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**PROJECT PALMMS (PHYSICAL ACTIVITY LEVELS AND FAMILY MEDICAL HISTORIES): AN UNDERGRADUATE SAMPLE**

by

Pierre Alexander Leon, M.A.

A Thesis

Submitted to the  
Department of Psychology  
College of Science and Mathematics  
In partial fulfillment of the requirement  
For the degree of  
Master of Arts in Clinical Psychology  
at  
Rowan University  
November 7, 2018

Thesis Chair: Georita M. Frierson, Ph.D.

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## **Dedications**

I would like to dedicate this manuscript to my parents, Wilfredo Leon and Maribel Garcia – Leon, my brother, Wilfred Leon II, and my loving wife, Bushra Ali-Leon. I truly appreciate all of your support, love, advice, and care.

## **Acknowledgments**

I would like to express my sincerest appreciation to Dr. Georita M. Frierson for her unwavering support, inspiration, and guidance through this process. Her knowledge, patience, understanding, and leadership were instrumental in the completion of this project. I would also like to thank my committee members Dr. Dustin Fife and Dr. Jeffrey Greeson for all of your patience and dedication in ensuring the best possible product. Lastly, I would like to express my gratitude to my lab-mates, Alex Jaffe and Anthony Eldridge, who supported me all throughout this process.

## **Abstract**

Pierre A. Leon, M.A.

PROJECT PALMMS (PHYSICAL ACTIVITY LEVELS AND FAMILIMEDICAL  
HISTORIES): AN UNDERGRADUATE SAMPLE

2018-2019

Dr. Georita M. Frierson, Ph.D.

Master of Arts in Clinical Psychology

Background: Physical inactivity has garnered significant attention as it is considered an emerging worldwide young adult problem. There is empirical evidence on predictors of low levels of physical activity (PA), such as an individual's sex and/or socio-economic status. There are also other possible reasons for the decline in PA, such as an individual's motivations and/or barriers for participation in physical activity and an individual's understanding of their predisposition to chronic illnesses. This study seeks to identify perceptions of benefits/barriers to PA and motivating factors needed to increase physical activity in college populations. Methods: A survey gathering information on demographics, PA, family medical history (FMH), and perceived benefits and barriers to physical activity was given. Results: One major finding of this study is that an individual's perceived benefits of exercise impacted PA levels across all analyses. Similarly to benefits, an individual's perceived barriers to exercise also had an impact on PA levels across all analyses. Conclusions: In this particular college-aged sample, an individual's family medical history of cancer or diabetes did not increase PA levels, but it has been shown in other studies to increase preventive behavior involvement, such as PA. Conversely, whether an individual assessed that PA offers more benefits to them, PA levels increased. These findings have the ability to inform interventions by finding strategies to increase college aged individuals' motivation to engage in PA.

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## **Chapter 1**

### **Introduction**

Physical inactivity has garnered significant attention as it is considered an emerging worldwide youth problem (Arat & Wong, 2017). Physical activity (PA) is defined by the National Heart, Lung, and Blood Institute (NHLBI; 2016) as any body movement that requires a larger expenditure of energy than while at rest. Despite the strong support of the established health benefits of physical activity (i.e. chronic illness prevention, increased quality of life [QoL], etc.), physical inactivity is a significant problem (Pauline, 2013; Egli et al., 2011; Hawkins et al., 2009). Physical inactivity is a global health problem becoming one of the leading risk factors for non-communicable diseases (NCD), such as diabetes and cancer, and death worldwide (WHO, 2018; Saraf et al., 2012; Arat & Wong, 2017). To combat premature death and the development of non-communicable diseases, physical activity recommendations were created through the joint efforts of the U.S. Department of Health and Human Services (HHS) and the American College of Sports Medicine (ACSM)/American Heart Association (AHA; Office of Disease Prevention and Health Promotion [ODPHP], 2017; NHLBI, 2016; AHA, 2014). The minimum recommended amount of physical activity for chronic disease prevention and health benefit attainment is 30 minutes a day for 5 days a week for moderate- and moderate-vigorous intensity forms of PA, or 25 minutes a day for 3 days a week for vigorous intensity forms of PA (Moore, Fulton, Kruger, & McDivitt, 2010; ODPHP, 2017; NHLBI, 2016; AHA, 2014). A decline in physical activity is a major contributor to the development of chronic illnesses and is a large concern in the young adult population (Bryan & Katzmarzyk, 2011; Grim, Hertz, & Petosa, 2011).

One of the most rapid declines in physical activity takes place during the ages of 18 and 24, when many individuals are usually enrolled into a university (Grim et al., 2011). A study conducted on 23 countries' university students showed that 40% of the students are physically inactive compared to the United States' 43% (Clemente, Nikolaidis, Martins, & Mendes, 2016). Also, individuals transitioning to a university tend to report significant increases in weight, lower levels of physical activity, as well as poorer dietary choices compared to their high school years (Han et al., 2008; Wengreen & Moncur, 2009). Furthermore, the largest decline of physical activity has been found to occur during the summer when individuals transition from high school to college (Han et al., 2008). These studies demonstrate the sensitivity of this age group in regards to physical activity. Whereas transitions in an individual's life, such as starting college, have been shown to be reliable predictors of physical activity, they are not the only supported predictors and/or correlates of PA (Grim et al., 2011; Clemente et al., 2016; Han et al., 2008; Wengreen & Moncur, 2009; Willey, Paik, Sacco, Elkind, & Boden, 2010; Shores & Shiness, 2014).

### **Common Predictors and Correlates of Physical Inactivity**

In addition to the transition to college, there are many other known predictors and correlates to physical inactivity, such as, but not limited to, socio-economic status (individuals with a lower socio-economic status tends to have lower PA than their higher socio-economic counterparts; Shi, Zhang, van Meijgaard, Macleod, & Fielding, 2015), race/ethnicity (caucasian individuals tend to have higher PA than their minority counterparts; Willey et al., 2010; Shores & Shiness, 2014; Shi et al., 2015; Sohn, Porch, Hill, & Thorpe, 2017), living environments (individuals living in rural or urban

environments tend to have lower PA compared to their suburban counterparts; Willey et al., 2010; Shi et al., 2015; Peralta, Martins, Guedes, Sarmiento, & Marques, 2018; Sohn et al., 2017), and sex differences (Baskin et al., 2013; McCarthy, Davery, Wackers, & Chyun, 2014; Koyanagi, Stubbs, & Vancampfort, 2018; Wells, Nermo, & Ostberg, 2017; Linetzky, De Maio, Ferrante, Konfino, & Boissonnet, 2013; Kaur et al., 2015; Armstrong, 2013; Willey et al., 2010). When assessing PA levels, women tend to not meet the recommendations for physical activity and are generally characterized as less physically active than their male counterparts (Baskin et al., 2013; McCarthy et al., 2014; Koyanagi et al., 2018; Wells et al., 2017; Linetzky et al., 2013). A couple of reasons denoted by the literature in regards to the different levels of PA amongst males and females is the forms of activities engaged in (Baskin et al., 2013; Hagströmer et al., 2007) and their self-efficacy for PA (Koyanagi et al., 2018). In many studies, regardless of SES, ethnicity, and environment, sex was almost always a strong predictor of physical activity levels in adult populations (Willey et al., 2010; Shi et al., 2015; Baskin et al., 2013; Linetzky et al., 2013). The literature is rich in continuously providing empirical support for the aforementioned predictors of PA, but is scarce on cognitive predictors, such as one's motivations or barriers towards PA engagement.

### **Further Possible Reasons for the Decline in Physical Activity**

In conjunction with already known predictors and correlates of PA, there are other possible predictors and/or correlates that may assist in understanding the decline in physical activity. One of the first possible reasons that can explain the decline in physical activity is an individual's motivations and barriers for participating in physical activity (Pauline, 2013). Studies assessing the motivations and barriers of individuals in this

particular age group and its impact on physical activity levels are scarce. A potential second overlooked predictor of PA is an individual's understanding of their family's predisposition to chronic illnesses, as measured through family medical history (FMH). Although these predictors have been studied in older adult populations (Jones & Paxton, 2015; Ottenbacher et al., 2011; Withall, Jago, & Fox, 2011; Prichard, Lee, Hutchinson, & Wilson, 2015; Zlot, 2012; Wang et al., 2012), there is a paucity in college-aged students. Some known motivations for physical activity in college students tend to be physical appearance and enjoyment (DeLong, 2006), but what is not known is whether or not college students' motivations for physical activity is being strengthened by their family medical history or other forms of motivations for physical activity.

### **Importance of Addressing Physical Activity in the College Population**

The susceptibility of this age group in developing poor physical activity habits is critical to understand. This particular age group (young adulthood) is sensitive to the development of life-long behaviors (Pauline, 2013). Many beliefs and behaviors are established during their college years, therefore the possible development of life-long unhealthy habits, such as physical inactivity, can be prevented earlier in their lives (Pauline, 2013). In regards to physical activity and developing poor habits, an individual's beliefs about developing chronic illnesses heavily influence their engagement in preventive behaviors, such as physical activity.

### **Beliefs of Chronic Illness Development**

An individual's engagement in physical activity is motivated through their: (a) perceived control, (b) their perceived ability to engage in the behavior, and (c) the consequences of the behavior (Gellert et al., 2015). First, when assessing an individual's

perceived control of a behavior, one is assessing the individual's perceived ability to control the factors (i.e. paying the bill for his gym membership) either reinforcing or impeding their ability to engage in the behavior (Ajzen, 1991; Neighbors, Foster, & Fossos, 2013; Straatmann et al., 2017; Patterson, 2001; Ryan & Carr, 2010; Mimiaga, Reisner, Reilly, Soroudi, & Safren, 2009). Second, when assessing an individual's perceived ability to engage in a behavior, an individual takes into account their perceived ability to actually carry out the behavior (Ajzen, 1991; Neighbors et al., 2013; Straatmann et al., 2017; Patterson, 2001; Ryan & Carr, 2010; Mimiaga et al., 2009). For example, a college student perceiving their ability to engage in physical activity may be hindered due to time constraints, such as class, studying, homework, and work. Lastly, an individual's motivation to engage in a behavior relies on the individual's perceived consequences, whether it is perceived to be negative (i.e sore muscles or potential injury) or positive (i.e. weight loss) (Ajzen, 1991; Neighbors et al., 2013; Straatmann et al., 2017; Patterson, 2001; Ryan & Carr, 2010; Mimiaga et al., 2009). An individual's perception of the consequences of their behavior can manifest new beliefs or alter previous beliefs an individual has about the possible benefits, or drawbacks, of the behavior.

In regards to physical activity, an individual's beliefs about developing chronic illnesses may also influence their engagement in physical activity. A common belief of chronic illness is that it will develop regardless of an individual's behaviors, such as physical activity or diet, but rather due to chance (Prichard et al., 2015; Lykins et al., 2008). Both personal and vicarious experiences of chronic illness can influence causal beliefs of chronic illness, which can potentially be positively changed through an understanding of their family medical history (Lykins et al., 2008). For example,



individuals who believed that a chronic illness from their FMH was developed through inheritance reported low PA levels, but individuals who believed that developing a chronic illness was due to lifestyle and behavioral factors within their control reported higher levels of PA (Wang & Coups, 2010). An awareness of one's risk of developing a chronic illness from their FMH has the potential ability to motivate the individual to engage in preventive measures (Prichard et al., 2015; Zlot, 2012; Wang et al., 2012) provided they believe the illness was caused by controllable factors. The engagement of these behaviors through their beliefs can be readily explained through the framework of the Theory of Planned Behavior.

### **Prediction of Physical Activity through the Theory of Planned Behavior (TPB)**

The Theory of Planned Behavior (TPB) has the ability to examine the key beliefs of health behavior, specifically in populations who undergo major transitions, such as entering college (French & Cooke, 2012; Cowie & Hamilton, 2014). TPB is a social cognitive theory that depicts the psychological processes that are involved in behavioral change (Ajzen, 1991; Straatmann et al., 2017). When assessing behavioral change, TPB is widely accepted and is used as a global framework for behavioral change due to its holistic approach (Gellert et al., 2015; Straatmann et al., 2017; Ajzen, 1991). TPB explains behavioral change as a process with 3 constructs: (a) the individual's attitude towards the behavior being made, (b) subjective norms, (i.e societal norms), & (c) an individual's perceived control over their ability to engage in the behavior (Ajzen, 1991; Neighbors et al., 2013; Straatmann et al., 2017; Patterson, 2001; Ryan & Carr, 2010; Mimiaga et al., 2009).

TPB posits that intention is the proximal predictor of behaviors, along with attitude, subjective norms, and perceived behavioral control (Cowie, White, & Hamilton, 2018). Furthermore, these three constructs consist of behavioral beliefs, normative beliefs, and control beliefs, respectively (Cowie et al., 2018). We have incorporated measures that assess the three main constructs (attitude, subjective norms, and perceived control) of TPB, but due to the lack of measures assessing intention in the current study, which is the mediating construct of TPB, TPB will not be assessed fully. TPB will be used as a framework for understanding current PA behavior. TPB explains that an individual's perceived benefits and/or barriers, or social-cognitive beliefs, of being physically active influences their health behavior, in part, through perceived control.

#### **TPB, Benefits & Barriers, and Physical Activity**

Physical activity engagement is motivated through an individual's perceived control over their behaviors, as well as by the consequences of the behavior (Ajzen, 1991; Neighbors et al., 2013; Straatmann et al., 2017; Patterson, 2001; Ryan & Carr, 2010; Mimiaga et al., 2009). An individual's perceived loss of control in their ability to prevent the development of an illness through physical activity may lead the individual to negatively appraise the benefits of physical activity, resulting in the lack of engagement of physical activity. Perceived barriers, such as the aforementioned perceived loss of control, has an indirect influence, mediated by an individual's perceived behavioral control, on an individual's behavioral engagement (Gellert et al., 2015). An individual's perceived benefits and barriers predict behavioral change, due to its influence over an individual's intention to engage in a behavioral change (Lovell, Ansari, & Parker, 2010; Gellert et al., 2015; McArthur, Dumas, Woodend, Beach, & Stacey, 2014). An

individual's perceived barriers, specifically, has been shown to be strongly related to an individual's intention and engagement of PA (Lovell et al., 2010; Armitage & Conner, 2001; Lynch, Owren, Hawkes, & Aitken, 2010). An understanding of an individual's perceived benefits & barriers to physical activity can explain individual differences in activity levels amongst this population (Gellert et al., 2015).

### **Perceptions Influencing Physical Activity**

**Perceived barriers to physical activity.** An individual's perception of their barriers and/or benefits to physical activity rely heavily on both physical and psychological variables, as mentioned prior in the TPB framework (Gellert et al., 2015). An individual's perceived barriers is a multifaceted issue due to barriers being present on social, environmental, and individual levels (Cho & Park, 2017). An individual's perceived barriers to physical activity can manifest itself as physical or mental obstacles, inconveniences, or expenses that hinder an individual's motivation to engage in physical activity (Victor, Ximenes, & Almeida, 2012). Furthermore, an increased use of technology (i.e video games, television, etc.), increased hours spent at work and/or in the classroom, increased pressures to excel academically, declines in availability to participate in sports (i.e. individuals participated in sports in high school tend to not participate in any type of sport in college), and increases in mental illness prevalence are all reported barriers to PA and affect the way and amount individuals engage in physical activity (Ng & Popkin, 2012; Zschucke, Gaudlitz, & Ströhle, 2013; Pauline, 2013). Individuals have also reported that lack of support, limited accessibility to facilities, lack of interest, and a lack of overall knowledge on physical activity recommendations create barriers that influence their physical activity decisions (Jones & Paxton, 2015;

Ottenbacher et al., 2011; Withall et al., 2011). The literature is rich with information on the potential barriers to physical activity, but is scarce in the literature that assesses the impact these barriers have on the college population.

**Perceived benefits to physical activity.** Similarly to the perceived barriers, perceived benefits of physical activity is a multifaceted concept. The benefits of physical activity can be perceived on social, environmental, and individual levels, as well. Some reported examples of perceived benefits of physical activity are, but not limited to, an increase in quality of life, adoption and adherence to a healthier lifestyle, ability to prevent chronic illnesses, social interaction, and an increase in self-confidence (Committee PAGA, 2008; Mokdad et al., 2004). Individuals who overall have a better perception of the benefits that come with physical activity are more likely to have higher physical activity levels. One method of potentially increasing the perceived benefits of physical activity is through a family medical history tool.

### **Family Medical History**

A family medical history record is a tool that can be used as a preventive measure against chronic illnesses, such as cancer and diabetes, as well as potentially influence an increase in physical activity (Lykins et al., 2008; Prichard et al., 2015; Zlot, 2012; Wang et al., 2012). A family medical history is a concise record of an individual's health information along with the health information of close relatives (Genetic Home Reference [GHR], 2017). It can be used to identify an individual's predisposition to a chronic illness and potentially prevent its development (GHR, 2017). Through this identification, it is possible for the individual to understand their susceptibilities and level of risk of developing a chronic illness (Yoon et al., 2002; Morales, Cowan, Dagua, &

Hershberger, 2008). Family history has the ability to not only identify, but physically represent on paper an individual's probability of developing an illness and provides a strong argument for its usefulness as a preventive tool.

Even though the knowledge of using a family medical history record is supported empirically, it is still being underutilized in health promotion and in the risk assessment of individuals who are at a high risk for disease (Lykins et al., 2008; Ruffin et al., 2011). A lack of knowledge of an individual's risk of developing a chronic illness can strongly impact the way individuals address or do not address the risk of chronic illness (Lykins et al., 2008). Individuals who believe that developing a chronic illness is due to chance may incorrectly believe so due to their lack of awareness of their FMH. As mentioned prior, a family medical history tool has the ability to provide information on the individual's risk of developing chronic illnesses by taking into consideration not only medical information, but social and environmental information as well (Adámková, Bělohoubek, Adámek, Juhaňáková, & Pirk, 2015; Shuval et al. 2013).

A full family medical history record has the ability to capture the various components of disease, including shared cultures, behaviors, and social risks (Adámková et al., 2015); minimally, a family medical history will capture evidence of past and present family medical illnesses. Shuval et al. (2013), mentions that lifestyle behaviors play a large role in risk levels and the development and maintenance of unhealthy behaviors (i.e physical inactivity, poor diet, etc.). Many times these unhealthy behaviors are learned through social or familial constructs (Shuval et al., 2013). Individuals with an FMH of chronic illness are more vulnerable to those specific chronic illnesses, therefore the benefits of physical activity can impact them much more (Shuval et al., 2013).

Raising an awareness of individuals' predispositions to chronic illnesses is of the utmost importance in promoting health and healthy behavior.

### **FMH, PA, and Chronic Illness Development**

Utilizing tools that can help an individual become aware of the probabilities of developing a chronic illness, such as cancer or diabetes, and initiate behaviors that can prevent the development of these chronic illnesses is a major goal in many health service fields. It has been shown that individuals who are aware of their chronic illnesses and believe that the development of these chronic illnesses are within their control are meeting the recommended amounts of physical activity (Wang & Coups, 2010). The two chronic illnesses that will be focused on for the remainder of this paper are cancer and diabetes. Physical activity has been shown to be highly effective in reducing the risk of these two specific chronic illnesses, which are of the most common among young adults (Moore et al., 2016; Kushi et al., 2012; Rock et al., 2012; Bonn et al, 2015; Holmes et al., 2005; Yang, Thornton, Shapiro, & Andersen, 2008; Andersen et al., 2010; Dieli-Conwright, Lee, & Kiwata, 2016; Chimen et al., 2012; Snowling & Hopkins, 2006; Church et al., 2010; Sluik et al., 2012).

Physical activity has been shown to highly impact the onset, progression, and remission of various cancers (Moore et al., 2016). Physical activity has also been shown to significantly reduce the risk of many types of cancers, ranging from breast cancer to colorectal cancer (Moore et al., 2016). Likewise, higher levels of physical activity are associated with reduced overall mortality in almost all cancers (Kushi et al., 2012; Rock et al., 2012; Bonn et al, 2015). Furthermore, sedentary behavior increases risk for cancer recurrence (Holmes et al., 2005; Yang et al., 2008; Andersen et al., 2010; Dieli-

Conwright et al., 2016), whereas physical activity lowers cancer recurrence after treatment (Garcia & Thomson, 2014; Ibrahim & Al-Homaidh, 2011). Similarly to cancer, diabetes is heavily impacted by physical activity.

The diabetes literature has provided strong evidence of the key role that physical activity plays in preventing its onset, as well as in assisting in diabetes management and progression (Chimen et al., 2012; Snowling & Hopkins, 2006; Church et al., 2010; Sluik et al., 2012). Physical activity has been shown to reduce the risk of developing Type II diabetes by up to 70% (Church et al., 2010). Physical activity also decreases insulin resistance and helps manage other risk factors that can lead to secondary illnesses and symptoms of both Type I and Type II Diabetes (Chimen et al., 2012; Snowling & Hopkins, 2006). Individuals with higher levels of PA displayed lower mortality risks than their sedentary diabetic counterparts (Sluik et al., 2012). Within the same study, individuals who engaged in moderate amounts of PA showed appreciably lower risk of early death than inactive persons (Sluik et al., 2012). Due to cancer and diabetes having a large and growing presence within the US population, it is important to focus on prevention.

In 2018, it is estimated that there will be 1.73 million new cases of cancer of any site, with 87% of all cancers in the US being diagnosed in people 50 years or older (American Cancer Society, 2017). As individuals grow older, their risk for developing a cancer increases (National Cancer Institute, 2015). Similarly, in 2015, 1.5 million Americans ages 18 and older were diagnosed with diabetes (Centers for Disease Control and Prevention [CDC], 2017). 193,000 Americans under the age of 20 are estimated to become diagnosed with diabetes (CDC, 2017). The risk of developing cancer and

diabetes increases with age, as well as with poor health behaviors. Therefore, if physical activity levels can be increased while individuals are younger, such as in college, it is possible that many cases of these highly prevalent chronic illnesses can be prevented in the future. As mentioned prior, an individual's family medical history and an individual's perceived benefits and barriers have an impact on one's physical activity (Wang & Coups, 2010; Lovell et al., 2010; Gellert et al., 2015; McArthur et al., 2014). It can be further speculated that an individual's perceived benefits of physical activity positively affects the way an individual addresses their family medical history concerns through preventive measures.

### **Purpose of the Study**

Although the sharpest decline in physical activity is seen in 18-24 year olds, a group that makes up about six percent of the U.S. population, the literature on their physical activity levels, and possible predictors thereof, is limited (NCES, n.d; McArthur & Raedeke, 2009). Moreover, there are few studies dedicated to increasing PA levels in this population, possibly due to the lack of research into college students' perceived benefits and barriers of PA and their awareness of their FMH. In order to address this critically important gap in understanding modifiable factors that might help or hinder PA levels in college students, the overarching goal of this study is to: (a) estimate the strength of the association between FMH awareness and PA, (b) estimate the degree to which an individual's perceived benefits/barriers of exercise relate to PA levels, and (c) determine how strongly benefits and/or barriers moderate the relationship between FMH and PA. Given prior literature that has established sex differences in PA levels, an sex will be controlled in statistical models.



## **Hypotheses**

**Hypothesis 1.** Knowledge of a family medical history of cancer (FMH-c) will predict higher levels of physical activity, after controlling for sex.

**Hypothesis 2.** Knowledge of a family medical history of diabetes (FMH-d) will predict higher levels of physical activity, after controlling for sex.

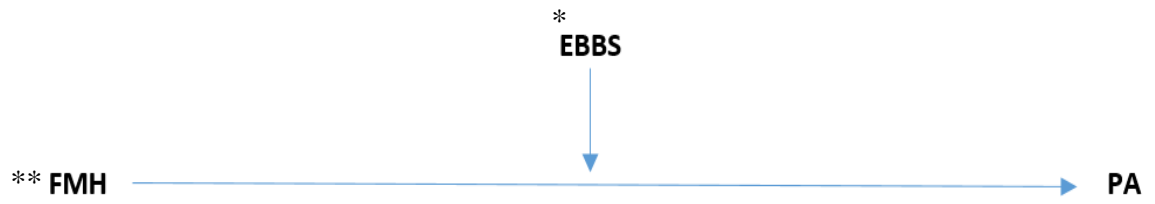
**Hypothesis 3.** Higher total Exercise Benefits and Barriers Scores (EBBS) will predict higher levels of physical activity, after controlling for sex.

*Hypothesis 3a.* Higher Benefits scores on the EBBS will predict higher levels of physical activity, after controlling for sex.

*Hypothesis 3b.* Higher Barriers scores on the EBBS will predict lower levels of physical activity, after controlling for sex.

**Hypothesis 4.** EBBS scores will moderate the relationship between FMH-c and PA levels, after controlling for sex, such that the magnitude of the positive relationship between FMH-c and PA levels will be stronger for participants who scored high on the EBBS compared to those who score low on the EBBS measure.

**Hypothesis 5.** EBBS scores will moderate the relationship between FMH-d and PA levels, after controlling for sex, such that the magnitude of the positive relationship between FMH-d and PA levels will be stronger for participants who scored high on the EBBS compared to those who score low on the EBBS measure.



\*The hypothesized moderation model for hypotheses 4 and 5.

\*\*FMH in the model is attributable to both FMH-c and FMH-d.

## **Chapter 2**

### **Methods**

#### **Design and Participants**

This is an IRB approved study that implements a cross-sectional design to collect data on FMH knowledge of cancer and diabetes, PA levels, and an individual's perceived benefits and barriers of PA. The sample for this study is undergraduate students, freshman to senior levels denoted by credits accrued, who are 18 years or older. Participants were recruited from a southern New Jersey university. This sample was collected over a time span of three semesters (Spring 2017, Fall 2017, and Spring 2018). The exclusion criteria consisted of: (a) individuals under the age of 18 years, (b) individuals who did not complete more than 33% of the assessment, and (c) an individual's ability to read and understand the materials written in English. Any progress under 33% would not have provided substantial information necessary to be included within the analyses.

#### **Recruitment and Survey Completion**

Recruitment of participants was done using on-campus flyers, email recruitment notices, in-class presentations, as well as through SONA's participant/subject pool. SONA is an electronic subject pool software used by the university to facilitate recruitment for research studies. If participants were interested in participating after successful recruitment, and they chose to complete the survey online, there was a standard, web-based consent procedure. Qualtrics was used as a way to administer the survey and collect data.

When individuals initially accessed the survey portal, the informed consent form appeared and participants gave voluntary consent (by electronic signature) to partake in

the study. After consent and successful completion of the pre-screener to determine eligibility they gained access to the full study survey. Participants completed a 30-45 minute survey consisting of 55-items assessing demographics, family health history, physical activity levels, and perceived benefits and barriers to engagement in physical activity. If a participant chose an in-person appointment, a trained undergraduate research assistant administered the informed consent and the surveys, followed by securing any and all materials in a locked file cabinet in a locked office.

**Completion of survey/incentive allotment.** After the completion of the survey, students with active SONA accounts that were enrolled in an Essentials of Psychology course earned four (4) credit points towards their study participation requirement needed to pass the course. If students were not enrolled in an Essentials of Psychology course and/or did not have an active SONA account, yet they still participated, the investigator coordinated with the students' professor in order to reward participation, such as extra credit.

### **Instruments/Assessments**

Participants completed the following measures:

**Informed consent form.** This consent form explained that participation in this study is voluntary. The participant was also briefly informed about the purpose of this study, as well as how long it may take for them to complete the questionnaire.

Participants were also made aware of the risks, or in this study the lack of risk, in participating in this study. Participants were also informed on the anonymity of the study, as well as the security of the information being collected.

**Pre-screener.** This screener assesses an individual's eligibility to participate in the study (Frierson, Pinto, Denman, Leon, & Jaffe, 2017). This pre-screener again informed the participant about the purpose of the study, as well as the questionnaires involved within the study. Completers were asked to sign/click a box after the review of the screener to acknowledge that s/he read the form.

**Demographics questionnaire.** This questionnaire covered five bio-psycho-social areas: (a) socio-demographics, (b) family and personal medical and insurance history, (c) academic achievement, (d) health behaviors, & (e) knowledge of physical activity guidelines (Frierson et al., 2017). Individuals who completed the survey answered questions with yes or no, provided a length of time, or checked a categorical response for the majority of these questions.

**Physical activity questionnaires.**

*The Godin- Shephard Leisure Time Exercise Questionnaire (GLTEQ).* A four-question self-report questionnaire that assesses an individual's physical activity throughout a typical 7-day time period (Godin & Shephard, 1985). Individuals are asked to provide the number of times they engaged in physical activity for 15 or more minutes at a time in order to gauge their physical activity levels (Amireault & Godin, 2015; Godin, 2011). When assessing for reliability, Sari & Erdogan (2016) noted that both test-retest and the correlation between independent observers (ICC) values were similar in nature,  $r=.97$  &  $=.98$ , respectively, along with a Cronbach's alpha of  $\alpha = .64$ . The Cronbach alpha for this particular sample was calculated to be  $\alpha = .624$ , similar to Sari and Erdogan (2016). When assessing for validity, a study compared physical activity data derived from the use of the GLTEQ and physical activity data derived from the use of an

accelerometer over 7 days (Amireault, Godin, Lacombe, & Sabiston, 2015). The strength of the association between the GLTEQ classification system (active or sedentary) and the accelerometer when assessing PA was large ( $d \sim .80$ ; Amireault et al., 2015).

***Exercise Benefits/Barriers Scale (EBBS)***. The EBBS is a self-report measure consisting of 29 items that assess the possible perceived benefits of physical activity and 14 items that assess the possible perceived barriers for individuals to engage in physical activity (Akbari Kamrani, Zamani Sani, Fathire-Zaie, Bashiri, & Ahmadi, 2014).

Individuals responded to these items using a 4 point Likert scale that ranged from: strongly agree to strongly disagree. Higher EBBS scores indicate higher perceived benefits and lower perceived barriers to PA. The Total EBBS scale scores range from a minimum of 42 to a maximum of 172. The benefits subscale ranges from 29 to 116, and the barriers subscale ranges from 14 to 56.

The EBBS has been reported to have a high Cronbach's alpha of  $\alpha = .94$  (Victor et al., 2012), which was reproduced in this study ( $\alpha = .94$ ). In regards to the validity of the scale, a factor analysis conducted by the creators of the EBBS, Sechrist, Walker, and Pender (1987), yielded a 9-factor solution with almost 65% explained variance. Five of the nine factors are comprised of perceived benefits and the other four are comprised of perceived barriers (Sechrist et al., 1987). The outcome of this factor analysis supports the instrument's ability to measure two phenomena, perceived benefits and barriers (Sechrist et al., 1987).

## **Analytic Strategy**

**Preliminary analyses.** Descriptive analyses were performed on all of the participants in the sample. The research team analyzed data using SPSS 24. Preliminary analyses, such as boxplots, scatterplots, and residual dependence plots, were run to ensure that all variables (i.e. FMH (cancer and diabetes), EBBS, and GLTEQ scores) met the assumptions for the statistical analyses that were planned. After a visual inspection of the scatterplots and boxplots, all of the variables fell within the assumptions of the analyses. After the variables were found to meet required distributional assumptions, they were included in the main analyses. All analyses will have sex controlled for only after a linear regression is conducted on the sex variable to test whether sex did in fact relate to PA levels in this student sample. If sex does not have an effect than it will be omitted from further analyses.

**Main analyses.** Our main analyses consisted of five linear regressions and two moderation regressions. Two linear regressions were conducted on the FMH variables: cancer and d). We hypothesized that students with knowledge of their family medical history of cancer (FMH-c), or diabetes (FMH-d), would predict higher levels of physical activity. Furthermore, three regressions will be conducted on the second independent variable (IV), perceived benefits and barriers to exercise (EBBS), which was split into 3 variables. The EBBS was separated into the total EBBS score, the barrier subscale score, and the benefits subscale score. This was done to assess whether the total score and/or specific subscales produced different findings. As mentioned prior, the barriers subscale score tended to be more predictive of behavioral change and physical activity engagement, therefore we wanted to assess whether or not that will be substantive in this

sample. We hypothesize that higher Exercise Benefits and Barriers total scores and higher benefits scores will predict higher physical activity levels. Conversely, we hypothesize that higher barriers scores will predict lower physical activity levels.

The last two analyses were conducted to assess the moderating effects EBBS has on the relationship between FMH-c, or FMH-d, and PA. The 2 two-way interaction models incorporated the total EBBS score only, the specific chronic illness, either cancer or diabetes, and the dependent variable (GLTEQ). We hypothesized that EBBS will moderate the relationship between FMH and PA, such that higher physical activity levels are observed when individual's report higher perceived benefits of physical activity.



## Chapter 3

### Results

#### Preliminary Analyses

This undergraduate student sample was comprised of 47% (n=174) males and 53% (n=196) females. The participants' (n=370) ages ranged from 19–37 (M= 21.25; SD = 2.379) (Table 1). The participants' ethnic-racial make-up was comprised of: 68.4% (n=282) Caucasian/White, 13.6% (n=57) Black/African-American, 9.5% (n=39) Hispanic/Latino, 7% (n=29) Asian, 1% (n=4) American Indian/Alaska Native, and 0.5% (n=2) Native Hawaiian/Pacific Islander (Table 1). The majority of students who took the survey reported their academic standing as freshman 48.3% (n=163), followed by 27.5% (n=93) sophomores, 15.7% (n=53) juniors, and 8.5% (n=28) seniors (Table 1). Each of the academic designations (e.g. freshman, sophomore, junior, and senior) were denoted by the accrued academic credit hours. To be placed in the freshman designation the students needed to report 0-30 accrued credit hours, sophomores 31-60 accrued credit hours, juniors 61-90 accrued credit hours, and seniors 90+ accrued credit hours.

Table 1 also provides information on the means and standard deviations of the quantitative survey questionnaires (GLTEQ and EBBS). In this sample, 80.6% (n=278) were considered to be 'active' and only 19.6% (n=67) were considered to be sedentary, which is denoted by cutoff scores from the GLTEQ (Table 1). The mean total score on the GLTEQ measure was a 51 (SD= 28.358). In regards to the EBBS, this sample had a mean total score of 130.85 (SD =17.155) for the total EBBS scores, a mean Benefits subscale score of 89.15 (SD=14.621), and a mean Barriers subscale score of 28.30 (SD=7.077). Table 2 delineates all of the chronic illnesses and diseases reported by this

sample, with the highest reported chronic illness being cancer 51.2% (N= 562), followed by diabetes I/II 18.7% (N=206).

Table 1

*Demographics & Assessment Scores*

		<b>N</b>	<b>%</b>	<b>M</b>	<b>SD</b>	<b>Range</b>
<b>Sex</b>	<b>Male</b>	<b>174</b>	<b>47</b>			
	<b>Female</b>	<b>196</b>	<b>53</b>			
<b>Socio-demographics</b>	<b>Age (Years)</b>	<b>370</b>		<b>21.25</b>	<b>2.379</b>	<b>19-37</b>
	<b>BMI</b>	<b>369</b>		<b>24.78</b>	<b>4.556</b>	<b>16-46</b>
	<b>Academic Status</b>					
	<b>Freshman</b>	<b>163</b>	<b>48.3</b>			
	<b>Sophomore</b>	<b>93</b>	<b>27.5</b>			
	<b>Junior</b>	<b>53</b>	<b>15.6</b>			
<b>Race/Ethnicity</b>	<b>Senior</b>	<b>28</b>	<b>8.5</b>			
	<b>White/Caucasian</b>	<b>282</b>	<b>68.4</b>			
	<b>African American/Black</b>	<b>57</b>	<b>13.9</b>			
	<b>Hispanic/Latino</b>	<b>39</b>	<b>9.5</b>			
	<b>Asian</b>	<b>29</b>	<b>7.1</b>			
	<b>American Indian/Alaska Native</b>	<b>4</b>	<b>1</b>			
	<b>Native Hawaiian/Pacific Islander</b>	<b>2</b>	<b>0.5</b>			

Table 1 (cont.)

		N	%	M	SD	Range	Skewness	Kurtosis
<b>GLTEQ</b>	<b>Total Scores</b>	<b>349</b>		<b>51.43</b>	<b>28.358</b>	<b>0-137</b>	<b>.229</b>	<b>-.292</b>
	<b>Active</b>	<b>278</b>	<b>80.6</b>					
	<b>Inactive/ Sedentary</b>	<b>67</b>	<b>19.4</b>					
<b>EBBS</b>	<b>EBBS Total</b>	<b>349</b>		<b>130.85</b>	<b>17.155</b>	<b>82-171</b>	<b>-.019</b>	<b>-.001</b>
	<b>EBBS Benefits</b>	<b>349</b>		<b>89.15</b>	<b>14.621</b>	<b>29-116</b>	<b>-.728</b>	<b>2.438</b>
	<b>EBBS Barriers</b>	<b>349</b>		<b>28.3</b>	<b>7.077</b>	<b>14-56</b>	<b>.559</b>	<b>.928</b>

Table 2

*Reported Family Medical History of Chronic Illness and Diseases*

	N	%
<b>Diabetes, Type I</b>	<b>109</b>	<b>26.52</b>
<b>Diabetes, Type II</b>	<b>97</b>	<b>23.60</b>
<b>Heart Disease</b>	<b>105</b>	<b>25.55</b>
<b>Adrenal Cortical Cancer</b>	<b>10</b>	<b>2.43</b>
<b>Anal Cancer</b>	<b>12</b>	<b>2.92</b>
<b>Bladder Cancer</b>	<b>18</b>	<b>4.38</b>
<b>Bone Cancer</b>	<b>22</b>	<b>5.35</b>
<b>Brain Cancer</b>	<b>26</b>	<b>6.33</b>
<b>Breast Cancer</b>	<b>109</b>	<b>26.52</b>
<b>Cervical Cancer</b>	<b>22</b>	<b>5.35</b>
<b>Leukemia</b>	<b>33</b>	<b>8.03</b>
<b>Lung Cancer</b>	<b>75</b>	<b>18.25</b>
<b>Lymphoma</b>	<b>16</b>	<b>3.89</b>
<b>Oral Cancer</b>	<b>13</b>	<b>3.16</b>
	<b>N</b>	<b>%</b>
<b>Ovarian Cancer</b>	<b>16</b>	<b>3.89</b>

Table 2 (cont.)

<b>Pancreatic Cancer</b>	<b>34</b>	<b>8.27</b>
<b>Penile Cancer</b>	<b>5</b>	<b>1.22</b>
<b>Prostate Cancer</b>	<b>38</b>	<b>9.25</b>
<b>Stomach Cancer</b>	<b>12</b>	<b>2.92</b>
<b>Skin Cancer</b>	<b>69</b>	<b>16.79</b>
<b>Testicular Cancer</b>	<b>9</b>	<b>2.19</b>
<b>Thyroid Cancer</b>	<b>23</b>	<b>5.60</b>
<b>Chronic lower respiratory diseases</b>	<b>15</b>	<b>3.65</b>
<b>Cerebrovascular diseases (e.g stroke)</b>	<b>45</b>	<b>10.95</b>
<b>Alzheimer's disease</b>	<b>70</b>	<b>17.03</b>
<b>Influenza/Pneumonia</b>	<b>63</b>	<b>15.33</b>
<b>Nephritis, Nephrotic Syndrome &amp; Nephrosis (Live disease)</b>	<b>11</b>	<b>2.68</b>
<b>Other</b>	<b>20</b>	<b>4.87</b>

**Sex and physical activity levels.** The effect of sex on PA levels was very small ( $\beta=.016$ ) and not statistically significant ( $t=.291$ ,  $p=.771$ , Table 3; Graph 1). Thus, sex was dropped from subsequent analyses.

Table 3

*Linear Regression Model Estimating the Effects of Sex on Physical Activity Engagement (N= 344).*

<b>Variable</b>	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
<b>Constant</b>	<b>50.078</b>	<b>4.902</b>		<b>10.216</b>	<b>.000</b>
<b>Sex</b>	<b>.891</b>	<b>3.060</b>	<b>.016</b>	<b>.291</b>	<b>.771</b>

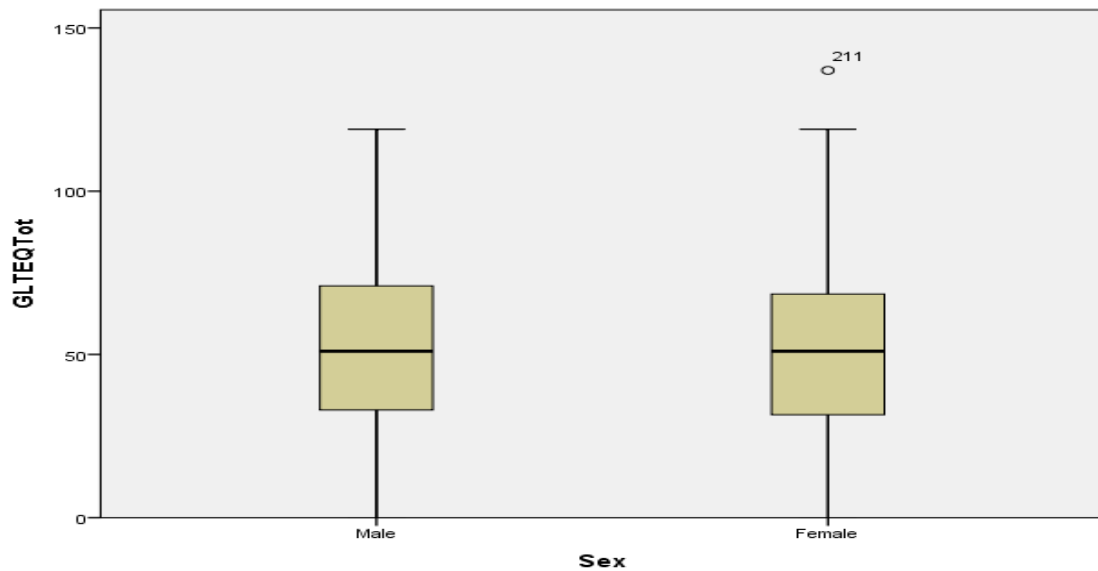


Figure 1. The Effects of Sex on Physical Activity Engagement.

## Main Analyses

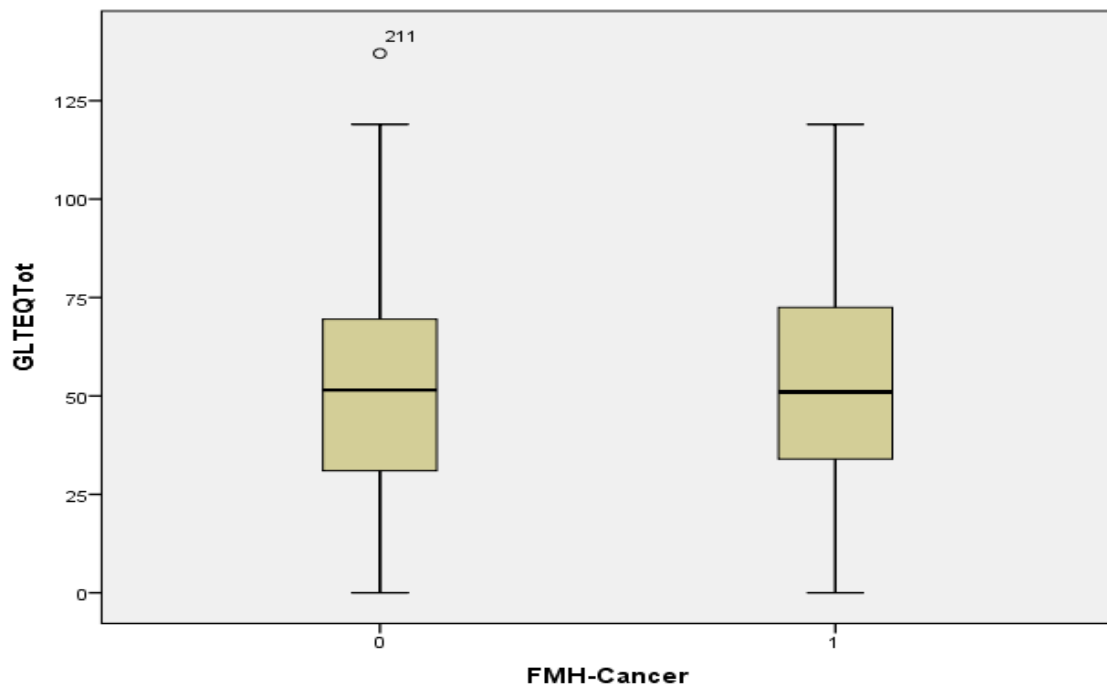
**Family medical history and physical activity levels.** The first two regressions that were conducted on family medical history assessed whether an individual's knowledge of cancer, or diabetes, in the family predicted their physical activity level. Regardless of the illness in question, PA levels reportedly were minimally affected. Specifically, FMH-c had little to no effect on physical activity ( $\beta=.033$ ) and was not statistically significant ( $t= .542$ ,  $p = .577$ ). Similarly, FMH-d also had little to no effect on physical activity ( $\beta=-.055$ ) and was unable to reject the null ( $t= -.926$ ,  $p= .355$ ), as well. Graph 2 displays the distribution of PA scores as a function of FMH-c and Table 4 displays the unstandardized regression coefficients (B), intercept, and the standardized regression coefficients ( $\beta$ ) for FMH-c. Graph 3 displays the distribution of PA scores as a function of FMH-d and Table 5 displays the unstandardized regression coefficients (B), intercept, and the standardized regression coefficients ( $\beta$ ) for each variable for FMH-d.

The null findings of the first 3 analyses (Sex -> PA, FMH -> PA, and EBBS -> PA) contradicts the literature and may be due to a plethora of other factors (i.e. living environment, race/ethnicity, and availability of resources), which will be further explained in the discussion section.

Table 4

*Linear Regression Model Estimating the Effects of Cancer Family Medical History (FMH-c) on Physical Activity Engagement (N= 290).*

<b>Variable</b>	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
<b>Constant</b>	<b>51.754</b>	<b>1.666</b>		<b>31.065</b>	<b>.000</b>
<b>FMH- c</b>	<b>2.095</b>	<b>3.746</b>	<b>0.033</b>	<b>0.559</b>	<b>0.577</b>

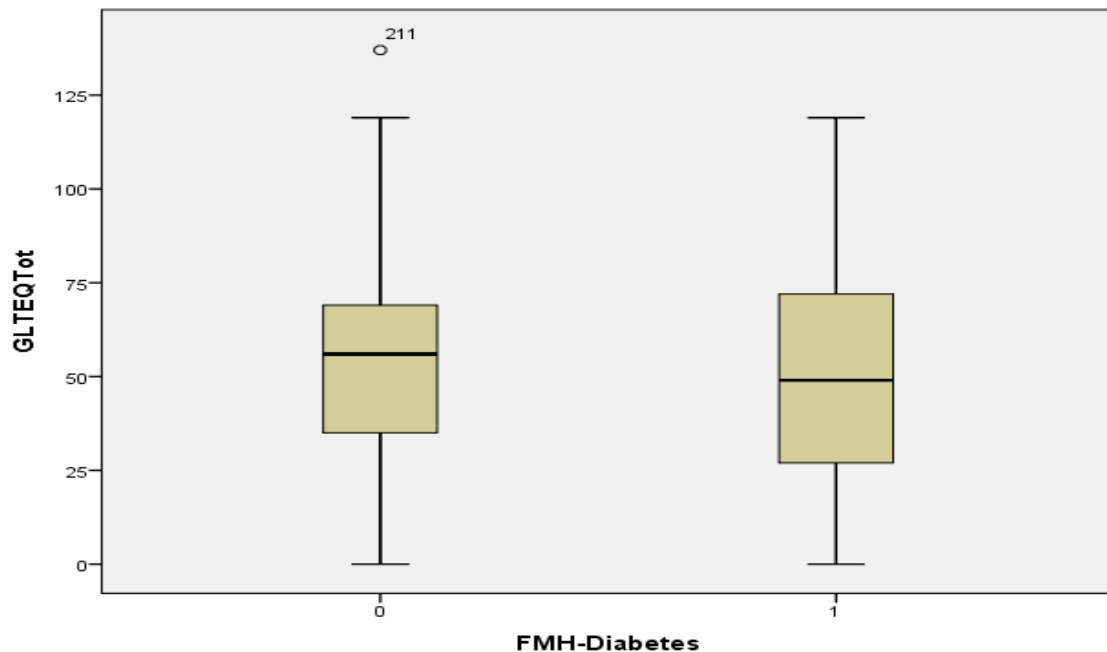


*Figure 2. The Effects of Cancer Family Medical History (FMH-c) on Physical Activity Engagement.*

Table 5

*Linear Regression Model Estimating the Effects of Diabetes Family Medical History (FMH-d) has on Physical Activity Engagement (N= 280).*

Variable	B	SE	$\beta$	t	p
Constant	52.156	1.665		31.325	0.000
FMH (Diabetes)	-3.114	3.363	-.055	-.926	0.355



*Figure 3. The Effects of Diabetes Family Medical History (FMH-d) has on Physical Activity Engagement.*

**EBBS scores and physical activity levels.** The total EBBS score had a small effect ( $\beta=.287$ ) on an individual's physical activity level ( $t=5.547$ ,  $p < .001$ ). The higher an individual's EBBS scores, the higher their reported physical activity levels (Graph 4). Table 6 displays the unstandardized regression coefficients (B), intercept, and the

standardized regression coefficients ( $\beta$ ) for the total EBBS. Regarding relationships between the EBBS subscales and physical activity levels, both the barriers subscale ( $F(1,343)= 6.871, p = .009$ ; Table 7) had and the benefits subscale ( $F(1,343)= 26.613, p < .001$ ; Table 8) had small effect sizes in the expected directions ( $\beta = -.140$  and  $\beta = .268$ , respectively). For the barriers subscale, lower scores were associated with higher reported physical activity levels (Graph 5) and vice versa for the benefits subscale score (Graph 6). The higher the benefits subscale score, the higher reported levels of physical activity, similar to Total EBBS scores (Graph 4). Tables 6 through 8 show unstandardized regression coefficients (B), intercept, and the standardized regression coefficients ( $\beta$ ) for the EBBS and its subscales.

Table 6

*Linear Regression Model Estimating the Effects Total EBBS Scores has on Physical Activity Engagement (N= 344).*

<b>Variable</b>	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
<b>Constant</b>	<b>51.441</b>	<b>1.465</b>		<b>35.121</b>	<b>.000</b>
<b>EBBS Total Score</b>	<b>.474</b>	<b>.085</b>	<b>.287</b>	<b>5.547</b>	<b>.000</b>



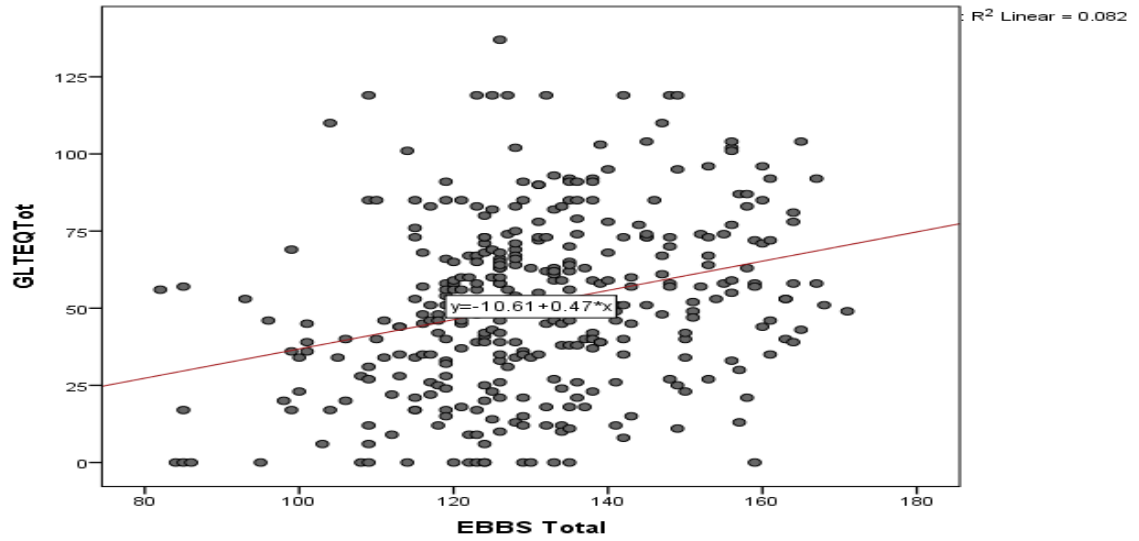


Figure 4. The Effects Total EBBs Scores has on Physical Activity Engagement.

Table 7

Linear Regression Model Estimating the Effects EBBs: Barriers Subscale Scores has on Physical Activity Engagement (N= 344).

Variable	B	SE	$\beta$	t	p
Constant	67.285	6.233		10.794	.000
EBBS Barriers Score	-.561	.214	-.140	-2.621	.009

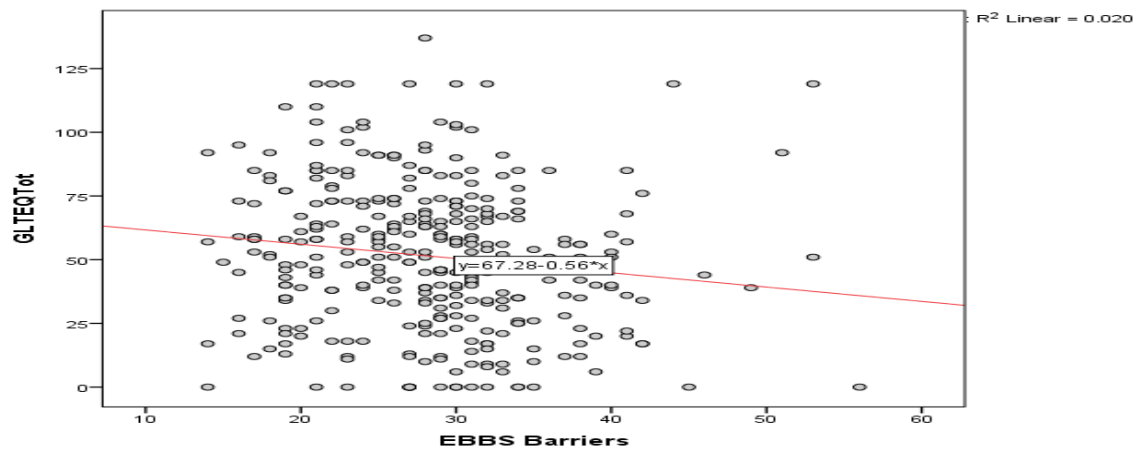
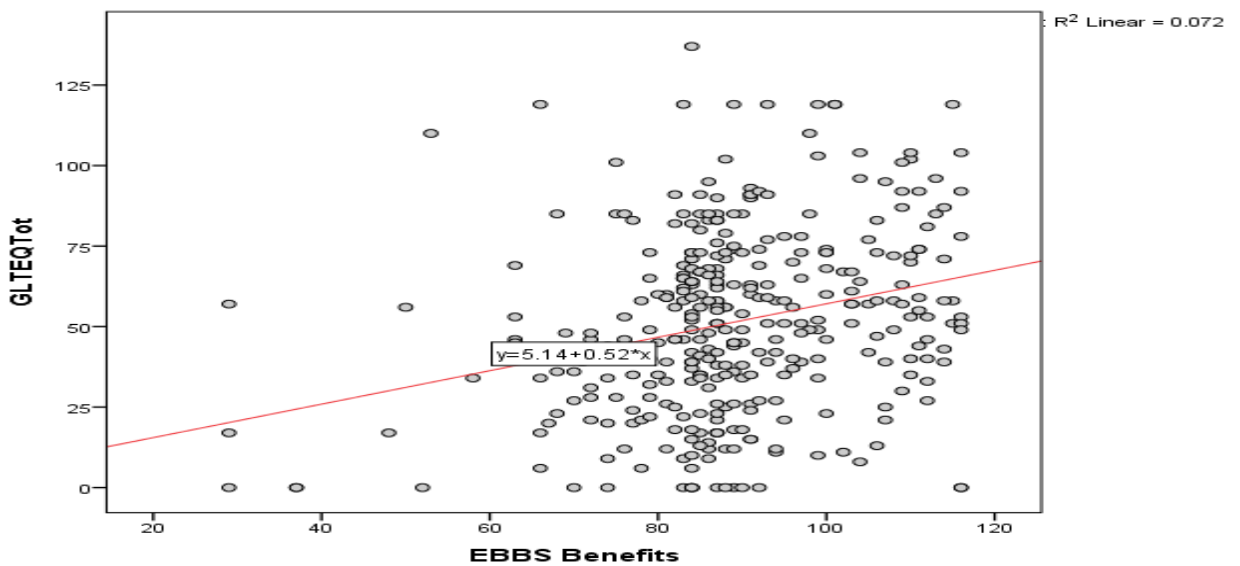


Figure 5. The Effects EBBs: Barriers Subscale Scores has on Physical Activity Engagement.

Table 8

*Linear Regression Model Estimating the Effects EBBS: Benefits Subscale Scores has on Physical Activity Engagement (N= 344).*

Variable	B	SE	$\beta$	t	p
Constant	5.144	9.093		.566	.572
EBBS Benefits Score	.520	.101	0.268	5.159	.000



*Figure 6. The Effects EBBS: Benefits Subscale Scores has on Physical Activity Engagement.*

**FMH, EBBS, and physical activity levels: testing for moderation.** Lastly, two 2-way regression models were utilized to investigate whether EBBS had a moderating effect on the relationships between FMH and PA. The two predictors and their interaction were entered into a simultaneous regression model. Results indicated that the interaction term of FMH-c x EBBS ( $t = -.011$ ,  $p = .991$ ;  $\beta = .001$ ) and the interaction term of FMH-d x EBBS ( $t = .026$ ,  $p = .979$ ,  $\beta = .002$ ) had little to no effect on physical activity levels. It was

predicted that higher EBBS scores would amplify the positive relationship between an individual's FMH and their PA levels. Results from this undergraduate student sample, however, indicated that perceived benefits and barriers to exercise did not affect the relationship between FMH and PA. Table 9 and 10 displays the unstandardized regression coefficients (B), intercept, and the standardized regression coefficients ( $\beta$ ) for FMH-c x EBBS and FMH-d x EBBS, respectively. Graphs 7 and 8 display the distribution of physical activity scores as function of FMH-c x EBBS and FMH-d x EBBS, respectively, as well.

Table 9

*Multiple Regression Model Estimating the Moderating Effect of Total EBBS Scores on the Relationship between Family Medical History of Cancer (FMH-c) and Physical Activity Engagement (N= 290).*

<b>Variable</b>	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
<b>Constant</b>	<b>51.443</b>	<b>1.597</b>		<b>32.207</b>	<b>.000</b>
<b>EBBS Total Score</b>	<b>.499</b>	<b>.094</b>	<b>.297</b>	<b>5.278</b>	<b>.000</b>
<b>FMH-c</b>	<b>2.325</b>	<b>3.590</b>	<b>.036</b>	<b>.684</b>	<b>.518</b>
<b>EBBS*FMH-c</b>	<b>.002</b>	<b>.208</b>	<b>.001</b>	<b>.011</b>	<b>.991</b>

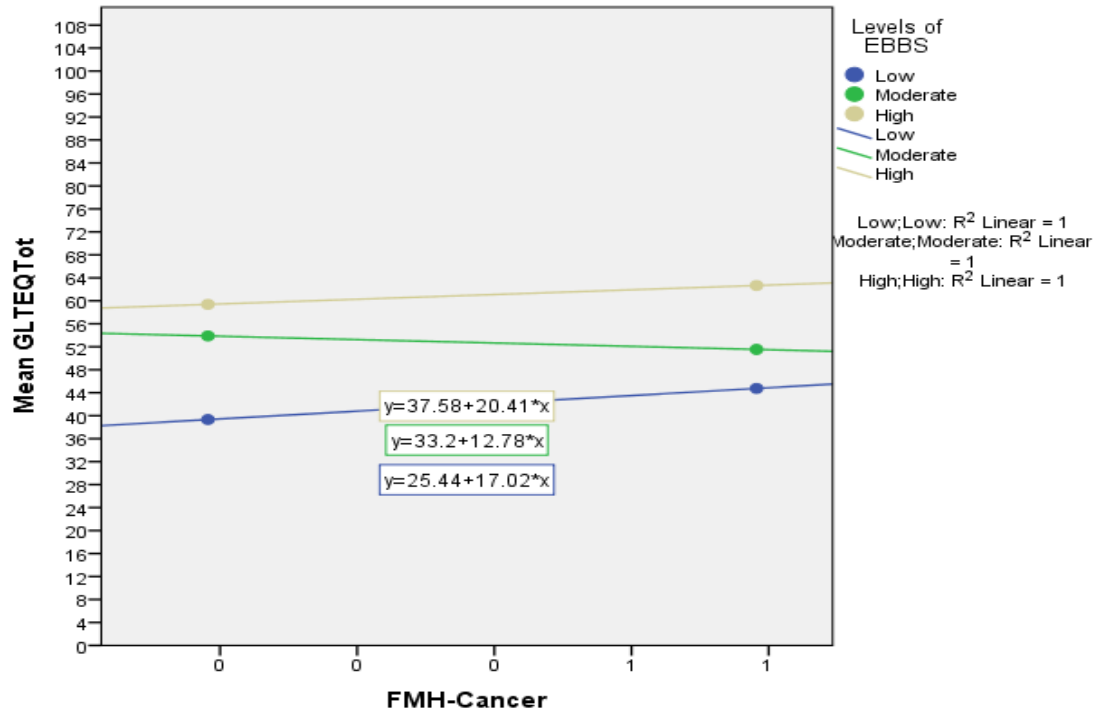


Figure 7. The Moderating Effect of Total EBBS Scores on the Relationship between Family Medical History of Cancer (FMH-c) and Physical Activity Engagement.

Table 10

Multiple Regression Model Estimating the Moderating Effect of Total EBBS Scores on the Relationship between Family Medical History of Diabetes (FMH-d) and Physical Activity Engagement (N= 280).

Variable	B	SE	$\beta$	t	p
Constant	51.985	1.609		32.303	.000
EBBS Total Score	.435	.093	.272	4.700	.000
FMH-d	-3.586	3.251	-.064	-1.103	.271
EBBS*FMH-d	.005	.188	.002	.026	.979

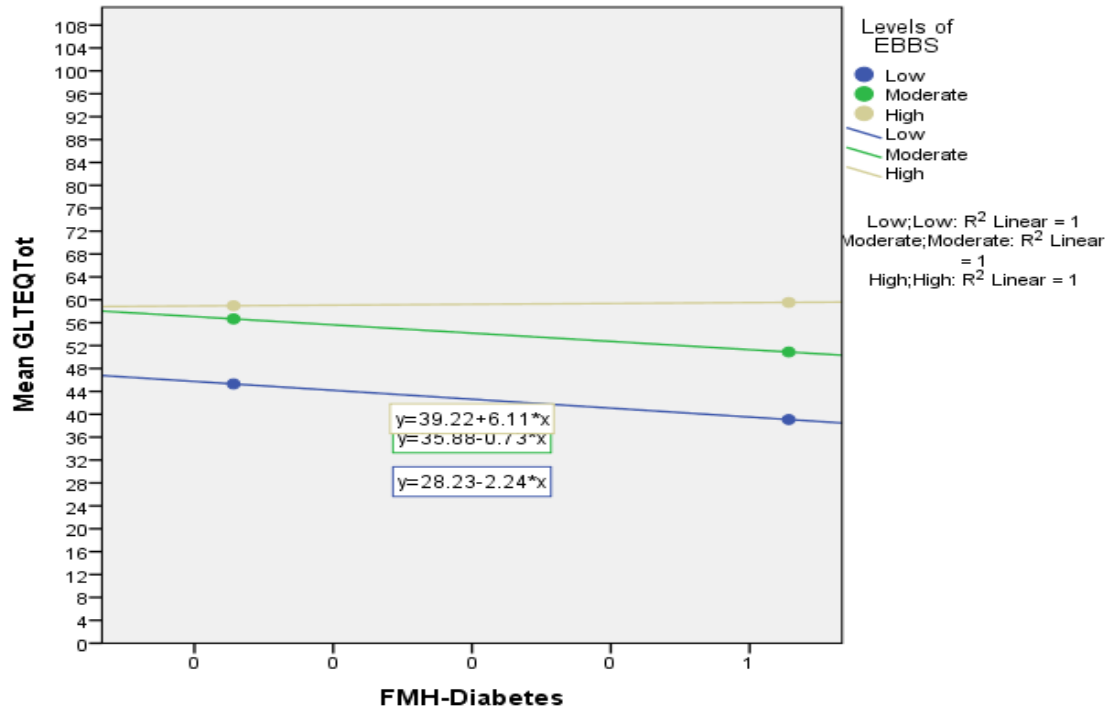


Figure 8. The Moderating Effect of Total EBBS Scores on the Relationship between Family Medical History of Diabetes (FMH-d) and Physical Activity Engagement.

## **Chapter 4**

### **Discussion**

The main purposes of this study was to: (a) assess the strength family medical history has on physical activity levels, (b) assess the degree to which an individual's perceived benefits and barriers relate to physical activity levels, and (c) assess the moderating effect an individual's perceived benefits and barriers of exercise has on the relationship between an individual's family medical history and their physical activity. The current study's first aim was to assess whether an individual's reported family medical history, specific to cancer or diabetes, would predict their physical activity levels. Results from the linear regression analyses on an individual's reported family history revealed that for this college sample an individual's predisposition to a chronic illness, whether it was cancer or diabetes, had little to no significant effect on their physical activity levels. These findings also contradict what multiple studies have found in regards to self-reported FMH knowledge and PA (Zlot 2012; Wang et al., 2012; Prichard et al., 2015). These studies have found that individuals who are aware of their family medical history and their predispositions to chronic illness, the appropriate preventive behaviors, such as PA, diet, and screenings, are motivated and incorporated into their daily life (Zlot 2012; Wang et al., 2012; Prichard et al., 2015). Due to the outcomes presented, it may be assumed that for this sample the specificity of a chronic condition did not affect its predictive ability of an individual's FMH in regards to PA levels. The outcome of this first aim can potentially be explained due to some findings within the data, such as the high physical activity levels of this college sample.

This phenomenon of FMH not being a reliable predictor for physical activity can possibly be explained by this college sample being highly physically active. As previously reported, over 80% of individuals in this sample were considered physically active, and less than 20% of individuals were considered inactive/sedentary. It is possible that this specific college sample may not be affected from the drastic decline in physical activity this group is characterized with within the literature (Bryan & Katzmarzyk, 2011; Grim et al., 2011; Clemente et al., 2016). It is also important to note that age plays a significant role in physical activity levels (Zang & Ng, 2016). Individuals who are younger in age tend to have higher levels of PA compared to individuals who are older in age, regardless if their PA levels are under the recommended amount; their levels are still higher than their older counterparts (Zang & Ng, 2016). Most of the sample had higher moderate-vigorous physical activity levels surpassing the minimum cutoff GLTEQ score < 25 to be considered active, with a sample GLTEQ mean score of 51.43, double that of the cutoff (Amireault & Godin, 2015; Godin, 2011). A potential explanation of the high GLTEQ scores of this sample may be due to the age, ethnicity/racial demographics, and resources of the sample and physical environment of the university (Willey et al., 2010; Shores & Shinew, 2014; Shi et al., 2015; Sohn et al., 2017; Willey et al., 2010; Shi et al., 2015; Peralta et al., 2018; Sohn et al., 2017).

A potential reason for the high GLTEQ scores and FMH-c, or FMH-d, being noted as having little to no significant effect on PA, can be the location of the university, resources (i.e insurance) and the ethno-racial make-up of the sample, which may play a role in the higher reported physical activity levels. The university that the sample was collected from is considered to be located in a suburban environment, also surrounded by

more suburbs and rural areas. Many of the students that attend this university commute from or live in university affiliated, -owned, or -operated housing ( Common Data Set [CDS], 2017). Furthermore, all fulltime freshman must live on Rowan campus for their first two years, with few exceptions; this is particularly of interest due to most of our sample being freshman. We speculate that an increase of their PA levels can be possibly due to their requirement to live on campus and their ability to walk to classes, work (i.e work-study), dining halls, and etc which are all located within a close proximity of one another. Also, studies have shown that individuals living in suburban environments tend to have the highest physical activity levels compared to their rural and urban counterparts (Parks, Housemann, & Brownson, 2003). It has been shown that urban and rural environments tend to lack the ability to foster physical activity due to location, traffic, lack of sidewalks and parks, safety, and much more, which have been noted as reasons for urban-living individuals to perceive more barriers to PA (Parks et al., 2003; Wendel-Vos et al., 2007).

Also of note, this sample was predominantly Caucasian (>68%) and comprised of an over-representation of minorities, compared to the minimum requirements ( $\geq 25\%$ ) of recruitment of minorities in the PA literature. The high percentage of participant's being Caucasian in this sample may be due to the fact that >65% of the incoming freshman, which was the most present academic cohort in the sample, were Caucasian as well (CDS, 2017). The students in the Essentials Psychology/Introduction to Psychology courses that was primarily recruited from historically have a large enrollment of freshmen. Numerous studies have shown that Caucasian individuals tend to have higher levels of physical activity compared to their racial/ethnic minority counterparts (Wilson-



Frederick et al., 2014; Vasquez et al., 2013). The sample came from primarily Caucasian participants within a suburban university, which may add more information to understanding their high moderate-vigorous PA levels.

Initially, sex differences were included within the model, but due to sex having little to no significant correlation with physical activity in this college sample, it was omitted from further analyses within this study. This finding contradicts the literature which reports notable sex differences in physical activity levels (Baskin et al., 2013; McCarthy et al., 2014; Koyanagi et al., 2018; Wells et al., 2017; Linetzky et al., 2013). Many studies have noted that males tend to be, many more times than not, more physically active than their female counterparts across most age groups (Baskin et al., 2013; McCarthy et al., 2014; Koyanagi et al., 2018; Wells et al., 2017; Linetzky et al., 2013). We speculate that there are quite a few factors playing a role into this study's lack of sex differences in PA. One presumption is the impact social media has had in recent years on body image and physical activity levels (Kim & Chock, 2015; Al-Eisa et al., 2016).

As mentioned prior, males tended to be more physically active than females, but studies have shown that females' physical activity levels have been positively impacted, or motivated, by social media apps that foster social comparison and/or support, such as Instagram and Facebook (Kim & Chock, 2015; Al-Eisa et al., 2016). Females tend to be more present on social media apps such as Instagram (Omnicores, 2018), therefore their exposure to more opportunities of social comparison may be driving the increase in physical activity in college age females, reducing the PA gap. Another possible reason that there may not be any sex differences in this sample is due to types of activities these

college women may be engaging in in their day to day lives. Hagströmer et al. (2007) mentioned self-reports collected in past research, men were always seen more physically active than women. Hagströmer et al. (2007) goes to explain that it may be due to the fact that women spend time doing physical activity that most people did not constitute as “physical activity”, or “exercise”, at that time, such as cleaning or playing with children , whereas in reality these are forms of physical activity. Therefore, women may not be recording accurate amounts of physical activity in their self-reports. As mentioned, sex was removed from forthcoming analyses, the independent relationships between the FMH, or EBBS, and physical activity levels were assessed without regards to sex differences.

Furthermore, over 97% of students report having health insurance coverage at the time of them filling out these questionnaires. Due to this sample having a high percentage of insured people, it is quite possible that this sample’s awareness of their cancer, or diabetes, FMH did not have an effect on PA because individuals may be more aware of their FMH. This awareness can be due to their ability to go for medical evaluations more often, therefore influencing their PA by their motivation to maintain their health. However, it should be noted that for both sex and FMH, -d and/or -c, we do not believe that the outcomes of the analyses was due to the sample size, power, or any imbalances in the groups.

The study’s second aim was to assess whether an individual’s EBBS, perceived benefits and barriers, score was predictive of their physical activity levels. Consistent with previous research, an individual’s perceived benefits and barriers of exercise was able to predict their physical activity levels (Cantell, Wilson, & Dewey, 2014; Lovell et

al., 2010). Along with this sample's high GLTEQ scores; they also displayed relatively high EBBS scores. This sample reached high levels of both the Total EBBS scale (M=130.85; SD =17.155) and the Benefits subscale (M= 89.15; SD=14.621), while reporting relatively low levels in the Barriers subscale (M= 28.30; SD=7.077). When an individual receives high scores on either the Total EBBS scale or the Benefits subscale, the more the individual perceives positive outcomes from PA. This sample's scores showed that they have a high perception of positive outcomes associated with physical activity, therefore they engage in physical activity, which accounts for the high levels of GLTEQ scores, similar to other samples (Stroud, Minahan, & Sabapathy, 2009; Akbari Kamrani et al., 2014). In regards to the EBBS barriers subscale, it showed that individuals with lower scores, signifying that they have fewer barriers or negative perceptions of exercise, had higher levels of physical activity, also similar to other samples (Akbari Kamrani et al., 2014).

The outcomes of the EBBS scores and physical activity are further supported by the Theory of Planned Behavior. Individuals who report positive attitudes towards a behavior, are more likely to engage in that behavior (Ajzen, 1991; Neighbors et al., 2013; Straatmann et al., 2017; Patterson, 2001; Ryan & Carr, 2010; Mimiaga et al., 2009). In this study, this sample demonstrated positive attitudes towards PA and in turn also displayed high levels of PA. Overall, the EBBS scores and both the subscale scores provided evidence of being good predictors of physical activity levels. The overall EBBS score was also shown to be effective in the interaction model.

The third aim of this study was to assess how strongly an individual's perceived benefits and/or barriers moderated the relationship between FMH-c, or FMH-d, and PA

levels. Within both interaction models, whether it was with FMH-c or FMH-d, neither of them were able to provide substantive information on EBBS having a significant moderating effect on FMH's relationship with PA. The analyses did not indicate that EBBS was a significant moderator within the FMH and PA relationship. The EBBS score did provide the highest predictive value within the model, individually, providing more information on its effect on PA. This outcome further supports the literature stating that EBBS is informative in regards to an individual's PA levels (Baskin et al., 2013; McCarthy et al., 2014; Koyanagi et al., 2018; Wells et al., 2017; Linetzky et al., 2013; Kaur et al., 2015; Armstrong, 2013; Willey et al., 2010). Conversely, the interactions terms, EBBS x FMH-c or EBBS x FMH-d, had little to no significant effect on physical activity levels. This study has provided information into the understanding of college student's perceived benefits and barriers to physical activity, as well as the role, or lack there-of, FMH plays in an individual's physical activity levels. There are some limitations that future research should take into consideration when studying this topic and population.

### **Limitations**

Due to this study's sample being collected from a suburban university in New Jersey, there were some shortcomings in the outcomes of the study that can be addressed in future studies. One of the first limitations of this study is the diversity of the sample. Even though the ethnic/racial minority profile makes up over 30% of this sample, the minority presence within samples should be more pronounced. The literature reports that the minimum diversity within the sample for physical activity research should be 25% (Frierson et al., 2008), but a higher representation should always be strived for due to the

rapidly changing ethnic/racial makeup of society. As mentioned prior, suburban environments, as well as Caucasian individuals, have been shown to have individuals with the highest levels of physical activity (Parks et al., 2003; Wilson-Frederick et al., 2014; Vasquez et al., 2013). Furthermore, another limitation is the diversity in academic statuses and majors. Due to the participants being collected through SONA, many of the students were freshman or sophomores, and all of them were psychology majors. Also, this study did not assess the different known barriers, individually, nor the different known correlates or predictors of physical inactivity. This study did not assess individually for all of the mentioned barriers to physical activity. Not including these covariates within the model may not have provided important information on a profile of what may or may not encourage or discourage physical activity.

### **Future Directions**

When taking into consideration the limitations of this study, future research may want to look at collecting a more diverse sample. A collection of participants from a more urban university may yield different results in physical activity levels (Ewing et al., 2014) and increase the generalizability of the findings from this study. The ethnic/racial makeup of the country is continuously changing and minorities are said to grow by 74% by 2060 (Frey, 2018). It is important for the literature to stay abreast of the changing diversity in this country to better inform the future of research and policy. A more diverse sample across different majors and academic years may provide more accurate insight into the college population in regards to perceived benefits and barriers, as well as physical activity levels on a continuum. Future studies may also want to assess the different levels of academia and not solely undergraduate students. There may be

between-group considerations that may be present amongst graduate students versus undergraduate students (Kristjánsson, Sigfúsdóttir, & Allegrante, 2010). Studies have shown relationships between an individual's academic achievement and physical activity levels (Kristjánsson, Sigfúsdóttir, & Allegrante, 2010). Furthermore, future studies should include all known predictors and barriers to physical activity within the model to see the effects of each on physical activity. Including these variables within the model will possibly better characterize the mechanisms of physical activity. In regards to the clinical direction the findings from this study can be used to create an RCT to increase the motivations for physical activity and increase physical activity levels in this population.

## **Conclusions**

Health promotion efforts have the ability to increase motivation in the population and break down barriers through education. As seen in this paper, an individual's perception has an effect on an individual's physical activity levels. Finding methods to increase perceived benefits and minimize perceived barriers of PA is paramount in increasing physical activity levels. In this particular sample, an individual's family medical history awareness did not increase physical activity levels, but it has been shown in other studies to increase preventive behavior involvement, such as PA (Wang & Coups, 2010). These findings have the ability to inform interventions by finding strategies to increase an individual's motivation to engage in physical activity.

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