Investigating how health apps influence college students' health behavior

by

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Abstract

This study examined how health apps influence college students' health behavior, because about 50 percent of college students do not comply with physical activity recommendations. Because mobile applications (apps) are popular among college students, they hold promise for promoting behavior change in physical activity.

This research was conducted through an online questionnaire distributed to a randomized sample of 18-35 year-old Mid-Western university students. Questionnaire data were analyzed from 237 surveys using Pearson's Product Moment correlation (r) and Pearson's chi-square test ($\chi 2$).

This study showed that college students generally perceived health apps to be useful with slightly over half of the participants using health apps (52.3 percent). Bivariate analysis indicated positive attitudes towards health apps and positive attitudes towards physical activity ($p < .001$). The amount of experience using health apps yielded a positive relationship with attitudes towards physical activity ($p = .008$). In addition, having strong beliefs towards physical activity indicated a positive correlation with engaging in physical activity ($p < .001$).

This study provides valuable information regarding attitudes towards health apps and the intention to use health apps for physical activity. While health apps do not trigger an intention to do physical activity, having "belief strength" and positive attitudes towards physical activity increases the likelihood for engaging in physical activity. Health communication intervention strategies and health practitioners can use this information to educate individuals about the advantages for their health that can be associated with using health apps.

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Dedication

This thesis is dedicated to my two adorable daughters, Hope and Zoe Kamanga. You are the reason I kept going when times were challenging. I am confident that you are ordained to achieve great things in life. So, from me to you: The sky is not the limit, but know that with perseverance comes character and character hope. And finally, hope will not put you to shame (Romans 5:4-5). I love you.

Chapter 1 - Background

Health problems associated with physical inactivity are widely recognized and have become a public health concern over the past three decades (U.S. Department of Health and Human Services, 2001)(USDHHS). About 70 percent of American adults are below the recommended level of physical activity for health benefits (Buckworth & Nigg, 2004). The transition from adolescence to adulthood and the period of early adulthood itself is a critical period in which there is a decline in physical activity, and college students make up a large segment of this group (Middleweerd et al., 2015). Studies indicate that more than 50 percent of college students do not meet the minimum physical activity recommendations (Desai et al., 2008; Furia et al., 2009; Kamarudin & Omar-Fauzee, 2007; Suminski et al., 2003).

Although many individuals do not comply with physical activity recommendations, smartphone applications (apps) that promote physical activity are popular among college students (Apple, Inc., 2012; Dute et al., 2016; Middleweerd et al., 2015). Evidence indicates that more than 50 percent of American adults own smartphones, and half of those owners use their phone to search for health information. Fifty percent of mobile subscribers use a fitness application app and in particular young adults use their smartphones more often than older adults (Dute et al., 2016; Fox & Duggan, 2012; Pew Internet & American Life Project, 2009; Yang et al., 2015). Literature indicates that 18-29 year olds are 50 percent more likely to download apps. In addition, 20 percent of 18-29 year olds download about 20 different apps and 30-49 year olds download about 11 apps on their smart phones (Pew Internet & American Life Project, 2009). Apps enable users to set targets and self-monitor, provide tailored feedback, and consequently raise awareness and increase motivation (Dute et al., 2016).

Research shows that physical activity interventions are needed for all age groups. Young adulthood in particular is a critical time for physical activity interventions due to the carry-over effects of physical activity patterns that may last a lifetime (Centers for Disease Control and Prevention, 2007)(CDC). The carry-over effects are due to sedentary lifestyles with less structured time due to increased life demands (getting married, starting a career, and starting a family) and less access to physical activity programs and facilities (Furia et al., 2009). Hence, apps that increase physical activity levels would be valuable because insufficient physical activity is the second-leading preventable cause of death in the U.S., with links to heightened risk for major non-communicable diseases (Lee et al., 2012; Mokdad et al., 2004).

While various interventions have been implemented in all levels of society, increases in physical activity remain to be seen, especially among college students (Keating, 2005; Wang & Beydoun, 2007). Therefore, additional integration of health communication for the enhancement of health among individuals needs to be done (NIH, 2014). Health communication campaigns that focus on delivering health communication messages through emerging media are particularly significant (Huhman et al., 2007; Randolph & Viswanath, 2004; Valle et al., 2015; Wakefield et al., 2010). In addition, with the increasing smartphone ownership, many users are actively seeking health-related information applications for these devises. Hence, app developers have responded by producing thousands of health-related apps (Cowan et al., 2013).

Health benefits associated with being physically active provide compelling reasons to adopt and maintain an active lifestyle (Buckworth & Nigg, 2004). Evidence indicates that the benefits of regular physical activity is associated with psychological and physiological health (USDHHS, 2001). To acquire these benefits, individuals' are recommended to participate in moderate and vigorous physical activity for sessions of 30 minutes in order to improve their psychological and physiological well-being. Additionally, national public health guidelines recommend that adults engage in at least 150 minutes per week of moderate-intensity aerobic activity or 75 minutes per week of vigorous-intensity aerobic activity for improved health (Hogan et al., 2013; Physical Activity Guidelines Advisory Committee, 2008).

Problem Statement

Research shows that lack of physical activity contributes to approximately 3.2 million deaths yearly and is the fourth leading risk factor to premature death (Middleweerd et al., 2014). In addition, medical costs related to physical inactivity reached $120 billion in the U. S. in 2000 and increased to $147 billion by 2012 (Flegal, 2005; Ma et al., 2012). Because of the widespread benefits of regular physical activity and cost of inactivity, one would expect physical activity to be the norm, but evidence indicates that physical activity declines from high school to college (Kilpatrick et al., 2005). To be specific, approximately 60 percent of college students do not meet the minimum physical activity recommendations (Desai et al., 2008; Furia et al., 2009; Kamarudin & Omar-Fauzee, 2007; Suminski et al., 2002). Such inactivity can lead to weight gain, which is associated with the development of cardiovascular disease risk factors and increased prevalence of metabolic syndrome, diabetes, and some cancers (Flegal, 2005; Maglione & Hayman, 2009; Valle et al., 2015). Evidence also exists that about 40 percent of U.S. young adults, ages 20 to 39 years, may be insufficiently active to achieve the health benefits of regular physical activity (Valle et al., 2015). Approximately 57 percent of males and 61 percent of female college students do not engage in vigorous or moderate physical activity at least three days each week (Buckworth & Nigg, 2004; Kulavic et al., 2013).

Studies indicate that college students have “low levels of perceived pressure to be healthy” (Kilpatrick et al., 2005). “Low levels of perceived pressure to be healthy” implies that individuals respond to hazards according to their perception of the risks that they pose. Moreover, evidence exists that young adults' perceived vulnerability to disease is low, hence their willingness to participate in risk-reduction behavior is minimal (Collins et al., 2004). In addition, college students participate in physical activity for external (looking good) motivational reasons instead of internal (health related) reasons. Ego-related factors such as challenge, strength and endurance, competition and social recognition play an important role among males; whereas, a higher level of motivation for weight management, revitalization, appearance, nimbleness, positive health, and stress management personifies female motives for being physically active (Furia et al., 2009; Kilpatrick et al., 2005; LaRose et al., 2011; Marquis, 2005; Pauline, 2013). Studies show that intrinsic motivation is mostly driven by enjoyment and competence among college students. Hence, individuals may only participate in physical activity for personal pleasure and satisfaction derived from the activity itself instead of the health- related factors associated with the activity (Furia et al., 2009; Pauline, 2013; Ullrich-French et al., 2011). Research also shows that one half of individuals who participate in physical activity programs drop out within the first three to six months (Kilpatrick et al., 2005; Kulavic et al., 2013).

Significance

Studies show that college age populations are often neglected in investigating factors related to obesity, compared to studies of children or middle-aged adults (Poobalan et al., 2012). Further, interventions tailored to meet the needs of young adults are also limited. College students' physical activity patterns are also poorly understood, and exploring factors affecting physical active behavior is crucial for health communication intervention purposes (Poobalan et al., 2012).

Physical activity is considered by many national and global authorities as one of the most important actions individuals can undertake regularly to improve health (National Physical Activity Plan, 2001; Pauline, 2013). Exploring the psychological correlates of physical activity has shown promise in explaining the decision process related to physical activity behavior (Manglione & Hayman, 2009). Research suggests that the first step in the process of increasing physical activity among college students is to gain an understanding about college students' physical activity patterns and key activity determinants (Keating et al., 2005; Pauline, 2013).

College years are a time of growth and development and a propitious time to educate, motivate, and prepare students to lead healthier lives (Manglione & Hayman, 2009). Therefore, with college students being an at-risk population for physical inactivity, it is necessary for health and fitness professionals to determine what motivates college students to exercise. Furthermore, developing improved programs and interventions to enhance physical activity patterns among college students is important (Kilpatrick et al., 2005; Kulavic et al., 2013; Poobalan et al., 2012). Potential public health benefits may result from using college campus settings to positively influence physical activity habits of young adults (Leslie et al., 2001).

Studies indicate that regular physical activity has many benefits that lead to the enhancement of physiological and psychological health (Kilpatrick et al., 2005). College students are vulnerable to stress and depressive disorders more than the general population. High levels of stress are associated with a plethora of mental health problems, higher burn-out rates, augmented sleep complaints, elevated levels of pain, and decreased quality of life (Gerber et al., 2014). In addition, physical activity is responsible for positive effects on mental health and mood, such as reduced depression and anxiety, positive well-being, enhanced bone density vigor, strength, and better cognitive function (Gerber et al., 2014; Hogan et al., 2013; Pauline, 2013; Swain et al., 2006). Therefore, it is important to engage in regular physical activity because it can lower the risk of early death, heart diseases, stroke, Type 2 diabetes, high blood pressure, adverse blood lipid profile, colon and breast cancer, prevention of weight gain, and metabolic syndrome (Pauline, 2013).

Physical activity research has identified the critical role of self-efficacy beliefs in guiding the self-regulation of behavior, including behavior involved with physical activity initiation and maintenance. Hence, self-efficacy has received significant focus in the literature and is found to be an important correlate of physical activity behavior (Pauline, 2013). Self-efficacy refers to individuals' situation specific self-confidence (Bandura, 1997).

Theoretical Framework

This study employs two theories, the Theory of Reasoned Action and the Expectation Confirmation Theory, and one model, the Technology Acceptance Model, which builds on the Theory of Reasoned Action.

The ordering of the attitude construct to the behavioral construct may be found in the Theory of Reasoned Action (TRA). In this theory, an intention construct mediates attitudes and behavior. Behavioral intentions are individuals' plans of action, which encapsulate the motivation to engage in a certain behavior (Ajzen & Fishbein, 1980). For some behaviors, the attitude component may be more important and for other behaviors, the normative component may be more important determining the behavioral intentions (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). Under the theory, behavioral intentions remain stable over short time periods. Attitudes are further guided by behavioral beliefs, which are beliefs about the consequences of the behavior (Ajzen, 1991). Hence, for this study an individual's "belief strength" is the perceived value of engaging in physical activity and the expectation that those beliefs will materialize. Also, the TRA has been used in past research to explain and predict physical activity behavior (Ajzen, 1988; Ajzen & Fishbein, 1980).

Therefore, under the TRA the more individuals are motivated to engage in certain behaviors, the more likely they are to be successful performing that behavior (Ajzen, 1991; Armitage, 2005). So, if individuals have a positive attitude towards physical activity, for example, then they are likely to have the intention to engage in physical activity. In other words, if they have a positive attitude towards health apps, they are likely to use these health apps. The same goes for negative attitudes linked to not engaging in that particular behavior. The TRA suggests that an individual's intention to engage in physical activity is the immediate predictor of physical activity (Blanchard et al., 2008). Therefore, this study focused on attitudes, because if one has a positive attitude towards a behavior one is likely to engage in that behavior (Ajzen & Fishbein, 1980).

The Expectation Confirmation Theory (ECT) posits that satisfaction is determined by interplay of prior expectations and perception of delivery. Individuals' satisfaction from using a product is largely determined by the confirmation of their initial expectations. Confirmation is a psychological state related to, and resulting from, a cognitive appraisal of the expectation performance discrepancy (Bhattacherjee, 2001). So, when an individual has high expectations of a technology, the extent of performance required for a high level of confirmation also increases. Lower levels of expectation are more likely to result in higher levels of confirmation. Hence, after one evaluates one's feelings about using an adopted technology, one may become satisfied with the technology (Cho, 2016). Therefore, if health apps meet or exceed expectations, individuals are therefore more likely to be satisfied with health apps and have an intention to use health apps.

The Technology Acceptance Model (TAM) is an information systems model that shows how users come to accept and use a technology (Davis, 1989). When users are presented with a new technology, two factors influence their decisions about how and when to use it:

- Perceived usefulness - the degree to which an individual believes that using a particular technology would enhance his or her job performance
- Perceived ease-of-use - the degree to which an individual believes that using a particular technology would be free from effort

The TAM is the most influential extension of Ajzen and Fishbein's TRA (Davis, 1989). Both the TRA and the TAM assume that when individuals form an intention to engage in a certain behavior, they are more likely to engage in that behavior (Bagozzi et al., 1992). So, if an individual perceives health apps to be useful, his or her perceived usefulness of health apps will increase.

Chapter 2 - Literature Review

Physical Activity

Amount of physical activity required to produce general health benefits

Physical inactivity is a major health problem, and compelling evidence suggests that it is a contributing factor in several chronic diseases and conditions (Hogan et al., 2013). Physical activity refers to any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level. Also, within these guidelines, physical activity generally refers to the subset of physical activity that enhances health (CDC, 2015). In recognition of the health and functional hazards of sedentary way of life, numerous health groups promulgate public health recommendations for physical activity (Blair et al., 2001). The primary recommendations to promote and maintain health require all adults aged 18-65 years to engage in moderate intensity aerobic (endurance) physical activity for a minimum of 30 minutes on five days a week or vigorous intense aerobic physical activity for a minimum of 20 minutes a week (CDC, 2005). Physical activity intensity is measured in kilocalories burned per minute of activity or in a unit called the metabolic equivalent (MET); which is the ratio of the metabolic rate during physical activity to the metabolic rate at rest (Bassuk & Manson, 2005). For example, moderate intensity physical activity includes brisk walking at 4 miles/hour (mph), that burns 3.5-7kcal/min or n equivalent to individuals that expend 3-6METs. In addition, moderate –intensity activities includes bicycling on a flat or hard surface (10-12 mph), playing tennis doubles, swimming leisurely, playing non-competitive volleyball, and physically washing a car (Bassuk & Manson, 2005).

Vigorous activities include running that burns more than 7 kcal/min or expends more than 6 METs (Bassuk & Manson, 2005). Vigorous –intensity aerobic physical activity causes rapid breathing and a substantial increase in heart rate. It includes walking at a very brisk pace (4.5mph), jogging (5 mph), running (7mph), carrying heavy loads such as bricks, heavy farming such as bailing, bicycling on a flat or hard surface (12-14 mph), playing a basketball game, playing tennis singles, and playing competitive volleyball at the gym or the beach (USDHHS, 2001). Based on CDC recommendations, an individual can engage in a combination of both moderate and vigorous intensity aerobic physical activity by walking briskly for 30 minute twice a day and then jogging for 20 minutes on the other days (CDC, 2005).

Benefits of physical activity

Research demonstrates that regular physical activity plays an important role in enhancing a range of physical indices (Hogan et al., 2013; Kilpatrick et al., 2005; Maglione & Hayman, 2009). However, college students in particular continue to exhibit poor health outcomes even though the American College Health Association has diligently promoted physical activity on campuses around the U.S. (Boyle & LaRose, 2009; Dart & Davis, 2008; Keating, 2005). Two-thirds of college students are physically inactive; hence, increasing physical activity has become a significant part in public health strategies to prevent weight gain and enhance health (Kilpatrick et al., 2005; Saris et al., 2003).

Weight management

Since college years are highly influential in shaping adult behaviors, especially with regard to diet, physical activity, and other lifestyle habits, maintaining weight and preventing weight gain during this period is of importance (Brunt et al., 2008; Desai et al., 2008). Physical activity is recommended as an important part of weight management by virtually all public health agencies and scientific organizations including the National Health Lung and Blood Institute (NHLBI), Centers for Disease Control and Prevention (CDC) and various medical societies such as the American Heart Association and American Medical Association (Donnelly et al., 2009). Research indicates that the primary prevention of obesity begins with weight maintenance, not weight reduction (Ball et al., 2001). However, weight reduction plays a significant role in decreasing health risks associated with chronic diseases (Donnelly, et al., 2009). Therefore, it is recommended that individuals engage in moderate-intensity physical activity between 150 and 250 minutes per week ($min \cdot wk^{-1}$).

In addition, moderate-intensity physical activity between 150 and 250 minutes per week will provide only modest weight control. Evidence indicates that greater amounts of physical activity more than 250 minutes per week have been associated with clinically significant weight loss (Donnelly et al., 2009). Previously, a minimum weight loss of 10 percent was recommended by the NHLBI (Panel, 1998), but recent studies indicate a reduction in cardiovascular disease risk -factors that come with 3 to 5 percent reduction in weight (Carels et al., 2004; Villareal et al., 2006).

Obesity in the U.S.

Obesity, a major health concern globally, has been defined as abnormal or excessive fat accumulation (Campos et al., 2006; Orji & Mandryk, 2014; Sentell et al., 2011; WHO, 2014; Zhang, 2004). Worldwide, obesity prevalence has more than doubled between 1980 and 2014, and more than 1.9 billion adults 18 years and older were overweight and 600 million were obese in 2014. This obesity epidemic affects 11 percent of men and 15 percent of women in 2014. At the same time, 39 percent of young adults 18 to 35 years were overweight with 38 percent of men and 40 percent of women falling within this category (WHO, 2014).

The United States in particular has witnessed a tremendous increase in the prevalence of obesity in the past three decades, where more than two thirds of US adults and approximately one-third of US children and adolescents are considered overweight or obese (Nelson et al., 2007; Singh et al., 2010; Wang & Beydoun, 2007).

Between 2003 and 2004, approximately 33 percent of adults 20–74 years old were obese, and more than 17 percent of teenager's age 12–19 years were either overweight or obese in the U.S. In addition, by year 2003–2004 the prevalence of obesity had increased to almost 32 percent in men and 34 percent in women (Ogden et al., 2007). Obesity remains highest among middle age adults, 40-59 years old (39.5 percent) than among younger adults, age 20-39 (30.3 percent) or adults over 60 (35.4 percent) (CDC, 2015). College students aged 18-25 years show increased trends in obesity, where the rates tripled from 5 percent to 17 percent between 1976 and 2002, while 2004 saw an increase to 36 percent of obesity among college students (Kilpatrick et al., 2005; LaCaille et al., 2011).

In view of the challenges associated with physical activity and its link to obesity, changes in "lifestyle approaches to increase physical activity" can be significant. "Lifestyle approaches to increasing physical activity" refer to interventions that incorporate behavioral theories and constructs to assist and facilitate increasing physical activity within one's lifestyle (Donnelly et al., 2009). In fact, goal-setting, self-monitoring, and relapse prevention strategies based on TRA are intervention approaches that can be useful to improve participation in physical activity (Kriska et al., 2003).

Reduce cardiovascular disease and diabetes

Sedentary lifestyle is an important modifiable risk factor for cardiovascular disease (CVD) and research indicates that physical activity provides metabolic and cardiovascular benefits (Bassuk & Manson, 2005; Wannamathee & Shaper, 2001). Diabetes is also a major cause of cardiovascular morbidity and mortality, and it increases the risk of developing coronary heart disease (CHD) by three-to-seven fold in women and two-to-three fold in men (Bassuk & Manson, 2005). Physical activity may slow the initiation and progression of Type 2 diabetes and its cardiovascular sequelae through favorable effects on body weight, insulin sensitivity, glycemic control, blood pressure, lipid profile, fibrinolysis, endothelial function, and inflammatory defense system (Bassuk & Manson, 2005).

Research shows that being physically active is associated with 50 percent reduction in risk of cardiovascular disease. An increase in energy expenditure from physical activity of 1000 kcal (4200 kJ) per week or an increase in physical fitness of 1 MET (metabolic equivalent) is associated with a mortality benefit of about 20 percent (Warburton et al., 2006). Moreover, low-intensity physical active training (e.g., being active at less than 45 percent of maximum aerobic power) is associated with an improvement in health status among patients with cardiovascular disease (Swain & Franklin, 2006).

Diabetes

Diabetes among the U.S. population is on the rise and 1.3 million new cases occur yearly (Eyre et al., 2004). Particularly, Type 2 diabetes affects more than 16 million Americans (CDC, 2005). In light of the challenges associated with diabetes and the link to CVD, evidence suggests that 30 minutes/day of moderate – intense physical activity can reduce the incidence of Type 2 diabetes and cardiovascular events (WHO, 2004). Previous observational studies indicates that walking briskly for at least 2.5 h/week (30 min/day for 5 days) is associated with 25 percent reduction in diabetes after adjusting for age and BMI and other risk factors for diabetes (Weinstein et al., 2004). In addition, walking that leads to moderate increases in heart and breathing rates is associated with significant reductions in all-cause mortality (Warburton et al., 2006).

Reduction of certain cancers

Physical inactivity has been identified as a modifiable risk factor for a variety of chronic diseases, including colon and breast cancer (Blair et al., 2001; UDHHS, 1991). Regular physical activity is associated with an improvement of overall quality of life and health status of patients with cancer (Warburton et al., 2006). Studies involving patients with breast and colon cancer indicate that physical activity is associated with decreased recurrence of cancer and risk of death from cancer. Further, the International Agency for Research on Cancer estimates a 20 to 40 percent decrease in the risk of developing breast cancer among the most physically active women, regardless of menopausal status, type, or intensity of activity. In addition to physical activity preventing recurrence, physical activity also prolongs survival (Haydon et al., 2006; Holmes et al., 2005).

At the same time, most women fail to accumulate the required amount of physical activity following treatment for breast cancer that is needed to derive these health benefits (Brunet et al., 2013). Albeit, evidence indicates that 30 to 60 minutes/day of moderate to vigorous activity is needed to reduce the risk of colon cancer in men and women and breast cancer in women respectively. Examples of such activities include expending more than or equal to 1000 kilo-calories per week by walking briskly, climbing stairs, and participating in sports or recreational activities (Lee, 2003).

Strengthen bones and muscles

Physical activity is important for maintaining healthy bones throughout life and plays a significant role in preventing osteoporosis, reducing falls, and decreasing the risk of hip fractures (Chan et al., 2004). Studies indicate that bones, like muscles, respond to stress by becoming bigger and stronger. Regular physical activity also places physical stress on the body, helps stimulate bone growth and preserve bone mass, and provides excellent general health benefits, the foremost being an increase in bone mineral density (BMD) (Qin et al., 2002).

Walking can help strengthen bones and muscles and, starting early in life, contributes to higher peak bone mass. Peak bone mass and subsequent bone mineral maintenance are largely affected by the interplay between mechanical stress, body composition, nutrition and bone metabolism. As a result, activities such as resistance training and weight-bearing exercises are recommended to help build bones and preserve bone mass (Chan et al., 2004). Examples of such activities include weight-lifting, hiking, stair-climbing, step aerobics, dancing, and other activities that require muscles to work against gravity without putting too much stress on bones and joints. In addition to increasing bone density, regular physical activity has the added benefits of enhancing coordination and strengthening muscles, both of which serve to reduce the risk of falling (Klibanski et al., 2002).

Improves mental health

Stress and stress-related mental disorders are extremely common among young individuals (Bayram & Bilgel, 2008; Gerber et al., 2014). Research shows that individuals with mental health disorders constitute an important population in which physical inactivity may contribute to increased morbidity and healthcare expenditures (Paluska & Schwenk, 2000). In addition, high levels of stress are associated with a plethora of mental health problems, including increased depressive symptoms, higher burnout rates, augmented sleep complaints, elevated levels of pain, decreased professional success, and decreased quality of life (Gerber et al., 2014; Marshall et al., 2008; Sundblad et al., 2008). College students in particular report depressive disorders more often than the general population with a mean occurrence rate of 31 percent and sleep complaints with prevalence rates up to 50 percent (Ibrahim et al., 2013; Jansson-Frojmark et al., 2008). Furthermore, a voluminous number of these disorders have a high temporal stability and persist over several years, leading to long-term bio-physiological changes (Gerber et al., 2014).

In fact, the role of physical activity as a factor that protects against stress-related mental disorders is well documented (Faulkner & Taylor, 2005; Steptoe & Butler, 1996). Studies indicate that young individuals who regularly engage in physical activity perceive less stress, , report lower depressive symptoms, experience fewer sleep complaints, and perceive fewer symptoms of pain (Brand et al., 2010; Gerber et al., 2014; Johnson et al., 2008; Sundblad et al., 2008). Moreover, regular physical activity can prevent mental health problems among individuals with high stress exposures (Gerber et al., 2014).

In summary, research shows that meeting the vigorous intensity standards of the American College of Sports Medicine is associated with improved mental health and more successful coping among young individuals. Hence, vigorous physical activity is an important factor in stress management, pain perception, and subjective and objectively assessed sleep quality, as well as having possible implications for preventing depression (Gerber et al., 2014).

Increase the likelihood of living longer

The leading causes of morbidity and mortality among youth and adults in the United States are related to six categories of priority health-risk behaviors: 1) behaviors that contribute to unintentional injuries and violence; 2) tobacco use; 3) alcohol and other drug use; 4) sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases (STDs), including HIV infection; 5) unhealthy dietary behaviors; and 6) physical inactivity. These behaviors are established during adolescence and young adulthood and are most likely to persist into adulthood (Eaton et al., 2012).

In light of the physical inactivity challenge, research shows that habitual physical activity is as an important component of living a healthy lifestyle (Twisk, 2001). Physical inactivity is not just related to many chronic physical diseases like coronary heart disease, diabetes mellitus, certain types of cancer, and osteoporosis but also to chronic mental diseases (Bassuk & Manson, 2005; Blair et al., 2001; Gerber et al., 2014). Evidence exists that the population attributable risks (PAR) for chronic diseases are not just high, but the PAR of physical inactivity for mortality from coronary heart disease is 35 percent, for diabetes mellitus 35 percent, and for colon cancer 32 percent, meaning that these deaths could have been theoretically prevented if all these individuals were physically active (Twisk. 2001). PAR refer to the number (or proportion) of cases that would not occur in a population if certain factors were eliminated (e.g. How many individuals would be prevented from getting a chronic disease due to lack of physical inactivity?). Additionally, within the context of health behaviors, a longer subjective life expectancy is associated with health behaviors, such as performing regular physical activity (Ross & Mirowsky, 2002).

Health behavior change

Engaging in regular physical activity involves being motivated, which results in forming an intention, and in subsequent self-regulation processes that address the pursuit of these goals According to the health action process approach (HAPA) risk perceptions, outcome expectancies, and perceived self-efficacy contribute jointly to the development of an intention to change (Ziegelmann et al., 2006).

Health Communication

Health communication focuses on informing and influencing individual and community decisions that enhance health (NIH, 2014). Because health communication focuses on delivering targeted or tailored messages to specific segments of audiences (NIH, 2014), this study will focus on how college students' use of health apps influences their health behavior.

Even though various mass media and community-wide campaigns have been effective in physical activity interventions, the dynamic growth and use of new technology among young adults has made it important to deliver health communication interventions through emerging media. For example, Internet use is exceptionally high among young adults and can be an important medium for disseminating health- related information to them (Huhman et al., 2007; Randolph & Viswanath, 2004; Valle et al., 2015; Wakefield et al., 2010).

While the Internet offers health information through various formats, individuals can use the Web to access information and support on demand. Using the Internet as a delivery mode applies to smartphone apps, too, because these are constantly accessible, adjustable to the needs of the user, able to provide tailored feedback, have a large reach, and have interactive features (Middleweerd et al., 2014). Research shows that individually tailored feedback based on the user's own characteristics and advice is more likely to be effective in relation to physical activity. Studies also demonstrate that a large percentage of individuals carry smart phones and can access data anywhere and anytime; hence, physical activity behavior change promotion apps offer opportunities to provide tailored feedback and advice at the appropriate time and place (Middleweerd et al., 2014). Also, some physical activity apps require the user to wear a separate sensor, (the Nike Fuel Band, Jawbone Up, or the Fitbit), which links with the mobile phone to transmit the data. Other apps, such as Runkeeper, use the accelerometer and Global Positioning System (GPS) native to the cellphone to track activity levels including running, walking, biking, or hiking (Eng & Lee, 2013). The Nexercise app gives individuals gift cards or discounts as rewards for doing physical activity. Finally, some apps make physical activity social, through support from and/or competition between friends by linking to social media like Facebook and Twitter (Eng & Lee, 2013).

As a result, apps offer new opportunities to deliver individually tailored interventions, including real-time assessment and feedback that are likely to be effective (Middleweerd et al., 2014). Social networking sites such as Facebook and Twitter, communication apps such as WhatsApp, and physical activity apps such as RunKeeper, Endomondo, Strava, and Nexercise, Fitbit, and MyFitnessPal can also be useful to this population (Cadmus-Bertram et al., 2015; Middleweerd et al., 2015). The Fitbit app became available for Windows 8 devices in 2013 and Windows Phone in 2014. Fitbit, in particular collects activity data, uploads it to the web, and produces simple graphs and charts (Cadmus-Bertram et al., 2015). Fitbit as an intervention tool is currently limited to two single-arm studies and one randomized trial (Kurti & Dallery, 2013; Washington et al., 2014). Fitbit accessories like the watch, scale, and activity tracker come at a cost that varies from $15-$250. The Fitbit website is free to use. However, to get a complete picture of one's overall health, it is recommended that one uses the tracker and the website together (Eng & Lee, 2013). MyFitnessPal, on the other hand, was founded in 2005 by Albert Lee and Mike Lee (Perez, 2015). They introduced a premium subscription tier for its applications in 2015, which allows subscribers to receive custom reports about their activities (Popper, 2015). MyFitnessPal can also be linked to Fitbit, allowing for the automated calculations of calorie counts (Nieder, 2013). Research shows individuals are willing to pay for the product to enhance their ability to track their physical activity progress (Washington et al., 2014).

Health apps and physical activity

Health related information is constantly sought after by the American public, and the Internet and mobile devices are two potential purveyors (Cowan et al., 2013; Pew Internet &

American Life Project, 2009). Mobile apps for physical activity are popular among highly educated young adults and hold promise for promoting behavior change and reducing non-communicable disease risk (Yang et al., 2015). Moreover, these health apps provide feedback, so individuals are able to track their progress (Middleweerd et al., 2015).

Smart phones and other Apple and Android devices provide a platform for freelance developers to design apps, which expand the functionality and utility of these devices. Apps are pieces of software that can run on mobile devises, and since the launch of the App Store in 2008, approximately 550,000 apps have become available with more than 25 billion downloads on Apple devices alone (Apple, Inc., 2012). The American adult population who own smartphones have access to approximately 23,500 health-related apps in iTunes, and about 17,800 health-related apps in Google Play. In 2010 one in ten smartphone users downloaded health related apps (Fox, 2010). Altogether, website delivery intervention and smart phone apps could be used to enhance engagement and increase levels of physical activity (Kirwan et al., 2012).

Individuals also have free and paid health app options, and many app publishers such as Android, iOS, Windows Mobile, etc., offer a basic trial version of their apps for free and then charge a fixed monthly subscription fee for premium services. To reduce risk and uncertainty in buying an app, users normally use the free trial version to become familiar with its content and functionality before deciding whether or not to purchase the paid version (Hsu & Lin, 2015). In this context, users either confirm or disconfirm the pre-purchase expectations after assessing performance against pre-purchase expectations. In turn, users' satisfaction level with the app is determined by such confirmation. As a result, factors contributing to users' intentions to purchase paid apps are an important consideration for app publishers and marketers (Hsu & Lin, 2015; Whitfield, 2013). But whether paid or free, research shows that using health apps enhances engagement and increases levels of physical activity among college students (Kirwan et al., 2012).

Intervention

The smartphone market is growing rapidly with about 35 percent of U.S. adults using smartphones in 2012. In addition, there has been an increasing interest from academics and clinicians in harnessing smartphones as a means of delivering behavioral interventions for health (Boschen & Casey, 2008; Miller, 2012). Research shows that physical activity is operant in nature and is therefore malleable, making behavior analysts uniquely qualified to develop behavioral treatment strategies that address suboptimal activity levels.

Hence, these devices offer the opportunity to bring behavioral interventions into real life contexts where people make decisions about their health. In addition, smartphone apps may provide cheaper, more convenient, or less stigmatizing interventions than the traditional intervention methods, where one may have been of the idea that one's privacy was invaded for example (Morris & Aguilera, 2012; Preziosa et al., 2009). Smartphones also have the ability to facilitate the sharing of behavioral and health data with health professionals or peers (Dennison et al., 2013; Patrick et al., 2008). The prospects of continuous and automated tracking of health-related behaviors and timely, tailored interventions for specific contexts are due to the increasing ability of smartphones to use internal sensors to infer context such as user location, movement, emotion, and social engagement (Lane et al., 2011).

Confirmation and perceived usefulness of health app usage

Many studies have focused on the post acceptance of using various technologies outside the field of health apps. These studies indicate that companies often lost money when employees stopped using various organizational systems, such as the company intranet (Bhattacherjee, 2001; Boe et al., 2015; Lin et al., 2005). Hence, the Expectation-Confirmation Theory (ECT), which was originally developed for research on consumers' post-purchase behaviors from a marketing perspective, proved highly predictive on post-adoption behaviors in the field of information technology (Lee, 2010; Thong et al., 2006). The precept of the theory is that individuals' post-consumption behaviors depend on the extent to which their initial expectations are confirmed by the experience of using the product. Therefore, the confirmation of a consumer's initial expectations is directly related to his/her satisfaction with the product, and can therefore be linked to post-consumption behavior (Cho, 2016).

Also, Bhattacherjee's Post Acceptance Model (PAM) incorporates key components of the ECT and the Technology Acceptance Model (TAM) (Bhattacherjee, 2001). The PAM focuses on the key roles of confirmation and satisfaction in order to improve information systems (IS) continuance intention. Under the TAM one's intention to adopt a new technology is determined by two perceptual factors—perceived usefulness and perceived ease of use (Kim & Park, 2012). Therefore, in light of health app usage, if an individual perceives that the health app saves efforts in completing a given task, the perceived usefulness of the health app increases. As the user becomes able to achieve a chosen goal in the expected way, s/he tends to experience an increase in perceived usefulness. For example, when a health app works as expected (for example, efficiently manages a health condition or helps obtain useful health information), the user will recognize the usefulness of that app (Cho, 2016).

In addition, if a user's expectations of a particular technology are confirmed, he or she uses that technology effectively. Based on the TAM, perceived ease of use is inversely proportional to the amount of effort needed to learn a new technology (Kim & Park, 2012). Thus, as one's experience of using a given technology increases, the effort needed to acquire technological skills decreases, which in turn increases perceived ease of use of that specific technology (Venkatesh & Davis, 2000). In particular, with regard to health apps, users, who are able to confirm their expectations of the app by using it in appropriate and expected ways, will have enough ability to use the app effectively. Thus, individuals, who confirm their expectations of health apps by gathering health information efficiently and managing their health more effectively, are likely to use health apps without putting in considerable effort learning how to use them (Cho, 2016).

In addition to the Theory of Reasoned Action, some of the hypotheses and research questions below were formed around the framework of the Expectation Confirmation Theory (ECT) and the Technology Acceptance Model (TAM). The first two hypotheses (H_1, H_2) and research questions RQ_{2a} and RQ_{3a} below are based on the ECT and the TAM –Model. The final three hypotheses are based on the studies conducted by Furia et al. (2009) and Kilpatrick et al. (2005). Therefore, the purpose of this study was to understand whether college students aged 18-35 years embrace apps for health related activities.

Hypothesis and research questions

ECT and TAM Framework

H_1 - Higher levels of confirmation of health app usage will be positively correlated with perceived usefulness of health apps

H_2 - Perceived usefulness of health apps will be positively correlated with continuation intention for health apps usage

RQ_{2a} – Does the amount of experience in using health apps positively correlate with attitudes towards regular physical activity?

RQ_{3a} – Does the amount of one's experience in using health apps positively correlate with one's intention to regularly engage in physical activity?

Theory of Reasoned Action Framework

H_3 – Males are less likely than females to use health apps for weight management purposes

H_4 – The correlation between attitudes towards health apps and intention to engage in physical activity will be more positively correlated for males than females

H_5 – The stronger an individual's beliefs strength toward engaging in physical activity, the more the individual will have positive attitudes toward engaging in physical activity

RQ_{1a} - Will one's attitude towards physical activity be more positive for individuals who use health apps than for individuals who do not use health apps?

RQ_{1b} - Will one's intention to engage in regular physical activity be greater for individuals who use health apps than for individuals who do not use health apps?

RQ_{2b} - Does the amount of experience in using health apps positively correlate with the strength of one's beliefs towards engaging in regular physical activity?

RQ_{2c} - Does one's evaluation of health apps positively correlate with one's attitude toward regular physical activity?

RQ_{2d} - Does price range of paid health apps positively correlate with one's attitude toward regular physical activity?

RQ_{3b} - Does one's evaluation of health apps positively correlate with one's intention to regularly engage in physical activity?

RQ_{3c} - Does the price range of paid health apps positively correlate with one's intention to regularly engage in physical activity?

Chapter 3 - Methodology

Participants and Procedures

Upon obtaining approval from the university's Institutional Review Board, prospective undergraduate and graduate participants aged 18 to 35 years were randomly recruited to participate in this study. A random sample of 3,000 students was requested for the study sample through the university's Information Technology Service system. A total of 237 students were sampled (n = 237), (152 females, 79 males, 1 transgender, 5 no response). The majority of the sample consisted of 193 Caucasians (83.3%), followed by 14 Hispanic/Latinos (6%), 10 Black/African Americans (4.3%), 4 Asians (1.7%), and 2 American Indian/Alaska Natives (.9%). In addition, 2 students (.9%) were from another race, 1 Native Hawaiian/ Pacific Islander (.4%), 6 (2.6%) students preferred not to answer, and 5 no responses. These demographics reflect the percentages found by the College Board with Blacks representing 4%, Asians 1%, and Hispanics 6% at the sampled Mid -Western University (2016). The 37-item survey was developed and distributed to voluntary participants through an anonymous online Qualtrics survey system. Participants were informed that no penalties would be attached for failure to participate. The survey was distributed via e-mail and only participants who provided consent were able to participate. Most participants completed the questionnaires in less than 10 minutes. The data analyses were accomplished through the Statistical Package for Social Sciences (SPSS Inc.), Version 22.

The current study investigated how health communication apps influence college students' motivation for physical activity. An online questionnaire was used to obtain participants' self-reported information about their motivation toward physical activity as well as the role health communication via health apps plays. This online approach was used because research shows that young adults are most likely to go online and are less likely to respond to traditional research settings for studies of health behavior (Bost, 2005; Ramo et al., 2011). An online -Qualtrics questionnaire was distributed through Kansas State University's IT –Helpdesk system for data collection. To maximize the response rate, weekly reminder e-mails were sent to participants. The questionnaire used in this study may be found in Appendix A. All the variables used in the questionnaire were tested for their factor structure employing a principle component analysis and, if multiple factors appeared, a varimax rotation was used for the interpretation.

Belief Strength about Engaging in Physical Activity

Belief Strength items were measured using the Exercise Motivations Inventory - 2 (EMI-2) questionnaire adapted from Kulavic et al. (2013). The EMI-2 represents a self-report measure of motivations to exercise consisting of 51-items (Markland & Ingledew, 1997). Following are seven of the 51-items that were used to measure attitudes towards physical activity. The two subscales measured strength and endurance while another three items measured positive health respectively. These seven items tapped into why individuals might be motivated to engage in physical activity. The items were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The strength and endurance items were 1) I engage in physical activity to build up my strength, 2) I engage in physical activity to increase my endurance, 3) I engage in physical activity to get stronger, 4) I engage in physical activity to develop my muscles. The positive health items were 1) I engage in physical activity to have a healthy body, 2) I engage in physical activity because I want to maintain good health, and 3) I engage in physical activity to feel healthier (Markland & Ingledew, 1997).

The factorability of the seven items was examined with one factor explaining 79.4 percent of the variance. Items one and three had similar loadings equaling .90, item two .92, item four .86, item five .88, item six .91, and item seven .87. Internal consistency was examined using Cronbach's alpha. The Cronbach's alpha for all seven items was .96.

Attitudes toward Physical Activity

Attitude items were adapted from Francis et al. (2004). The items were measured on a 7-point semantic differential scale and were preceded by the statement, for physical activity "For me, over the next two weeks engaging in physical activity regularly is" 1) beneficial/harmful, 2) good/ bad, 3) pleasant/ unpleasant, and 4) useful/ useless.

The analysis revealed a single-factor structure, in which 74.5 percent of the variance is explained. Factor loadings for item one was .89, item two .93, item three .71, and item four .91. Cronbach's alpha was .87 for the factor.

Attitudes toward Health Apps

Attitudes towards health apps items were adapted from Francis et al. (2004). The items were measured on a 7-point semantic differential scale and were preceded by the statement, "For me, health apps are", 1) beneficial/harmful, 2) good/ bad, 3) pleasant/ unpleasant, and 4) useful/ useless

Analysis on the four items revealed a single factor explaining 84 percent of the variance. Items one and three had a primary factor loading of .93 and .95 respectively, while items three and four had primary loading of .89. The Cronbach alpha for all four items was .94.

Intention for Physical Activity

Intention for physical activity was evaluated using four items adapted from Francis et al., (2004). The four items were measured on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). The three items were 1) I do physical activity at least three days each week for about an hour, 2) I want to do physical activity at least three days each week for an hour, 3) I intend to do physical activity for at least three days each week for an hour, and 4) I do not plan to use health apps in the future.

A single-factor structure was revealed in which 77.4 percent of the variance was explained. The factor loading for item one was .87, for item two .83, and item three .93. Cronbach's alpha was .84 for the factor.

Intention to Purchase Health Apps

Future intention of health app usage items were adapted from Hsu and Lin (2015). The 2-items were measured on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The items were 1) I will frequently purchase paid health apps in the future, 2) I intend to keep purchasing health apps

The factorability of the two items was examined explaining a single factor structure, in which 92.6 percent of the variance was explained. Both items had a primary loading of .96. The Cronbach alpha for both items was .92.

Health App Usage

Two items on beliefs about health app usage were adapted from Ballantine and Stephenson (2011) and six items about perceived usefulness, continuation intention, and confirmation on health apps were adapted from Cho (2016) respectively. The items were measured on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) and are, from Ballantine and Stephenson (2011), 1) I use health apps to gain information about physical activity, and 2) If I have a question related to physical activity, I can usually find the answers on health apps, and 3) I find health apps to be worthwhile.

The analysis on the beliefs about health app usage–items revealed a single factor structure, in which 58.7 percent of the variance was explained. Factor loadings for item one was .84, item two .85, and item three .58. The Cronbach alpha was .64.

Items from Cho (2016) were perceived usefulness: 1) Health apps are useful for managing my health daily, and 2) Health apps are advantageous for managing my health better.

The two items revealed a single factor explaining 82.9 percent of the variance. Both items in this analysis had a primary loading of .91. The Cronbach alpha for both items was .79.

Continuation intention 1) I will keep using health apps, and 2) I do not plan to use health apps in the future. For these two items a single factor explaining 79.4 percent of the variance. Both items had a primary loading of .90. The internal consistency for both items indicated a Cronbach alpha of .77.

The confirmation items were 1) I can manage my health well on my own, and 2) I can improve the condition of my health by using health apps. The analysis for these two items revealed a single factor structure, in which 63.3 percent of the variance was explained. Both items indicated a factor loading of .80 and a Cronbach alpha of .70 for the factor.

Further, participants had to respond to the following questions about their length in time of health apps usage: The items were adapted from Middleweerd et al. (2015). The items were "How long have you used health apps"? a) never, b) under one year, c) 1-2 years, d) 2-3 years, and e) 3 or more. Participants also responded on whether they use health apps and if so how many hours per week they do so. "Do you use health apps such as Endomondo, Fitbit, MyFitnessPal, MapMyFitness, Digifit iCardio, Charity Miles, Cyclemeter, RockMyRun, Strava, and Spotify on electronic devices such as iPhone, iPad and Android"? a) yes, or b) no. "How many hours per week do you spend using health apps"? a) less than 1hour, b) 1-2 hours, c) 3-4 hours, d) 4-5 hours, e) 5-6 hours, and f) 7 and above. Lastly, participants were asked to list the top three health apps that they use for physical activity.

Willingness to use free and paid health apps (Level of expenditure for health apps) were adapted from Breton (2011). The items were measured on a 7-point Likert scale ranging from strongly disagree to strongly agree. The eight items were preceded by the statement, "I am willing to use health apps that cost" a) $0, b) 1c - 99c, c) $1 - $1.99, d) $1.99 - $2.99, e) $2.99 - $3.99, f) $3.99 - $4.99, g) $4.99 - $5.99, and h) More than $6

Demographic characteristics were evaluated from participants' self-reported information on age, gender, race/ethnicity, year in college, and perceived weight (Kulavic et al., 2013; Wardle et al., 2006). General health quality was self-assessed by asking "In general, would you say your health is a) excellent, b) very good, c) good, d) fair, and e) poor (Hinami et al., 2015).

Chapter 4 - Results

Questionnaire data were analyzed using Pearson's Product Moment correlation (r) and Pearson's chi-square test (χ^2). Alpha was set at .05 for all statistical analyses. Three criteria were used to judge the stability of a correlation coefficient: its significance level, the coefficient of determination, and the values of a bootstrapped confidence interval on the correlation coefficient. The significance level, or alpha, was set at .05, meaning that a 5 percent chance exists of rejecting the null hypothesis when it is actually true.

The above risk, however, assumes that the sampling distribution is normally distributed. Typically, no one knows whether this is true. So, confidence intervals, using a bootstrapping approach, were employed. Bootstrapping gets around the problem of normality by estimating the properties of the sampling distribution from sample data. The bootstrap 95 percent confidence interval provides the range of values within which the true magnitude of the correlation falls. If the lower-bound crosses zero, it may indicate that there is no correlation, meaning that the test could be positive, negative or zero. So, it is possible that a correlation coefficient can be significant at .05 yet the bootstrapped confidence interval crosses zero. In this case, we will assume that not enough evidence exists to draw a conclusion that a positive (or negative) correlation exists in the population.

The coefficient of determination is the square of the correlation coefficient and it expresses the percentage of variance shared in common between the two variables. If the correlation between two variables is zero, then the coefficient of determination will also be zero, meaning that the two variables share nothing in common.

In the sample, individuals' who used health apps (52. 3 percent) was slightly more than those who did not use health apps (47.7 percent).

Bivariate Correlations

H_1 – Higher levels of confirmation of health app usage will be positively correlated with perceived usefulness of health apps

The relationship between levels of confirmation of health app usage and perceived usefulness of health apps was examined using a bivariate correlation. A correlation of .538 was found with a sample size of 120. The coefficient of determination (r^2) was = .29, meaning that 29 percent of the variance in confirmation of health app usage is shared by perceived usefulness of health apps. Additionally, the 95 percent confidence interval was .397 to .672. A one-tailed significance test revealed that the correlation was significant ($p < .001$). If p is less than .001, the significant value tells us that the probability of getting a correlation coefficient of .538 in a sample of 120 if the null hypothesis were true is virtually zero. The finding supported the hypothesis.

H_2 - Perceived usefulness of health apps will be positively correlated with continuation intention for health apps usage

The relationship between perceived usefulness of health apps and continuation intention for health apps has revealed a correlation of .467 with a sample size of 120. The coefficient of determination (r^2) was .22, indicating 22 percent of the decision of continuation intention is explained by the perceived usefulness of the health apps and the 95 percent confidence interval was .282 to .639. A one-tailed significance test revealed that the correlation was significant ($p < .001$). The results supported the hypothesis.

H_3 – Males are less likely than females to use health apps for weight management purposes

A chi-square test of independence was performed to examine differences among males and females and their respective use of health apps for weight management purposes. The results showed that females were significantly more likely to use health apps when trying to lose weight than males, $\chi^2 = 14.24$, $df = 1$, $p < .001$, Ø = .251. The results supported the hypothesis.

H_4 – The correlation between attitudes towards health apps and intention to engage in physical activity will be more positively correlated for males than females

The bivariate correlation between male attitudes towards health apps and their intention to engage in physical activity was .18 ($n = 29$) while the correlation for female attitudes towards health apps and their intention to engage in physical activity was .102 ($n = 88$). The difference between two correlation coefficients was tested using the Fisher r-to-z transformation. The results indicated that differences between the two correlations failed to produce a z-score large enough to provide the confidence that differences are due to change ($p = .36$). The results did not support the hypothesis.

H_5 – The stronger an individual's beliefs strength toward engaging in physical activity, the more the individual will have positive attitudes toward engaging in physical activity

The bivariate correlation between beliefs strength and attitudes towards physical activity was .383 ($n = 235$) and the coefficient of determination was .15. A one-tailed significance test revealed that the correlation was significant ($p < .001$). Furthermore, the boundaries for the bootstrap 95 percent confidence interval was from .224 to .546. The hypothesis was supported.

RQ_{1a} - Will one's attitude towards physical activity be more positive for individuals who use health apps than for individuals who do not use health apps?

Bivariate relationship between attitudes towards physical activity and health app usage revealed an insignificant correlation of .074 with a sample size of 237. Very little variance is shared between the two variables ($r^2 = .005$). Furthermore, the boundaries for a bootstrap 95 percent confidence interval crossed zero [-.049, .212]. Given this analysis, no support was found for RQ_{1a}.

RQ_{1b} - Will one's intention to engage in regular physical activity be greater for individuals who use health apps than for individuals who do not use health apps?

The correlation between health app usage and intention to engage in regular physical activity was .115 with a sample size of 237. The coefficient of determination (r^2) was = .01. A one-tailed significance test revealed that the correlation was significant ($p = .04$). Furthermore, the boundaries for a bootstrap 95 percent confidence interval crossed zero [-.237, .018]. The evidence does not support any correlation between health app usage and the intent to engage in regular physical activity.

RQ_{2a} – Does the amount of experience in using health apps positively correlate with attitudes towards regular physical activity?

The bivariate correlation between the amount of experience in using health apps and attitudes towards physical activity revealed a correlation of .216 with a sample size of 124. The coefficient of determination (r^2) was small at .04, but the boundaries for a bootstrap 95 percent confidence interval do not cross zero [.031, .390], indicating a positive correlation. A one-tailed significance test revealed that the correlation was significant ($p = .008$). The evidence supported a positive correlation between the amount of experience using health apps and having a positive attitude towards regular physical activity.

RQ_{2b} - Does the amount of experience in using health apps positively correlate with the strength of one’s beliefs towards engaging in regular physical activity?

Examining the correlation between belief strength for physical activity and the length of time using health apps, indicated a relationship of $r = .244$ with a sample size of 124. The coefficient of determination (r^2) was small at .05, and the boundaries for a bootstrap 95 percent confidence interval crosses zero [-.007, .467]. A one-tailed significant test revealed that the correlation between the two variables was significant ($p = .003$). However, the sample size and or the magnitude of the correlation are not sufficiently large to produce a more stable result. Consequently, the data do not support a relationship between health app usage and the strength of one's belief in engaging in regular physical activity.

RQ$_{2c}$ - Does one's evaluation of health apps positively correlate with one's attitude toward regular physical activity?

The bivariate correlation between attitudes towards health apps and attitudes towards physical activity revealed a correlation of .528 with a sample size of 119. The coefficient of determination (r^2) was large at .27. The 95 percent confidence interval was .284 to .702. A one-tailed test revealed a significant correlation ($p < .001$). The evidence indicated that a correlation exists between one's evaluation of health apps and one's attitude toward regular physical activity.

RQ$_{2d}$ - Does price range of paid health apps positively correlate with one's attitude toward regular physical activity?

The correlation for the bivariate analysis between attitudes towards physical activity and the level of health app expenditure was .147 with a sample size of 121. The coefficient of determination (r^2) was small at .02 and the confidence interval was -.016 to .338, crossing zero. A one-tailed significance test revealed that the correlation was not significant ($p = .054$). If p is greater than .05, the correlation is not significant. Therefore, the study found no correlation between the cost of health apps and attitudes toward regular physical activity.

RQ_{3a} – Does the amount of one's experience in using health apps positively correlate with one's intention to regularly engage in physical activity?

Exploring the association of intention to engage in physical activity and the length of time using health apps, using a bivariate correlation showed a relationship of .225 with a sample size of 122. The coefficient of determination was small at .05 and the 95 percent confidence interval was .008 to .423. A one-tailed significant test revealed that the correlation was significant (p = .006). This finding indicated support for a correlation between the amount of experience using health apps and the intention to engage in regular physical activity.

RQ_{3b} - Does one's evaluation of health apps positively correlate with one's intention to regularly engage in physical activity?

The relationship between attitudes towards health apps and intention to engage in regular physical activity revealed a Pearson's correlation of .112 with a sample size of 117. The coefficient of determination was small at .01 and the 95 percent confidence interval was -.301 to .059 in which the interval crosses zero. A one-tailed significant test revealed that the correlation was not significant (p = .114). This finding indicated no correlation between one's evaluation of health apps and one's intention to engage in regular physical activity.

RQ_{3c} - Does the price range of paid health apps positively correlate with one's intention to regularly engage in physical activity?

A bivariate correlation revealed the relationship between level of health app expenditure and the intention to engage in regular physical activity as .003 with a sample size of 120. Very little variance was shared between the two variables ($r^2 < .001$) and the 95 percent confidence interval was -.180 to .156, which crosses zero. This finding indicated the cost of health apps does not correlate with one's intention to engage in regular physical activity.

Chapter 5 - Discussion and Conclusion

This study explored how college students' aged 18 -35 years health behavior was influenced by health apps. Results for this study indicate that a few more individuals use health apps (52.3 percent) than those who do not (47.7 percent). Based on H_1 (Higher levels of confirmation of health app usage will be positively correlated with perceived usefulness of health apps) and H_2 (Perceived usefulness of health apps will be positively correlated with continuation intention for health apps), individuals who perceived health apps to be useful confirmed the use of health apps, meaning that that they are satisfied with the product so they intend to continue using health apps. This finding correlates with studies which indicate that individuals' reasoned action is considerably dependent on one's perception of a given technology. The Technology Acceptance Model (TAM) states that one's intention to adopt a new technology is determined by two perceptual factors—perceived usefulness and perceived ease of use (Kim & Park, 2012). In light of one's perceived usefulness and perceived ease of technology adoption, individuals who have more experience with health apps are expected to confirm the use of health apps according to the Expectation Confirmation Theory (ECT).

Given the significance of H_1 and H_2, individuals think that the health app saves efforts in completing a given task. Hence, the perceived usefulness of the health app increases and this study's findings confirm previous work (Cho, 2016). The conclusion can be drawn then if individuals find a health app helpful and are satisfied with their progress, they will be more likely continue using the health app, resulting in an increase of continuation intention. Hence, considering the potential advantages of using health apps in terms of mobile-health perspectives, the discontinuation of health app use could serve as lost opportunities in effectively managing one's personal health, a finding confirming previous studies (Middleweerd et al., 2015). Mobile health refers to mobile computing, medical sensor and communications technologies that can enhance chronic disease care beyond the traditional outpatient physician–patient encounter.

In view of H_1 and H_2, the findings from RQ_{2a} (Does the amount of experience in using health apps positively correlate with the strength of one's beliefs towards engaging in regular physical activity?) demonstrate a connection to individuals' experience with health app usage and their positive attitudes towards engaging in physical activity. So, although health app research is in its infancy, the results in this study indicate that the majority of the participants have been using the apps for an extended period of time and their attitudes are rather positive towards engaging in physical activity (RQ2a) ($p = .008$). Therefore, health apps are promising tools for achieving long-term behavior change outcomes. Giving young adults the platform to get feedback in real time may also be a reason that they continue using the health apps. Future research could also be helpful by having more in-depth investigations about health apps usage and their link to physical activity. Researching whether health apps are actually achieving the outcomes expected and whether individuals are using them for that very reason are potential areas of inquiry.

Those individuals who do not use health apps should be encouraged to do so in light of the advantages associated with using health apps. In addition, developers or marketers could look into why some people are disinterested, or why they may not trust the apps. This information is also helpful for scientists, who can investigate why some individuals distrust health apps. Evidence indicates that individuals download health apps but do not use them (Craver, 2015). These individuals may have issues with the app acquiring information that they think should remain private. Individuals may also believe there is some ulterior motive behind gathering information, such as increased or hidden costs, if one uses the paid version. At the same time, health communication strategists can use this information to help individuals understand the benefits associated with utilizing these apps.

The findings for H_5 (The stronger an individual's beliefs strength towards physical activity the more positive their attitudes towards engaging in physical activity) showed that individuals have positive attitudes towards engaging in physical activity. Their belief strengths about physical activity, including their heart being healthier, muscles being stronger and decreased chances for stroke, diabetes, high blood pressure, and other communicable diseases, are positively correlated with a *p*-value less than .001. Previous studies indicate that young adults engage in physical activity for extrinsic motivational purposes (Bassuk & Manson, 2005; Kilpatrick et al., 2005; Wannamathee & Shaper, 2001), but this study challenges that finding. The reason why young adults in this study might have a different view than that found in previous studies may be that today's young adults realize how their current decisions might have an impact on their future health status. They also might engage in physical activity as a way of being satisfied with accomplishing a goal, such as engaging in the behavior for fun and enjoyment.

In view of the results from H3 (Males are less likely than females to use health apps for weight management purposes), females in particular, are more likely to engage in physical activity to lose weight, whereas males are more interested in muscle building, social recognition, competition, strength building, and endurance. This finding supports previous studies (Furia et al., 2009; Kilpatrick et al., 2005; Pauline, 2013; Ullrich-French et al., 2011). Therefore, it is not surprising that females use health apps for weight management purposes more than males (p-value less than .001).

When this study is contrasted to previous studies that show young adults are actually engaging in physical activity for intrinsic motivational factors (Armitage, 2005; Blanchard et al., 2008; Kwan & Bryan, 2010; Rhodes et al., 2003), one may infer that young adults' attitudes are firmly linked to their intention to engage in physical activity. So, future intervention methods could be guided by theoretical frameworks which focus on attitudes and include health apps for effective health outcomes.

Even though individuals showed positive attitudes towards health apps and positive attitudes towards physical activity in this study, H_4 (The correlation between attitudes towards health apps and intention to engage in physical activity will be more positively correlated for males than females) results indicated that their attitudes towards using the health apps were not very strongly related to their intention to engaging in physical activity. As previous studies have indicated (Azjen, 1991) that in having a positive attitude towards a given behavior, one is more likely to engage in that behavior. This study demonstrated the opposite and the reason for that might be that the sample size had an impact on the probability finding (n = 29) for males and (n = 88) for females. So, the probability that males could have positive attitudes towards health apps might have an increased probability to them having an intention to using the health apps for physical activity. The latter inference is based on the literature that males mostly engage in physical activity for strength building and endurance (Furia et al., 2009). So, maybe if young males think that health apps might not provide them with the possibilities to achieve these outcomes, they may not have an increased positive attitude towards health apps. Given the findings from H_3 (Males are less likely than females to use health apps for weight management purposes), one could then infer that, since males are less likely to use health apps for losing weight, this (not using health apps for losing weight) might then have an impact on why their attitudes towards health apps are not very strongly related to their intention for using health apps for physical activity (r = .18) males, (r = .102) for females. Future studies may have a different outcome with a larger sample given the same variables, since previous research shows that attitudes are linked to intention (Ajzen & Fisbein, 1980).

RQ_{2c} (Does one's evaluation of health apps positively correlate with one's attitude toward regular physical activity?) demonstrates that participants' acceptance of health apps are high, so they communicated positive attitudes towards health app usage as well as positive attitudes towards physical activity. The results demonstrated that with an increase positive attitude towards physical activity, positive attitudes towards health apps also increased. Consistent with the Middleweerd et al., (2015) study, participants who had higher physical activity levels had a positive attitude towards health apps. The current study indicated that individuals who have positive attitudes towards physical activity are more likely to have positive attitudes towards health apps ($p < .001$).

That being said, findings to RQ_{1a} (Will one's attitude towards physical activity be more positive for individuals who use health apps than for individuals who do not use health apps?) and RQ_{1b} (Will one's intention to engage in regular physical activity be greater for individuals who use health apps than for individuals who do not use health apps?) and the link to RQ_{3c} (Does the price range of paid health apps positively correlate with one's intention to regularly engage in physical activity?) indicated that health apps do not have a relationship to individuals engaging in physical activity because the shared variance was too small for RQ_{1a} (r^2 = .005) and RQ_{1b} (r^2 =. 01). RQ_{1b} shows no evidence to the effect that health apps trigger intent to engage in physical activity. Further, the magnitude of the correlation may have not be sufficiently large to produce a more stable result. In addition, individuals may not be interested because of concerns that hidden costs could be associated with using health apps. Individuals may also think that health apps are not relevant to them and some may be find entering data time consuming. So, the results for RQ_{3c} indicated that intention to engage in physical activity is not dependent on how much individuals are prepared to spend on health apps. Other research shows that some individuals download health apps, but do not always use them (Craver, 2015). While some individuals indicated their willingness to pay for health apps, this finding is instrumental for healthcare practitioners to recommend these apps to individuals. Therefore, having individuals use the paid version, which may provide in-depth analysis could assist practitioners with diagnosing processes.

Simultaneously, this study shows that more than half of the individuals responding use the health apps (52.3 percent). Using health apps might also be an indication of approval for social status among young adults. Being part of an in-group is significant for young individuals, because it provides them with a sense of belonging, similar to what Gruber (2008) found. Hence, future research can use this study as a guide to focus on why individuals may download health apps and not use them for their intended purposes. These studies may then provide insight into strategies to get young adults to use health apps for their intended purpose, like giving feedback on the progress individuals are making toward their health goals and objectives.

Investigating the status concept could also provide an understanding of the usage of health apps and their integration with respect to peers. In addition, health communication specialists can emphasize the importance of understanding the usefulness of health apps, and with scientific evidence of apps providing effective results, could help medical practitioners get a better understanding of a patient’s health progress.

RQ_{2b} (Does the amount of experience in using health apps positively correlate with the strength of one's beliefs towards engaging in regular physical activity?) indicated that the data did not support a relationship between health app usage and the strength of one's belief in engaging in regular physical activity, and RQ3c (Does the price range of paid health apps positively correlate with one's intention to regularly engage in physical activity?) also showed no significant correlations between the cost of health apps and one's intention to engage in physical activity. However, H_5 (The stronger an individual's beliefs strength towards physical activity the more positive their attitudes towards engaging in physical activity) indicated that the larger the strength of one's belief, the greater the likelihood for one to engage in physical activity. So, with health apps not triggering one's physical activity intentions, the conclusion can be drawn that belief strength plays an important role with regards to attitudes towards physical activity. Having beliefs strengths will then override the amount of experience using health apps, since health apps usage do not form the basis for intention.

The lack of support found for RQ_{2b} may also be due to the magnitude of the correlation not being large enough to produce a more stable result, although a significant correlation was demonstrated between the variables (p = .003). However, the bootstrap 95 percent confidence interval crossed zero, hence the uncertainty of the correlation between the two variables [-.007, .467].

Although individuals demonstrate positive attitudes towards health apps and positive attitudes towards regular physical activity (RQ2c), their willingness to pay for the health apps does not correlate with their attitudes towards physical activity (RQ2d). This study indicates that individuals are primarily using Fitbit and MyFitnessPal, and most preferred the free version of these health apps. The findings of the current study are both in line and at odds with previous research. Although Fitbit and MyFitnessPal apps are free, one could purchase a premium membership to get a deeper analysis of one's data. This study found that some individuals are willing to pay for the product to enhance their ability to track their physical activity progress, a finding which supports previous research (Kurti & Dallery, 2013; Washington, 2014). At the same time, over 40 percent of the individuals in the current study prefer to use the free versions while 11 percent are willing to purchase the paid apps, if they are satisfied and get value for their money. These individuals are worth studying further, because they are the audience marketers want to target. Reasons why students may prefer the free apps could be budget constraints, since students could be dependent on their parents' financial support or they may have to work to pay their bills.

Further, if students perceive the free health app to provide the anticipated outcomes, they may not be willing to consider the in-depth feedback from the paid version. Health communication intervention strategies and health practitioners could use this information as a platform to educate individuals about the advantages of the in-depth analysis. Health practitioners may also be able to get a better understanding of health challenges in terms of the diagnosis process, and more importantly, gain an understanding of the patient's experience with the app. By so doing, the interpersonal relationship of client-health practitioner may improve, because studies indicate that communication with a medical professional affects the way patients perceive their health care (Arora, 2003; Ackerson & Viswanath, 2009).

Evidence indicates that if users perceive free apps as having comparable levels of functionality, they normally choose the free version, thus the availability of free alternatives negatively affects the intention to purchase (Hsu & Lin, 2015). Additionally, app ratings have also been confirmed to have a significant impact on purchase intention. Hence, marketers should devise strategies to encourage users of paid apps to provide positive ratings and reviews (Hsu & Lin, 2015). One way of achieving the latter is to highlight the pleasure, enjoyment, fun, and entertainment effects of the apps to increase user satisfaction, thus increasing a desire to purchase the apps. Therefore, a possible explanation for the results in this study could be that individuals are satisfied with the results obtained from free apps and do not find it necessary to purchase an app. Such information could be useful to future app developers, working cooperatively in the mobile health domain as well as with physicians and other practitioners who seek low-cost interventions to increase their patients' physical activity (Yang et al., 2015).

The results of this study further indicate that using health apps for an extended period of time increases one's intention to engage in regular physical activity (p = .006) (RQ_{3a}). This result can be useful to health communication specialists as well as health practitioners. The longer an individual is exposed to the health app, the more likely he/she will have an intention to use it. Although this study shows that health apps do not correlate with intention for physical activity, the length of time using health apps could have a different outcome. This observation warrants future study. Individuals may become accustomed to the idea that health apps could be useful and beneficial to their overall health but they may need encouraged to use the app. Hence, health practitioners and health communications specialists could educate individuals about the advantages of using health apps. In addition, health campaigns could focus on the benefits for families and peers and how communication among one another could be helpful for inspirational purposes. Since these apps have the ability to get feedback and communicate with other individuals, users could take advantage of these features for purposes of enhancing and overall health. Physicians could also use this information to emphasize the benefits associated with health app usage. Overall, scientists could investigate the effectiveness of the apps by having trials with individuals affected by chronic diseases.

While RQ_{3a} (Does the amount of one's experience in using health apps positively correlate with one's intention to regularly engage in physical activity?) demonstrated significant results, individuals' attitudes towards health apps showed no correlation with individuals' intention to engage in physical activity (RQ_{3b}). The significant finding of RQ_{3a} is confirmed by the ECT, whereby the longer an individual is exposed to a certain product, the more likely he/she will have an intention to use that product, indicating their satisfaction with the product according to Bhattacherjee (2001). In addition, satisfaction indicates that individuals have positive attitudes towards the app, hence their attitudes will be linked to their intention to use the health app, which also corresponds to previous research (Ajzen, 1991).

The results of this study already indicated that health apps do not warrant engagement in regular physical activity. However, findings in this study support other studies (Ajzen, 1991) that having a favorable attitude towards a particular behavior increases the likelihood for engaging in that behavior. So, while individuals had favorable attitudes towards health apps, they may have little understanding of how health apps actually work. Researchers can use this information to investigate this phenomenon. Evidence in other studies (Craver, 2015) shows that some individuals download apps, but they do not use them. Future research could be conducted to help determined why this is the case. Then, the information can be used for health communication purposes by educating individuals about the relevance attached to health apps. It will be of significance to communicate the relevance of health apps to health organizations such as the Centers for the Disease Control and Prevention, World Health Organization and the National Institutes of Health. Future studies may find different results with a larger sample size using the same variables, since this study indicates just a small variance between the two variables ($r^2 < .001$).

Overall, this study provides valuable information with regard to attitudes towards health apps and intention to use health apps for physical activity. This study demonstrates when individuals believe in what physical activity can do for them, they are very likely to want to engage in regular physical activity with or without health app support. While in and of themselves, health apps do not necessarily trigger the intention to exercise, this study shows that free alternatives affect the intention to purchase, hence developers and marketers must strategize around free competition as well as encourage users to provide positive ratings and reviews. Having individuals use apps that can provide in-depth feedback could be helpful to medical providers and health communication specialists. This information can be valuable for future health campaigns.

In summary, this study provides an understanding of the factors contributing to perceived usefulness and confirmation of health app usage through the Technology Acceptance Model and the Expectation-Confirmation Theory. At the same time, the Theory of Reasoned Action suggests that attitudes are linked to intention, which also gives insight as to what future approaches could be taken to enhance individuals' health outcomes. First, college-aged students regard their peers very highly. Therefore, it will be of significance for future interventions to focus on intrinsic motivational factors from using health apps such as enjoyment, fun, curiosity, and flow experience. Consequently, if peers observe one another, they might be curious and could be motivated to engage in the same behavior.

The findings from the current study accentuated why individuals may not commit to paid apps. As mentioned earlier, individuals have free and paid options and are likely to opt for the free trial before purchasing a health app. In addition, providers monetize their apps through advertising, in-app purchases, subscriptions, and functionality or content upgrades. As a result, in-app purchases may be improved by enhancing value through maximizing efficiency, effectiveness, and enjoyment while minimizing purchase price.

Since individuals opt for free rather than paid apps, free competition should be taken seriously. App providers should utilize the information retrieved from databases to offer a better free product, which in turn could attract more users to download the product and eventually increase customer intention to purchase a better version of the app.

Although this study indicated that most individuals have used health apps for an extended period of time, evidence indicates that health app usage is in its infancy, hence long-term studies will be needed in the future. Less evidence is available for longer-term usage, which is supposed to enhance maintenance of any changes in behavior that may be achieved when using the app according to a previous study (Dute et al., 2016). This information is valuable for future researchers and health campaign developers.

Given that health campaign managers can develop programs to enhance attitudes towards certain products as well as behaviors, the results of this study with regards to attitudes, health apps, and intention serve as a guide to implement programs that can enhance the use of the technology to enhance health. Again, approaching the initiation of health app usage for health promotion from a social perspective could prove helpful. That being said, it will be of significance to consider privacy issues and cultural values associated with using these apps. Individuals may not be keen to have their personal information accessible and may need assurance that their information will be secure and remain private. Other questions for future study may include “What values may be attached to using these apps? Do individuals wear tracking devices, such as Fitbit, as a social statement, or for their intended purpose? Will individuals eventually realize that these technological developments are ways of empowering themselves and taking charge of their health? Health practitioners and health communication specialists should use the information in this study, as well as the answers to those questions for future study, to educate individuals about the relevance of health apps in their lives.

Limitations and Other Suggestions for Future Study

One limitation of this study is that it involved only a small sample size of university students. Another is that the questionnaire participants were sampled when most students were on break. Perhaps more participants could have been reached, if the study were done during the regular academic year. Moreover, the Mid-Western University has a small ethnic population, hence the majority of the population for this study was Caucasian. Therefore, the findings cannot be generalized, and certainly not beyond the Mid-Western University. For generalizability to be increased, future research should examine these variables among more universities within the United States having a more equal distribution with regard to ethnic groups and their usage of health apps. In addition, a larger sample size from more universities could lead to refined results. But all in all, given the significant findings from the current study, future health interventions could benefit from using these results.

Another limitation is that this study focused only on self-reported information from participants, so there may be a bias associated with that reporting. Individuals use health apps for physical activity, but the question remains “Are the apps providing the outcomes that these individuals are seeking?” Hence, follow-up studies could focus on participants’ progress by evaluating the effectiveness of health apps’ usage over time.

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Appendix A - Questionnaire

Title: **INVESTIGATING HOW HEALTH APPS INFLUENCE COLLEGE STUDENTS' HEALTH BEHAVIOR**

Informed Consent Information

Thank you for supporting the current research by completing this questionnaire. We understand that your time is valuable, so we appreciate your participation. The current investigation seeks to understand college students' motivation for physical activity. This questionnaire will take about 10 minutes or less of your time. Participation in this research is anonymous and is not compulsory. You may quit this study at any time. Clicking the "I Accept" button will indicate you have read and understand this consent form and are willing to participate in the study under the terms described.

1. **In general, would you say your health is:**
   a) Excellent
   b) Very good
   c) Good
   d) Fair
   e) Poor

2. **On a scale from 1 to 7 with (1) being strongly disagree and (7) strongly agree, please respond to the following statements:**

	Strongly Disagree 1	2	3	4	5	6	Strongly Agree 7
a) I do physical activity at least three days each week for about an hour	1	2	3	4	5	6	7
b) I want to do physical activity at least three days each week for an hour	1	2	3	4	4	6	7
c) I intend to do physical activity for at least three days each week for an hour	1	2	3	4	5	6	7
d) I engage in physical activity to have a healthy body	1	2	3	4	5	6	7
e) I engage in physical activity to build up my strength	1	2	3	4	5	6	7
f) I engage in physical activity because I want to maintain good health	1	2	3	4	5	6	7
g) I engage in physical activity to increase my endurance	1	2	3	4	5	6	7
h) I engage in physical activity to feel healthier	1	2	3	4	5	6	7
i) I engage in physical activity to get stronger	1	2	3	4	5	6	7
j) I engage in physical activity to develop my muscles	1	2	3	4	5	6	7

3. **For me, over the next two weeks engaging in physical activity regularly is**

Beneficial	1	2	3	4	5	6	7	Harmful
Good	1	2	3	4	5	6	7	Bad
Pleasant	1	2	3	4	5	6	7	Unpleasant
Useful	1	2	3	4	5	6	7	Worthless

4. **Do you use health apps such as Endomondo, Fitbit, MyFitnessPal, MapMyFitness, Digifit iCardio, Charity Miles, Cyclemeter, RockMyRun, Strava, and Spotify on electronic devices such as iPhone, iPad and Android?**
   a) Yes
   b) No

If No is selected, then skip to 11. With which gender do you identify?

5. **How long have you used health apps?**
   a) Never
   b) Under one year
   c) 1-2 years
   d) 2-3 years
   e) 3 or more

6. **How many hours per week do you spend using health apps?**
   a) Less than 1 hour
   b) 1-2 hours
   c) 3-4 hours
   d) 4-5 hours
   e) 5-6 hours
   f) 7 and above

7. **Please list the top three health apps that you use for physical activity**

   First Choice ____

   Second Choice ____

   Third Choice ____

8. On a scale from 1 to 7 with (1) being strongly disagree and (7) strongly agree, please respond to the following statements: I am willing to use health apps that cost

	Strongly Disagree 1	2	3	4	5	6	Strongly Agree 7
a) $0	1	2	3	4	5	6	7
b) 1c - 99c	1	2	3	4	5	6	7
c) $1 - $1.99	1	2	3	4	5	6	7
d) $2 - $2.99	1	2	3	4	5	6	7
e) $3 - $3.99	1	2	3	4	5	6	7
f) $4 - $4.99	1	2	3	4	5	6	7
g) $5 - $5.99	1	2	3	4	5	6	7
h) $6 and more	1	2	3	4	5	6	7

9. Please indicate your agreement level to the following statements on a scale ranging from (1) strongly disagree to (7) strongly agree

	Strongly Disagree 1	2	3	4	5	6	Strongly Agree 7
a) I can manage my health well on my own	1	2	3	4	5	6	7
b) I can improve the condition of my health by using health apps	1	2	3	4	5	6	7
c) Health apps are useful for managing my health daily	1	2	3	4	5	6	7
d) Health apps are advantageous for managing my health better	1	2	3	4	5	6	7
e) I will keep using health apps	1	2	3	4	5	6	7
f) I do not plan to use health apps in the future	1	2	3	4	5	6	7
g) I use health apps to gain information about physical activity	1	2	3	4	5	6	7
h) If I have a question related to physical activity I can usually find the answers on health apps	1	2	3	4	5	6	7
i) I find purchasing health apps to be worthwhile	1	2	3	4	5	6	7
j) I will frequently purchase health apps in the future	1	2	3	4	5	6	7
k) I intend to keep purchasing health apps	1	2	3	4	5	6	7

10. For me, health apps are

Beneficial	1	2	3	4	5	6	7	Harmful
Good	1	2	3	4	5	6	7	Bad
Pleasant	1	2	3	4	5	6	7	Unpleasant
Useful	1	2	3	4	5	6	7	Worthless

11. With which gender do you identify?

a) Male
b) Female
c) Transgender

12. Please indicate your age:

a) 18-21 years
b) 22-25 years
c) 26-29 years
d) 30-33 years
e) 34-37 years
f) 38 years –above
g) Prefer not to answer

13. With which ethnicity do you identify?

a) Native Hawaiian/ Pacific Islander
b) Black / African American
c) White
d) Hispanic/Latino
e) Asian
f) American Indian /Alaska Native
g) Some other race
h) Prefer not to answer

14. Please indicate your year in college

a) Freshman
b) Sophomore
c) Junior
d) Senior
e) Graduate
f) Prefer not to answer

15. Do you perceive yourself to be

a) Very overweight
b) Slightly overweight
c) About the right weight (normal weight)
d) Slightly underweight
e) Very underweight
f) Prefer not to answer

16. Are you trying to lose weight?

a) Yes
b) No
c) Prefer not to answer

Thank you for your time. This information will be a useful guide for future health communication campaigns.