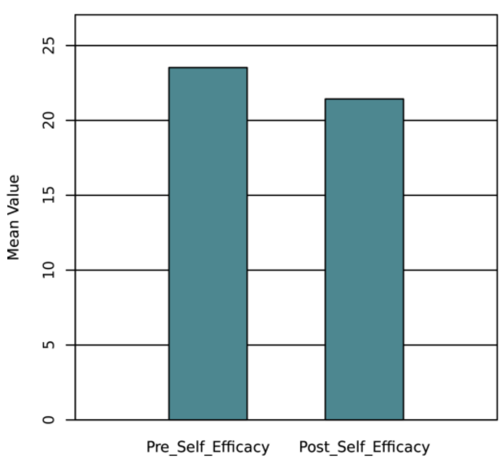
Pre-Intervention Caloric Expenditure		Post-Intervention Average Caloric Expenditure				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
122.57	227.09	168.58	197.45	-1.00	.331	0.22

Table 4.6

Two-Tailed Paired Samples t-Test for the Difference Between Pre-Exercise Self-Efficacy and Post Exercise Self=Efficacy

Pre-Exercise Self-Efficacy		Post-Exercise Self-Efficacy				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
23.52	6.48	21.43	6.47	2.09	.050	0.32

Figure 4.3



CHAPTER 5

DISCUSSION

The findings of this EBP project aimed to provide a foundation for improving physical activity levels, decreasing body mass index, and increasing exercise self-efficacy amongst university students. The EBP project was founded as a means to answer the aforementioned PICOT question: "What is the effect of using the mobile fitness application "My Fitness Pal" (I), as compared to current practice of provider recommendation (C) on weight management (O) in university college students (P) over the course of a 12-week period (T)?" Although there was not a statistically significant impact on all three of the measured variables of the project post project implementation, a thorough examination of key factors pertaining to implementation is warranted to understand their role and dynamic interaction which may have affected project outcomes. An explanation of project findings, along with examination of key project factors and strengths and limitations will be discussed in this chapter. Additionally, the theoretical framework and EBP model used to guide this project, and implications for future research pertaining to the topic will also be evaluated.

Explanation of Findings

The EBP project set out to examine the effects that the mobile fitness application intervention would have on the measurable primary and secondary outcomes of interest. Measurable outcomes of interest included changes in BMI, physical activity tracked in caloric expenditure, and self-efficacy as it pertains to exercise. Through statistical analysis and explained in detail throughout Chapter 4, it was determined that the EBP intervention did not produce statistically significant effects on the variables of BMI and caloric expenditure but did elicit a significant change in exercise self-efficacy scores. These findings suggest that project participant's BMI values did not vary significantly between the pre and post mobile fitness application intervention as the mean BMI pre intervention was 23.70 and the post intervention mean BMI was slightly greater at 23.80. The findings of the statistical analysis also suggest that although participants did burn a greater amount of weekly calories on average after partaking in the mobile fitness application intervention (*M* = 168.58) compared to the pre-intervention mean of 122.57 calories, the 46 calorie increase in results were not considered to be statistically significant. Possible explanations for such findings will be discussed further throughout this chapter.

Conversely, pre-intervention exercise self-efficacy scores compared to post-intervention self-efficacy scores did indicate a statistically significant change after the intervention occurred. Pre-intervention mean exercise self-efficacy scores were 23.52, while the mean of the post-intervention exercise self-efficacy scores was 21.43, indicating that participants had increased exercise self-efficacy and felt that they were more likely to engage in physical activities after implementation of the mobile fitness application intervention.

Evaluation of Applicability of Theoretical and EBP Frameworks

Theoretical Framework

The Health Belief Model (HBM) was selected as the theoretical framework guiding this EBP project. The particular model served as a framework for the development, implementation and evaluation of the overall project as it was determined to be a useful guide for predicting and explaining individual health behaviors such as physical activity. The main goal of the EBP project was to increase physical activity participation amongst college students by utilizing the six principles of the HBM: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy. The My Fitness Pal intervention addressed each component of the HBM as it relates to promoting engagement in physical activity to encourage healthy lifestyles and BMI ranges. For example, during the recruitment phase of the project participants were provided with meaningful statistical data regarding the alarming trends of obesity and obesity-related disease rates amongst university students nationwide thereby addressing perceived susceptibility and severity of the clinical problem. The initial intervention session included a discussion about the perceived barriers to university student engagement in physical activity and presented a brief review of literature to introduce the mobile fitness application, My Fitness Pal, designed to reduce such barriers. The educational intervention of the project provided participants with information regarding perceived benefits of exercise and incorporated cues to action by providing students with tips and tricks on how to increase their physical activity with resources that were readily available on the university campus. Self-efficacy was evaluated throughout the project with participant completion of the Exercise Self-Efficacy questionnaire (Neupert, Lachman & Whitbourne, 2009).

Incorporation of the 6 principles of the HBM led to the intervention outcomes which confirmed that the BMI values of participants were within normal limits pre and post intervention, and remained unchanged throughout the project timeframe. Participants did remain active throughout the intervention and increased their caloric expenditure, although not statistically significant. Furthermore, increases in exercise self-efficacy were noted, which is what the intervention ultimately aimed to do. Based on these overall findings, it can be determined that use of the Health Belief Model was a good fit for this evidence-based practice project.

EBP Framework

The Stetler model of evidence-based practice was used as the framework for this evidence-based project. The model provided the framework in order to incorporate research into practice with use of its' five phases: preparation, validation, comparative evaluation/decision-making, translation/application and evaluation. All of these phases were critical to the development, implementation and eventual evaluation of the EBP project. The first step of the model is the preparation phase. This particular phase involved identification of the clinical problem known as obesity trends and lack of physical activity amongst university students. After meeting with the director of the Student Health Center at University X where the project was to take place, and confirming the presence of the clinical problem, it was established that a wellness initiative to address weight management should occur. A literature review to address the project PICOT question was initiated and project development began.

The second and third phases of the model, the validation and decision-making phases were then used to analyze each article found in the literature review and synthesize the evidence for quality and applicability to the project. After the levels and quality of evidence were appraised, the literature was further analyzed, condensed, and critiqued which led to the development of the summary evidence table. These particular phases helped identify literature and evaluate evidence pertinent to the topic of the EBP project in an organized and systematic manner. Overall, 12 pieces of literature were reviewed and determined to be applicable to the project.

The fourth phrase of the Stetler EBP model, the translation/application phase, was used to guide the qualities and characteristics of the intervention that would be most beneficial to producing successful outcomes of the target population of university students. Utilizing evidence from the literature search, a tailored educational presentation and informational brochure on how to incorporate physical activity on the university campus was developed for project participants. In addition, fine details of the project such as the time frame, resources, location of weigh ins and follow ups, data collection, and measurable outcomes were finalized. These interventions comprised the implementation phase of the EBP project.

The final phase of the EBP model was the evaluation phase. This particular phase evaluated the outcomes of the project: changes in BMI, changes in physical activity caloric expenditure, and exercise self-efficacy. This evaluation phase involved the appraisal of each part of the project process including evidence appraisal, project implementation, data collection, and overall analysis. This phase also allowed the project manager to evaluate whether or not the goals of the project were met. In addition, the evaluation phase allowed for identification of the strengths and weaknesses of the project, and promoted revisions and improvements to be incorporated for future implications as necessary.

Strengths and Limitations of the EBP Project

Strengths

There were many strengths of this EBP project. A particular identified strength was the convenience and ease of the recruitment process as the project manager had great accessibility to a large group of participants. As the project manager was a former undergraduate nursing student of the university where the project occurred, there was support from the nursing faculty whom allowed the project manager to reach out to a variety of undergraduate courses in which they taught to recruit participants. In addition to recruiting undergraduate nursing students, the project site facilitator and supervisor of the university student health center was an advanced practice nurse enrolled in the doctoral nursing practice program at the university and was therefore very supportive of the project and the means to implement it. Another identified strength of the project was the popularity of the intervention amongst the participants that completed the project. Although, there was some attrition, which will be discussed as a limitation of the project, a majority of the participants who completed all aspects of the project have continued to utilize the mobile fitness application as a means to track their physical activity after the project has been completed. A specific characteristic of the My Fitness Pal mobile fitness application is that it incorporates somewhat of a social media design, thereby allowing individuals who are “friends” within the application to continue to track progress of their chosen peers, and continue to motivate each other to lead healthy lifestyles. Although the project has ended, the project manager still has access to the mobile fitness application accounts and has thereby noticed that students are still using the application at their leisure. Lastly, it can be identified that a final strength of the project is that participants increased their exercise self-efficacy after partaking in the intervention, which is ultimately what the project aimed to do.

Weaknesses

Although there were many strengths of the EBP project, many identified weaknesses were identified as well. For instance, although the project received much support from the campus faculty, all three of the nursing faculty members who allowed the project manager to recruit from their undergraduate courses offered extra credit to potential participants unbeknownst to the project manager. Although this factor undoubtedly contributed to the high number of initial participants that agreed to sign up for the project, it also indirectly affected the attrition rate of the project as well. Due to the timing of the IRB approval from the institution where the project took place, and in order to maintain the project implementation timeline of 12-weeks, the project had to span throughout segments of two semesters. Inevitably, the project was initiated at the end of the Fall 2018 semester and finished at the beginning of the Spring 2019 semester. As the nursing faculty offered extra credit to the students who chose to participate, several students signed up for the project, completed baseline data, utilized the mobile fitness application, attended the 6-week weigh in and follow up and obtained extra credit at the conclusion of the Fall 2019 semester accordingly. However, as those particular students were no longer enrolled in the course that they received the extra credit in, it is speculated that many students chose to no longer to participate in the project, or return for the 12-week weigh in and follow up, as there was no academic incentive to do so. It is believed that this factor contributed to the overall high attrition rate, as initially 141 students signed consent forms, 89 students returned to collect baseline data, and only 21 students completed all aspects of the project to be included for data analysis. In regards to the timing of the project, implementation spanned over the course of Thanksgiving Break and Christmas Breaks for the university students, which traditionally is not the best time to implement weight management programs.

Lastly, although not necessarily a limitation of the project, it is important to note that a potential explanation for the fact that there was no statistically significant changes noted in participant BMI or caloric expenditure could possibly be due to the fact that participants who completed the project had baseline BMIs that were within normal limits and were overall fairly active in regards to caloric expenditure to begin with. It is not appropriate for the project manager to assume that an intervention aimed at promoting physical activity for weight management and combatting obesity would produce large changes in participant BMI or exercise when enrolled participants had BMIs that were within healthy ranges with participants that were overall quite active prior to project enrollment.

Implications for the Future

Practice

This project has implications for practice within university student health centers as well as health clinics that offer primary health care and aim to promote preventative health practices. Due to low engagement in physical activity amongst university students and the growing trend of obesity prevalence throughout college campuses, this EBP project can help advise health care team members of the usefulness of electronic/mobile fitness applications and educational interventions. Moreover, it can bring light to the situation of college student obesity, and address the fact that although many healthcare providers are recognizing that this rising epidemic is contributing to overall morbidity and mortality later in life, there is undoubtedly a disparity in place as interventions and programs designed to combat obesity within the university student population are lacking at best. For example, when determining a need for the project, it was learned that the university student health center did not have any standards of practice in place to address obesity at all. Knowledge from this project can be used within the university community to educate students on the dangers of obesity and promote the use of campus resources to engage in physical activity. The project intervention can also be implemented at other various clinical practice settings with patients who have overweight BMIs and are motivated to engage in physical activity in hopes of losing weight.

Research

Evaluation of the project has also allowed for the needs of future research to be identified. Although this project was successful with increasing exercise self-efficacy scores amongst participants, it was not successful in producing changes in BMI or physical activity caloric expenditure. A potential reason for this could be due in part to the fact that participants that completed the project had BMI values within normal limits and fairly active lifestyles. Therefore, it could be beneficial to implement this EBP project amongst sedentary individuals who are specifically overweight or obese according to BMI values and are interested in weight loss. Due to the accessibility to participants within the College of Nursing and the attrition of students recruited from other majors from the University Health Center, the EBP project outcomes solely focused on nursing majors. It may be beneficial in the future to evaluate whether the project had similar outcomes when applied to individuals from other undergraduate programs, specifically those in which are not considered to be part of the health sciences domain.

Conclusion

In conclusion, this EBP project has provided substantial evidence supporting the need for wellness initiatives aimed to address weight management and the promotion of physical activity on college campuses. Interventions aimed at addressing the growing trend of obesity amongst university students and standards of care emphasizing obesity prevention among this population are lacking. Key outcomes of the PICOT question were measured and analyzed, however such outcomes were potentially limited due to the characteristics of the participants of the project. These factors were identified and can potentially lead the way for future evidence-based projects to occur. The Health Belief Model was an ideal fit for this EBP project as it provided the necessary concepts to address the multifactorial issue of obesity and lack of physical activity amongst the target population. The Stetler Model was also an ideal framework to guide the development, implementation and final evaluation of the project. Although not all of the outcomes produced statistically significant results, findings from this project may be useful for future obesity related evidence-based projects in the primary care setting to promote physical activity and weight management of individuals whom are overweight and are interested in engaging in physically active lifestyle modifying behaviors.

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Erica L. Deenihan

Ms. Deenihan, a native of Crown Point, IN, began her journey into the field of health sciences in 2012 upon graduation from the University of Kentucky with a Bachelor of Science degree in kinesiology and health promotion. She returned to northwest Indiana to complete an accelerated Bachelor of Nursing degree from Valparaiso University in 2016. After obtaining licensure, Erica began her nursing career in the field of Oncology at Community Hospital in Munster, Indiana and has remained an active member of the Oncology Nursing Society for the past 3 years. Ms. Deenihan has strived to pursue an advanced education, and is currently attending Valparaiso University again to earn her Doctorate of Nursing Practice degree in May 2019. Throughout her studies, Erica has maintained membership with the American Association of Nurse Practitioners as well as the Society of Advanced Practice Nurses of Northwest Indiana. She has also served on the Valparaiso University Graduate Student Advisory Council as a representative for the DNP program during the 2017-2018 academic year. Erica routinely assists undergraduate students during simulation activities through the Valparaiso University Virtual Learning Center and is currently a clinical instructor for Valparaiso University undergraduate nursing program as well. Ms. Deenihan has been nominated for several awards and scholarships during her graduate coursework and most recently was the recipient of the Tri Kappa Beta Rho scholarship. As a future advanced practice nurse, Erica is passionate about functional and preventative medicine and is specifically interested in educating the public on the beneficial aspects of exercise as it pertains to health and wellness.

ACRONYM LIST

ANOVA: Analysis Of Variance

“App”: Application

BMI: Body Mass Index

CASP: Critical Appraisal Skills Programme Checklist

CDC: Centers for Disease Control and Prevention

CINAHL: Cumulative Index to Nursing and Allied Health

DNP: Doctorate of Nursing Practice

EBP: Evidence-Based Project

HBM: Health Belief Model

IPAQ: International Physical Activity Questionnaire

IRB: Institutional Review Board

MANOVA: Multivariate One Way Analysis of Variance

MESH: Medical Subject Heading

METs: Metabolic Equivalencies

MVPA: Moderate to Vigorous Physical Activity

PA: Physical Activity

PAGs: Physical Activity Guidelines

PICOT: Patient population, intervention of interest, comparison intervention or status, outcome, and timeframe

RCTs: Randomized Control Trials

SED: Sedentary Time

SMART: Specific, Measurable, Action-Oriented, Adjustable, Realistic, and Timely

US: United States

Appendix A

Review of Literature of the Appraised Evidence

Citation (APA)	Purpose	Design	Sample	Measurement/ Outcomes	Results/Findings	Level
Aguilar-Martinez, A., Sole-Sedena, J., Mancebo-Moreno, G., Medina, X., Carreras-Collado, R., & Saigi-Rubio, F. (2014). Use of mobile phones as a tool for weight loss: a systematic review. *Journal of Telemedicine and Telecare, 20*(6), 339-349.	To review the use of mobile phones and associated apps as weight-loss tools	Systematic Review	10 studies whose primary aim was to achieve weight loss or weight loss maintenance, and which reported data about weight change were included in the review	Measurements of bodyweight, BMI, waist circumference and body fat were assessed from the various interventions	• 10 of the 12 studies showed a reduction in participant bodyweight, BMI, waist circumference and body fat • There appeared to be a proportional relationship between weight loss and program use • Frequent self-recording of weight seemed to be important, as was the personalization of the intervention (counselling and individualized feedback) • a social support system acted as a motivational tool	I
Bort-Roig, J., Gilson, N.D., Puig-Ribera, A., Contreras, R.S., & Trost, S.G. (2014). Measuring and influencing physical activity with smartphone technology: a systematic review. Sports Medicine, 44, 671-686.	To systematically review evidence on smartphones and viability for measuring influencing physical activity	Systematic Review	26 articles reviewed; 17 implemented and evaluated an intervention aimed at increasing physical activity with use of a smartphone	Physical activity level as measured by step counts	• Smart phone strategies tended to be ad hoc rather than theory based • Physical activity profiles, goal setting, real time feedback, social support networking and online expert consultation = most useful strategies to encourage physical change • 4 studies reported exercise increases • 1 study reported exercise maintenance	I

Flores, M.G., Jordi, G.R., Granado, F.E., Ferre, G.C., Montana, C.X. (2015). Mobile phone apps to promote weight loss and increase physical activity: A systematic review and meta-analysis. *Journal Of Medical Internet Research, 17*(11),	To perform a systematic review and meta-analysis of studies to compare the efficacy of mobile phone apps compared with other approaches to promote weight loss and increase physical activity	Systematic Review and Meta-Analysis	12 articles that assessed a mobile phone app intervention With weight-related health measures (i.e., body weight, body mass index, or waist circumference) or physical activity outcomes were included in the review	Net change estimates comparing the intervention group with the control group were pooled across studies using random-effects models	• Compared with the control group, use of a mobile phone app was associated with significant changes in body weight (kg) and body mass index (kg/m2) of -1.04 kg (95% CI [-1.75,-.34]; *I2* = 41%) and -.43 kg/m2 (95% CI [-.74, -.13]; *I2* = 50%), respectively. Moreover, a non-significant difference in physical activity was observed between the two groups (standardized mean difference .40, 95% CI [-.07, .87]; *I2* = 93%). These findings were remarkably robust in the sensitivity analysis	I
Levine, D.M., Savarimuthu, S., Squires, A., Nicholson, J., Jay, M. (2015). Technology-assisted weight loss interventions in primary care: a systematic review. *Journal Of General Internal Medicine, 30*(1), 107-117.	To conduct a systematic review of technology-assisted weight loss interventions specifically tested in PC settings	Systematic Review	Inclusion criteria: (1) Randomized controlled trial; (2) trials that utilized the Internet, personal computer, and/ormobile device; and (3) occurred in an ambulatory PC setting to include 16 studies	Weight Loss in (kg)	Twelve(75 %) interventions achieved weight loss (range: 0.08 kg – 5.4 kg) compared to controls,while 5–45%of patients lost at least 5 % of baseline weight Interventions that included clinician-guiding software or feedback from personnel appeared to promote more weight loss than fully automated interventions	I

Muntaner, A., Vidal-Conti, J., & Palou, P. (2016). Increasing physical activity through mobile device interventions: A systematic review. *Health Informatics Journal, 22*(3), 451-469. doi10.1177/1460458214567004	Summarize existing literature on increasing physical activity through mobile device interventions	Systematic Review	12 articles that either examined indirect measures to assess physical activity (i.e. self-reported minutes of physical activity, self-reported frequency of physical activity, or self-reported questionnaires) or direct measures to assess physical activity (i.e. accelerometers, or pedometer data)	self-reported minutes of physical activity, self-reported frequency of physical activity, or self-reported questionnaires) or direct measures to assess physical activity (i.e. accelerometers, or pedometer data)	• 6 studies showed significant increases in physical activity levels status post utilizing mobile device interventions.	I
Schoeppe, S., Alley, S., Van Lippevelde, W., Bray, N.A., Williams, S.L., Duncan, M.J., & Vandelanotte, C. (2016). Efficacy of interventions that use apps to improve diet, physical activity and sedentary behavior: A systematic review.	To examine the efficacy of interventions that use apps to improve health behaviors	Systematic Review	Literature search in 5 databases regarding the use of smartphone apps to improve health behaviors yielded 27 studies -21 studies targeted physical activity -13 targeted diet -5 studies targeted sedentary behavior	Outcomes measured were changes in health behaviors and related health outcomes such as body weight, blood pressure, glucose, cholesterol and quality of life	• Of the 21 studies targeting physical activity, 14 show significant health improvements with use of the app • Of the 5 studies targeting sedentary behavior, 2 show improvements with use of the app	I
Allen, J.K., Stephens, J., Dennison Himmelfarb, C.R., Stewart, K.J., & Hauck, S. (2013). Randomized controlled pilot study testing use of smartphone technology for obesity treatment. *Journal of Obesity,*	To evaluate the feasibility, acceptability, and preliminary efficacy of theoretically based behavioral interventions delivered by smartphone technology	Randomized Control Trial	Participants were recruited through a variety of strategies used successfully in our other studies such as flyers, physician referrals, and existing lists of volunteers from prior studies of the investigators. Individuals between 21 and 65 years of age with body mass index (BMI) of 28–42 kg/m2	The study randomized 68 obese adults to receive one of four interventions for six months: (1) intensive counseling intervention, (2) intensive counseling plus smartphone intervention, (3) a less intensive counseling plus	• Participants in the intensive counseling plus self-monitoring smartphone group and less intensive counseling plus self-monitoring smartphone group tended to lose more weight than other groups • Participants in the self-monitoring smartphone group lost the least weight • There were non-significant trends for differences in weight loss among the four intervention groups	II

			who had an iPhone or Android phone and were willing to download the application to be used on their devices were eligible to participate. 68 participants were selected	smartphone intervention, and (4) smartphone intervention only. The outcome measures of weight, BMI, waist circumference, and self-reported dietary intake and physical activity were assessed at baseline and six months.		
Fanning, J., Roberts, S., Hillman, C.H., Mullen, S.P., Ritterband, L., & McAuley, E. (2017). A smartphone "app"-delivered randomized factorial trial targeting physical activity in adults. *Journal of Behavioral Medicine, 40,* 712-729.	To determine the individual and combined impact of a self-monitoring smartphone-app and 2 theory based modules on moderate to vigorous physical activity (MVPA), psychosocial outcomes and app usage	Randomized Four Arm Factorial Trial	Convenience sampling of 116 individuals from	Participants randomly received 1) basic self-monitoring app, 2) basic app + goal setting, 3) basic app + points based feedback or 4) basic app plus both modules Physical activity measured as a means of minutes of MVPA	• Individuals across all interventions increased daily MVPA by more than 11 minutes • Points-based feedback module was effective for promoting physical activity behavior change • Individuals with access to the modules maintained higher levels of activity	II
Bond, D.S., Thomas, G.T., Raynor, H.A., Moon, J., Sieling, J., & Trautvetter, J. (2014). B-MOBILE - A Smartphone-Based Intervention to Reduce Sedentary Time in Overweight/Obese Individuals: A Within-Subjects Experimental	To test a smartphone-based intervention to monitor and decrease SED in overweight/obese individuals, and compared 3 approaches to prompting physical activity	Cohort Study	A convenience sample of men and women were recruited from via B-MOBILE study advertisements placed in local newspapers and on research hospital network-affiliated intranet/internet sites and social media	Subjects wore the SenseWear Mini Armband (SWA) to objectively measure SED for 7 days at baseline. Participants were then presented with 3 smartphone-based PA break	All PA break conditions yielded significant decreases in SED and increases in light (LPA) and moderate-to-vigorous PA (MVPA)	III

Trial. Plos One, 9(6), e100821	(PA) breaks and delivering feedback on SED		outlets (i.e. Facebook and Twitter). 30 participants were included in the study	conditions in counterbalanced order: (1) 3-min break after 30 SED min; (2) 6-min break after 60 SED min; and (3) 12-min break after 120 SED min. Participants followed each condition for 7 days and wore the SWA throughout		
Aroni, A., Castillo, E., Sousa, C., Machado, A., Filho, E., & Tenebaum, G. (2017). Smartphone applications used for initiating and maintaining physical activity: an exploratory analysis. Journal of Sport Psychology, 27(1), 89-95.	To explore the degree to which smartphone based fitness applications help people start and maintain regular physical activity	Descriptive Exploratory Study	904 respondents from North America, South America and Europe obtained through survey via use of Facebook and LinkedIn	Surveys consisting of demographic information, closed questions and Likert type responses assessed use of fitness apps and physical activity	• 72.7% of Americans have downloaded a fitness app. • 5.9% of Americans report the app helped them in the beginning of an exercise regimen • 8.9% of Americans report that the app helps them maintain their already implemented exercise program • Apps have limited effect on exercise engagement, apps remain unused	VI
Litman, L., Rosen, Z., Spierer, D., Weinberger-Litman, S., Goldschein, A., & Robinson, J. (2015). Mobile exercise apps and increased leisure time exercise activity: A moderated mediation analysis of the	To examine whether the use of exercise apps is associated with increased levels of exercise and improved health outcomes	Qualitative Survey Design	Recruitment occurred through Amazon's Mechanical Turk Platform to obtain 726 participants	Participants 1) who have never used exercise apps, 2) those who used app previously but discontinued, and 3) those who currently use	• 75% of current app users reported being more active, compared to 50% of non-users and past users • App users had higher total leisure time metabolic equivalent expenditures	VI

role of self-efficacy and barriers. Journal of Medical Internet Research, 17(8), 1-15				exercise applications were surveyed about their use of exercise apps long term, and within the previous week utilizing the International Physical Activity Questionnaire	compared to non-users and past users • Non-leisure physical activity levels were similar across all participants • Current app users had lower BMI than counterparts, which was shown to be mediated by exercise levels and self-efficacy and perceived barriers to exercise	
Sarcona, A., Kovacs, L., Wright, J., & Williams, C. (2017). Differences in eating behavior, physical activity, and health-related lifestyle choices between users and nonusers of mobile health apps. American Journal of Health Education, 48(5), 298-305.	To determine the relationship between the use of mobile health apps and health behaviors in college students	Cross-Sectional Study	Convenience sampling of 401 university students from 1 suburban university and 1 urban university	Eating behavior, physical activity and health-related lifestyle choices assessed via surveys: 1998 Lifestyle and Habits Questionnaire-brief version, Godin-Shepard Leisure Time Physical Activity Questionnaire and Eating Behavior Inventory	• Mobile health users reported increase in physical activity compared to non-users • Users of mobile health apps also reported feeling healthier, had better self-monitoring of food intake and exercise patterns and reported higher motivation to engage in healthy behaviors	VI

Appendix B

TITLE OF STUDY
The effect of a mobile fitness application on weight management amongst university students.

PRINCIPAL INVESTIGATOR
Erica Deenihan
Valparaiso University- College of Nursing and Health Professions
836 Laporte Ave. Valparaiso, IN. 46383
219-308-4470
erica.deenihan@valpo.edu

PURPOSE OF STUDY

You are being asked to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully. Please ask the researcher if there is anything that is not clear or if you need more information.

The purpose of this study is to examine the effects of a mobile fitness application, My Fitness Pal, on physical activity, caloric expenditure and weight management amongst university students.

STUDY PROCEDURES

- Participants of the study will receive an educational information session regarding background information on "My Fitness Pal" and the details of the project. (10 minute session during approved class time).
- Upon providing consent to participate. Participants will complete a demographic form pertinent to the study.
- At the time of consent completion, participants will be instructed how to download the application and will track their normal day to day physical activity routines for one week in order to obtain baseline physical activity data within the app.
- After the first week, participants will receive educational information and tips about how to increase their physical activity around campus and how to maximize their use of the mobile fitness app via a Valparaiso University approved brochure. At this time, they will also complete a self-efficacy screening via a Likert type survey and complete an initial weigh in. (10 minute session following the class that the initial recruitment took place during).
- After baseline data is obtained, participants will be encouraged to continue tracking their physical activity and calculated caloric expenditure via the mobile application and report such values to me on a weekly basis either through the application or via e-mail correspondence.
- Participants will have the option to correspond with me through the mobile fitness application and share access to their weight loss, physical activity and caloric expenditure in a social media type manner if they add my user name "DNPfit2018" to their friends list through the application. However this feature is strictly voluntary.

- Participants will also be asked to complete an additional weigh in at the 6-week halfway mark of the intervention. (10 minute session following class).
- At the conclusion of the 12-week data collection, participants will then complete a post-intervention weigh in, as well as a self-efficacy screening via the same Likert type survey as completed previously. Pre and post body weight and self-efficacy scores will be compared accordingly. (10 minute session following class).

RISKS

Participants may experience the risk of potentially feeling embarrassed about having their weight recorded during weigh-ins. However, only a total of 3 weigh-ins will be recorded throughout the study, the weights will be obtained in a private and secluded manner in a non-judgmental fashion, with only the participant and principal investigator present. Recorded data will only be accessible by the principal investigator and the faculty advisor. You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

BENEFITS

There is no direct guaranteed benefit for you to participate in this study. However, it is believed that participants who participate in this study will become more aware of their own physical activity level and will increase their self-efficacy in regards to exercise. It is also projected that participants will increase their physical activity as well which will benefit them physically and psychologically. We also hope that the study will provide meaningful information in regards to effective strategies for implementing a campus wide health initiative program through the Valparaiso University Health Center in the future.

CONFIDENTIALITY

Your responses to the self-efficacy questionnaire, application data entry and weigh in values will be anonymous. Please do not write any identifying information on your forms. Every effort will be made by the researcher to preserve your confidentiality including the following:

- Assigning code numbers for participants that will be used on all research notes and documents
- Keeping notes, forms, and any other identifying participant information in a locked file cabinet in the personal possession of the researcher

Participant data will be kept confidential except in cases where the researcher is legally obligated to report specific incidents. These incidents include, but may not be limited to, incidents of abuse and suicide risk.

CONTACT INFORMATION

If you have questions at any time about this study, or you experience adverse effects as the result of participating in this study, you may contact the researcher whose contact information is provided on the first page. If you have questions regarding your rights as a research participant, or if problems arise which you do not feel you can discuss with the Primary Investigator, please contact the Valparaiso University Institutional Review Board at sponsored@valpo.edu or 219-464-5798.

VOLUNTARY PARTICIPATION

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decide to take part in this study, you will be asked to sign a consent form. After you sign the consent form, you are still free to withdraw at any time and without giving a reason. Withdrawing from this study will not affect the relationship you have, if any, with the researcher. If you withdraw from the study before data collection is completed, your data will be returned to you or destroyed.

CONSENT

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Participant's signature ______________________________ Date __________

Investigator's signature _____________________________ Date __________

Appendix C

ID:

The effect of a mobile fitness application on weight management and physical activity amongst university students

Demographics:

Username: ____________________________________ Ht:_________________

University Major: ____

Grade Level: ____________________________ Age: __________________ Sex: ____________

Self Reported Minutes of Weekly Physical Activity: _____________________________________

Do You Utilize Campus fitness center classes: Yes No

I am willing to share my application information with the principal investigator: Yes No

Initial Weight:___________ 6-week weight:______________ 12 week weight: ____

Appendix D

Exercise Self Efficacy

About: This scale, created by Neupert, Lachman, & Whitbourne is a modified version of Bandura's Exercise Self-Efficacy Scale (Bandura, 1997).

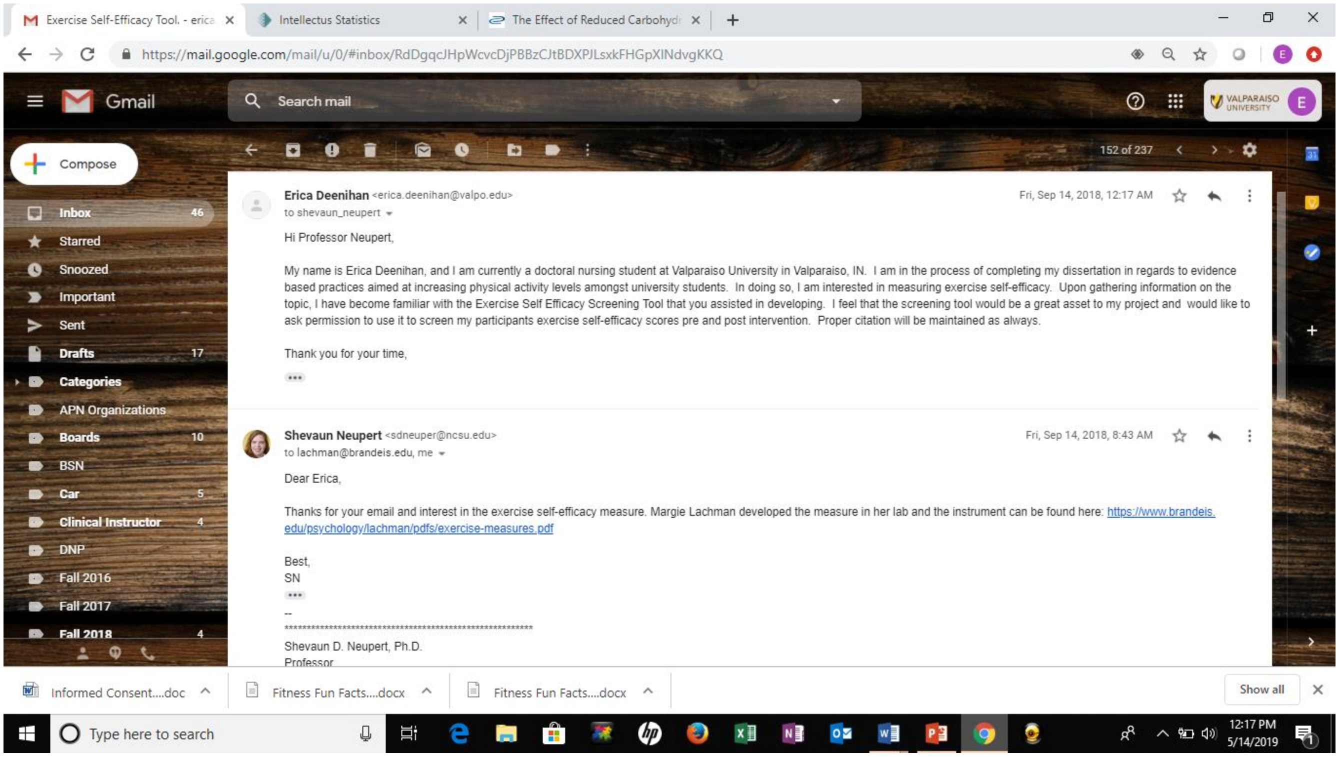
Now I would like to ask you some questions about exercise. Please tell me how sure you are that you will do each of the following.

How sure are you that you will do each of the following:

	Very Sure	**Pretty Sure**	**A Little Sure**	**Not at All Sure**
Exercise regularly (3 times a week for 20 minutes)	1	2	3	4
Exercise when you are feeling tired	1	2	3	4
Exercise when you are feeling under pressure to get things done	1	2	3	4
Exercise when you are feeling down or depressed	1	2	3	4
Exercise when you have too much work to do at home	1	2	3	4
Exercise when there are other more interesting things to do	1	2	3	4
Exercise when your family or friends do not provide any kind of support	1	2	3	4
Exercise when you don't really feel like it	1	2	3	4
Exercise when you are away from home (e.g., traveling, visiting, on vacation)	1	2	3	4

Appendix E

Permission to use Exercise Self-Efficacy Questionnaire


Erica Deenihan <erica.deenihan@valpo.edu> Fri, Sep 14, 2018, 12:17 AM
to shevaun_neupert

Hi Professor Neupert,

My name is Erica Deenihan, and I am currently a doctoral nursing student at Valparaiso University in Valparaiso, IN. I am in the process of completing my dissertation in regards to evidence based practices aimed at increasing physical activity levels amongst university students. In doing so, I am interested in measuring exercise self-efficacy. Upon gathering information on the topic, I have become familiar with the Exercise Self Efficacy Screening Tool that you assisted in developing. I feel that the screening tool would be a great asset to my project and would like to ask permission to use it to screen my participants exercise self-efficacy scores pre and post intervention. Proper citation will be maintained as always.

Thank you for your time,

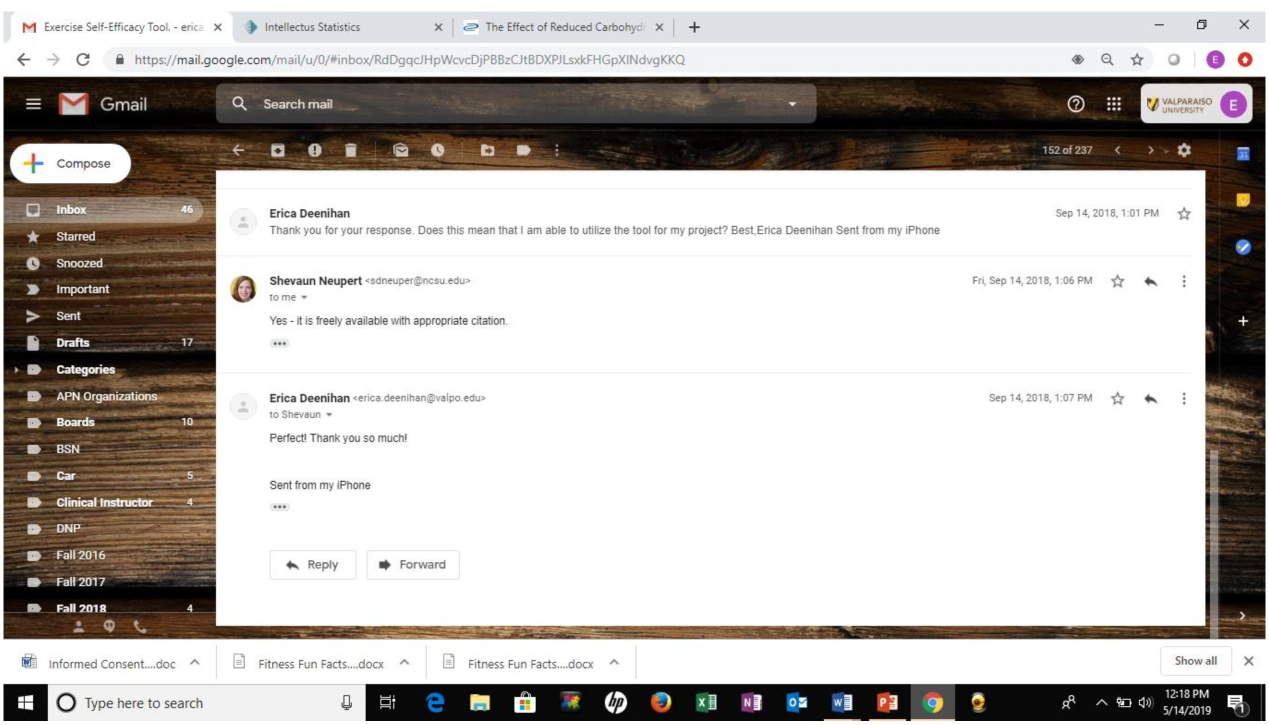
Shevaun Neupert <sdneuper@ncsu.edu> Fri, Sep 14, 2018, 8:43 AM
to lachman@brandeis.edu, me

Dear Erica,

Thanks for your email and interest in the exercise self-efficacy measure. Margie Lachman developed the measure in her lab and the instrument can be found here: https://www.brandeis.edu/psychology/lachman/pdfs/exercise-measures.pdf

Best,
SN

Shevaun D. Neupert, Ph.D.
Professor


Erica Deenihan Sep 14, 2018, 1:01 PM
Thank you for your response. Does this mean that I am able to utilize the tool for my project? Best,Erica Deenihan Sent from my iPhone

Shevaun Neupert <sdneuper@ncsu.edu> Fri, Sep 14, 2018, 1:06 PM
to me

Yes - it is freely available with appropriate citation.

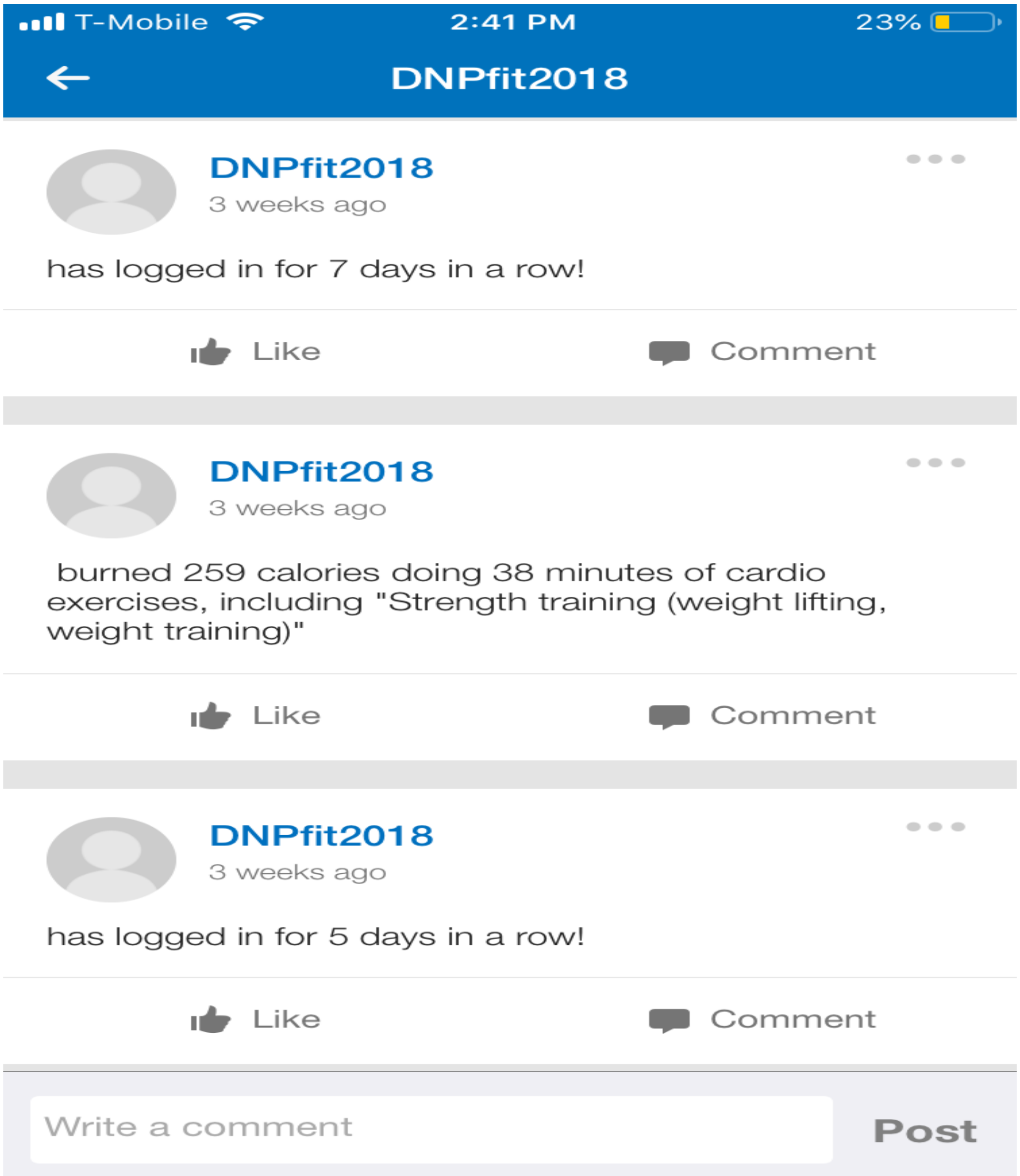
Erica Deenihan <erica.deenihan@valpo.edu> Sep 14, 2018, 1:07 PM
to Shevaun

Perfect! Thank you so much!

Sent from my iPhone

Appendix F

Sample of My Fitness Pal mobile application log in



TIVITY

Appendix G

Benefits of Exercise

1. Weight Control
2. Combat Chronic Disease
3. Improved Mood
4. Boost Energy
5. Sleep Better
6. Improve Social Interactions!
7. Improved Complexion.
8. Reduce Stress

Did you know?

- Burning 3500 calories is equivalent to losing 1lb of fat!
- Losing 0.5lbs per week amounts to 26lbs a year!
- Walking at a fast pace burns almost as many calories as jogging for the same distance!
- Muscle is about three times more efficient at burning calories than fat, even when at rest.
- Exercise is more effective at increasing your energy levels than caffeine.

Recreational Sports Fitness Center

1109 Union Street
Valparaiso, IN. 46383
219.464.5211

- 25 Cardio Stations
- Cybex Strength Circuit
- Stretching Area
- Free Weight Station

Hours:https://www.valpo.edu/recreationalsports/facilities/building-hours/

Club Sports

- Men/Women's Ultimate Frisbee
- Men/Women's Soccer
- Tennis
- Swimming
- Bowling
- Running
- Women's Softball

Valpo Yoga Club: Tuesdays &Thursdays:7-8:00pm Guided yoga and meditation space:(mats & oils provided)

Check Out Group Fitness Classes

valpo.edu/fitnesscenter/classes/

Interested in Club Sports? Check out each team's page on the Club section of IMLeagues.com.

VALPARAISO UNIVERSITY

Increasing Physical Activity on Campus

A Physical Activity Wellness Initiative

Campus Fun Fitness Tips:

- If you commute to campus, consider purchasing a remote parking pass! It's cheaper and a way to increase your daily step counts!
- Join the Valpo Velocity Bike Share movement powered by the Zagster app!
- Review your notes and PowerPoint slides while slowly walking on the treadmill!
- From Lebien Hall to the Christopher Center it is approximately 1001 steps. (FitBit & iPhone tracking data)
- From the health center to the Christopher Center it is roughly 758 steps. (FitBit & iPhone tracking data

P.S. Take the Stairs

- Harre Union has 29!
- Christopher Center has 75!

Physical Activity Guidelines for Americans

According to Physical Activity Guidelines (PAGs) for Americans, young adults are encouraged to complete either 150 minutes of moderate-intensity aerobic physical activity per week, or 75 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate/vigorous-intensity physical activity. In addition to aerobic exercise, young adults are also encouraged to complete muscle-strengthening activities that target major muscle groups on a biweekly basis (Farren, Zhang, Martin & Thomas, 2017).

Burning Calories:

A well-known physiologic effect of physical activity is that it expends energy! A metabolic equivalent, or MET is a unit that is used to describe and measure specific energy expenditure. It is the ratio of the rate of energy used during an activity compared to the rate of energy used at rest!

Example: If a person completes a 4 MET activity for 30 minutes, they have completed 120 MET minutes of activity (4x30). A person could also obtain 120 MET minutes by completing an 8 MET activity for 15 minutes!

According to physical activity guidelines, adults should aim for 500-1,000 MET minutes per week to obtain health benefits. (More if weight loss is desired)

Light Intensity = 1.1-2.9METS

Moderate Intensity= 3.0-5.9 METS. (walking at 3.0 mph requires about 3.3 METs)

Vigorous Intensity= 6.0+ METS (Running at 6.0mph is a 10 MET activity).

Utilize the "Compendium of Physical Activities Tracking Guide"

Prevention.sph.sc.edu/tools/docs/documents_compendium.pdf

As a means to track how may METS are required to complete hundreds of various types of physical activity!

For example:

Bicycling <10mph leisurely= 4.0METs

Bicycling 12-13.9mph with moderate effort = 8.0METS.