MODERATE TO VIGOROUS PHYSICAL ACTIVITY AS A PROTECTIVE FACTOR IN THE CONTEXT OF RISK: A MODERATOR MODEL PREDICTING INSTITUTIONAL COMMITMENT

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A Dissertation Presented in Partial Fulfillment Of the Requirements for the Degree Doctor of Education

Liberty University
April, 2014
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April, 2014

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ABSTRACT

The purpose of this quantitative, non-experimental correlational study was to determine if cumulative risk is associated with undergraduate student institutional commitment. Additionally, moderate to vigorous physical activity was investigated as a moderator of the association between cumulative risk and institutional commitment, specifically serving as a protective factor for students experiencing high levels of cumulative risk factors. Data were collected through anonymous, online surveys from a convenience sample of undergraduate students enrolled at a large, Southern Association of Colleges and Schools (SACS)-accredited, 4-year private university located in Virginia. The statistical program, SPSS 22.0 (2013) was used to analyze the descriptive analysis and test the assumptions. Hierarchical multiple regression was used to statistically analyze the association between: (a) cumulative risk and institutional commitment, (b) moderate to vigorous physical activity and institutional commitment, and (c) the interaction between cumulative risk and physical activity and institutional commitment. Hypothesis 1 was supported by the findings, which suggested that cumulative risk was negatively associated with institutional commitment. Hypotheses 2 and 3 were rejected, since moderate to vigorous physical activity was not found to be significantly associated with institutional commitment. Additionally, moderate to vigorous physical activity did not moderate the association between cumulative risk and institutional commitment. The findings from this study can be used to inform student retention research by providing evidence of a predictive association between cumulative risk and institutional commitment (i.e., risk of departure). While moderate to vigorous physical activity was not found to moderate the association between cumulative risk and institutional commitment, future researchers should investigate potential moderators.

Keywords: undergraduate student institutional commitment, cumulative risk, physical activity
Dedication/ Acknowledgments Pages

Formulating the words to communicate my thoughts for this dedication was just as difficult as it was for the rest of manuscript. The only comfort in writing this page is the knowledge that even if written in full Briannese, those individuals who deserve the acknowledgement and a life-time of gratitude for helping cross the finish line will understand every word. It is through these individuals that God completed an act I literally dared Him to accomplish many years ago. Thankfully, His grace is sufficient.

I start by thanking the ones who endured the most through the entire doctoral process. While my committee members and friends were a critical part of my success, through the course of my doctoral work and dissertation my family sacrificed and sometimes suffered the most. I begin by thanking my husband, Jason. During the course of my doctorate I lost patience, sleep, friends, and at times my sanity; I questioned my intelligence, my strength, and my ability, yet I never once questioned us. He was there through it all. His willingness to sacrifice is the only way I was able to juggle my responsibilities as a wife, mother, professor, and doctoral student.

I also must thank my sons. Ben and Brent have literally lived their entire lives with a mother who was constantly preoccupied with “homework”. Perhaps it is because they do not know any better, but they love me as though I am the best mom in the world. My “homework” is finally done boys! I must also say thank you to my parents and in-laws who have been unfailing in their support for all of us. It was much easier to give up precious time with my husband and boys when I knew they were getting quality times with the grandparents! Quality time I plan on getting in now myself.
Next, I thank my committee. True to character, these women selflessly gave their time and shared their knowledge to make me a better researcher and writer. They all began the process as friends that I admired and respected. While I did not think it possible to admire or respect any of them more than I did at the start, I do. So I thank Dr. Brianne Friberg, the person I am convinced God moved across the country to chair my committee. There is absolutely no one else in the world that could have led me through the dissertation process. While painful, frustrating, and time consuming, she allowed me to be myself through the entire course of the dissertation. I know that providing me that freedom was no small task given doing so required her to give a lot of time, stop a lot of tangents, listen to a lot of rambling, and do a lot of teaching. She went above and beyond and I am so thankful.

Brianne was joined by Dr. Beverly Mahoney and Dr. Tamerah Hunt. Bev always found a way to provide me another perspective when I was too exhausted and confused to see beyond myself. Without her caring touch through my entire doctoral career, my progress may have stalled before I ever wrote the first word of my manuscript. Tamerah was always willing to listen to my academic spews as I tried to give structure to my often jumbled thoughts. Without her, I would still be staring at my computer screen unable to move anything from my head to the page. I am not sure I will ever be able to put into words how grateful I am for my committee and all they did for me.

There are also several friends in addition to my family and committee that also provided support. As I fear I would inadvertently miss a name, I will only say that if you are reading this dedication I am probably talking about you! I also would like to thank the Psychology Department for allowing to me to utilize their sample pool. Not a single word would have been possible without those around me. Thank you all!
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CHAPTER ONE: INTRODUCTION

Introduction

Staff of the U.S. Department of Education National Center for Education Statistics (2011) reported that of the first-time students who enrolled in a 4-year institution in 2004, only 58% obtained a bachelor’s degree within 6 years. The cost of undergraduate students who fail to earn a degree is high, not only for the students themselves, but also for the institutions, and the United States taxpayers (American Institutes for Research, 2010; Bureau of Labor Statistics, 2011). In an attempt to reduce undergraduate student attrition and improve institutional retention rates, research (e.g., Allen, Robbins, Casillas, & Oh, 2008; Duggan & Pickering, 2008; Friedman & Mandel, 2011; Hartley, 2011; Mattern & Shaw, 2010) has been conducted to identify predictors of student attrition in order to identify at-risk students and provide appropriate interventions.

While several predictors of student attrition have been identified through research, such as high school grade point average and college admissions exams, institutional staff has not been able to translate the information into interventions that effectively reduce the risk (Tinto, 2006).

The inability of institutional staff to translate research into intervention may be a result of flaws with the current student attrition theories used to study undergraduate student persistence behaviors and degree completion (Tinto, 1987). There are two major flaws within the current student retention literature. First, there is no consensus about how to operationally define the terms, which are often used synonymously in the literature, such as: (a) retention, (b) persistence, (c) student departure, and (d) dropout (Hagedorn, 2012; Pascarella & Chapman, 1983). Persistence is a student-specific measure that does not imply degree completion (Hagedorn). Most often persistence behaviors (i.e., re-enrollment) are used to operationally define a student’s persistence as it relates to completion of a degree (Cabrera, Nora, & Castaneda, 1993).
Retention, which is an institutional measure of students who continue to enroll, also does not imply degree completion (Hagedorn). The often dichotomous definitions are incapable of describing the multitude of student enrollment patterns, such as a student who does not re-enroll for a year between beginning a degree program and degree completion, or a student who does not re-enroll due to an academic suspension for lack of academic progress (Hagedorn). Second, there is no single theory capable of accounting for and organizing the current research findings regarding college outcomes (Robbins, Allen, Casillas, Peterson, & Le, 2006).

Failure to produce interventions may additionally be attributed to the focus on prediction of departure. As such, researchers and institutional administrators often focus on actual withdrawal decisions, a past behavior that cannot be altered (Cabrera, Nora, & Castaneda, 1993; Tinto, 2006). The research provides information about student characteristics, which increase the risk of student departure, but does not provide the institution with information as to how to reduce the risk for students (Tinto). Consequently there is a need for research that focuses on variables that can be altered and are predictive of persistence intentions, the precursor to departure, such as institutional commitment (Bean, 1975; Bean & Metzner, 1985; Braxton & Lee, 2005; Cabrera, Castaneda, Nora & Fossella, 1992; Pascarella & Terezini, 1980; Terenzini, Wendell, & Pascarella, 1981; Tinto, 1975). Institutional commitment is the level of student confidence in and satisfaction with the college of matriculation (Davidson, Beck, & Milligan, 2009). Institutional commitment has been shown repeatedly to have both main and interaction effects on persistence behavior (i.e., reenrollment) (Braxton, Jones, Hirschy, & Hartley, 2008; Nora & Cabrera, 1993; Terenzini, Lorang, & Pascarella, 1981; Tinto, 1975). Specifically, institutional commitment has been found to predict persistence behaviors directly and through intent to persist (Braxton, Milem, & Sullivan, 2000; Nora & Cabrera, 1993; Pascarella &
Terenzini, 1980; Terenzini et al., 1981). Additionally, social and academic integration have been found to indirectly impact persistence behaviors through institutional commitment (Pascarella & Chapman, 1983).

A theory that may help fill this gap within the research is the cumulative risk model (Sameroff & Fiese, 2000). Sameroff and Fiese proposed a transactional developmental theory, which suggested that developmental and behavioral outcomes are a function of the dynamic interactions between the individual and the environment. From the transactional model, a cumulative risk model emerged. It is maintained in this model that an individual’s risk is determined not by any isolated risk factor, but rather by the accumulation of individual risk. Moreover, Wright and Masten (2005) suggested that compensatory or protective factors predict better outcomes in the presence of risk or adversity. As stated by Sameroff and Fiese (2000) “the greater the risk factors, the worse the outcomes; the more promotive factors, the better the outcomes,” (p. 141) with no single risk factor or specific combination having a greater influence on the outcome. Therefore, within the model, outcomes are determined by the accumulation of risk, not by: (a) any one specific risk factor, (be) a specific number of risk factors, or a specific combination of risk factors (Sameroff & Fiese).

There are several reasons the cumulative risk model (Sameroff & Fiese, 2000) should be explored as a viable model to investigate undergraduate student outcomes. The model can account for the various independent risk factors, which have been identified within the student retention literature to increase the risk of departure (e.g., family background characteristics, minority status). The cumulative risk model may be used to explain why the study of isolated variables do not inform effective institutional action (e.g., economic status, demographics, social activity, academic discipline, emotional control, etc.). However, in addition, the model can be
used to investigate protective factors, which are factors that are associated with better outcomes within the context of risk (Wright & Masten, 2005). Within the context of the cumulative model, the investigation of protective factors provides valuable information about variables that may moderate risk.

One particular variable that is modifiable and has the potential to impact student outcomes is moderate to vigorous physical activity. The benefits of exercise are numerous. The staff of the Physical Activity Guidelines Advisory Committee (PAGAC; 2008) reported that participation in exercise can reduce the risk of: (a) coronary heart disease; (b) high blood pressure; (c) stroke; (d) type 2 diabetes and metabolic syndrome; (e) some cancers, particularly colon and breast cancer; and (f) depression, while the quality of sleep and health-related quality of life is improved. Physical activity has been investigated as a correlate of academic performance, at the primary- and secondary-level with mixed results (e.g., London, & Castrechini, 2001; Singh, Uijtdewillingen, Twisk, van Mechelen, & Chinapaw, 2012). While there is far less research on young adults the association between physical activity, exercise, and fitness, and cognition, brain function, and mood have been supported (Brown et al., 2012; Davis et al., 2011; Donnelly & Lambourne, 2011; Guiney & Machado, 2013; Roberts, Freed, & McCarthy, 2010; Voss et al., 2011). Alterations in brain function related to cognition and mood may indirectly affect the interactions between the student and the institutional environment. Given the body of research, it is possible that physical activity functions as a protective factor for those students experiencing various risk factors.

Findings from this study are likely to contribute to both the undergraduate student retention literature and the cumulative risk literature by investigation of the interaction between cumulative sociodemographic risk and physical activity as a predictor of institutional
commitment. The focus of the remainder of this chapter is on: (a) the historical, social, and theoretical context for this study, (b) the purpose and significance of this study, and (c) the proposed research questions. Finally, this chapter will identify and define all relevant variables and discuss the assumptions and limitations.

**Background**

The cost of a college student who does not persist to degree completion is not isolated to the student alone. Staff of the American Institute for Research (2010) reported that between 2003 and 2008, states appropriated almost $6.2 billion to colleges and universities to help pay for the education of students who did not return for a second year, and $1.4 billion in grant money to students who did not return to school. In addition, the Federal government gave over $1.5 billion in grants to students who did not return. The Bureau of Labor Statistics (2011) found that individuals with a college degree earned on average twice what individuals without a college degree earned per week, which has obvious implications related to the socioeconomic status (SES) of the individual. Based on this information, all U.S. citizens are impacted when college students fail to earn a degree.

**Undergraduate Retention Theory and Research**

Through more than 50 years of research on undergraduate student retention, multiple theories have developed as frameworks to guide research related to undergraduate student persistence (Astin, 1984; Bean, 1983; Spady, 1970; Tinto, 1975). While all theories have been criticized for inadequacies, each has contributed to the body of knowledge related to undergraduate student persistence and has served as a catalyst for research (Bean, 1983; Bean & Metzner, 1985; McQueen, 2009; Tinto, 1975; 2006).
Two early theories about student retention (Spady, 1970; Tinto, 1975) are grounded in suicide theory. Tinto credited Spady for being the first to apply the theory of suicide to undergraduate dropout, but reported that it was necessary to expand Spady’s theory. Tinto believed Spady’s theory only described undergraduate dropout and was not robust enough to predict retention. Tinto expanded Spady’s theory in order to provide a framework that would allow for research to go beyond explanation of the dropout process, and investigate factors that could predict dropout before it occurred. Thus began the shift from descriptive theories to the theories of today that attempt to identify predictors of retention. Tinto’s theory suggested that insufficient integration and values, which were incongruent with those of the institution, would lead to low commitment and increase the risk of departure. The model proposed by Tinto, entailed a longitudinal process in which experience within the system and individual characteristics resulted in continual modification to goals and institutional commitment. These modifications where what Tinto believed determined continued enrollment or dropout.

Bean (1979) developed a theory derived from organization theory of employee turnover to address weaknesses he had identified in Tinto’s (1975) theory. Bean depicted a longitudinal model where satisfaction was regulated by background characteristics and institutional determinates. Bean proposed that satisfaction then influences institutional fit, which alters intent to persist and subsequent departure. The most recent shift in retention theory began in 2006, when Tinto (2006) called for theory that would allow not only for prediction of student retention, but also for institutional action.

Despite variations in theories, several determinants have consistently been found to either moderate the associations or account for variance within investigational models of undergraduate persistence behaviors. Sawyers (2013) supported high school GPA and college admissions tests
as the best predictors of college success. In addition, gender and age have been shown to moderate associations and explain differences within retention research (Buchmann & DiPrete, 2006; Schofield & Dismore, 2010; Scott, 2005). As such, these variables are frequently controlled for within research designs (e.g. Friedman & Mandel, 2011; Pascarella & Terenzini, 1980; Ma & Cragg, 2013).

**Institutional Commitment**

The findings from retention research are of particular relevance to the staff of institutions of higher education as retention and graduation rates are now being used as an indication of institutional effectiveness. According to the staff of the College Board (2009) not only are graduation rates used at the Federal and State level to evaluate effectiveness, but also at the public level. The U.S News and World Report’s (2012) annual report on *America’s Best Colleges* uses graduation and retention rates as part of its college and university ranking system. For these reasons, the College Board staff (2009) stated that “[i]nstitutions need a deeper understanding of the student-institution interaction from which student persistence arises” (p. 2), and called for continued research related to undergraduate student retention, specifically at an institutional level.

The statement made by the College Board (2009) clearly placed the burden of responsibility on institutions to manage undergraduate student attrition. Specifically, the focus of the College on the student-institution interaction implies that the student characteristics must be considered in the context of an institution. Additionally, the dynamic mutual effect exerted on and by both student and institution must also be considered. Persistence behaviors (i.e., reenrollment) are often employed in research designs as an outcome measure; however, persistence behaviors do not necessarily imply persistence to degree or non-persistence to degree
(Hagedorn, 2012; Woosley, Slabaugh, Sadler, & Mason, 2005). As such, persistence behaviors do not provide institutions with information related to the student-institution interactions, which can alter persistence outcomes, since the focus is on a past behavior (Cabrera, Nora, & Castaneda, 1993). Instead, institutional staff must investigate intervention strategies that focus on variables that are both strong predictors of predispositions to withdraw and can be manipulated (Cabrera et al., 1993).

Institutional commitment may then be a better measure of retention than persistence behaviors as it is related to the student-institution interaction. This construct has been identified in several student retention theories (Bean, 1975; Bean & Metzner, 1985; Braxton & Lee, 2005; Cabrera, Castaneda, Nora & Fossella, 1992; Pascarella & Terezini, 1980; Terenzini, Wendell, & Pascarella, 1981; Tinto, 1975), and numerous researchers support the predictive nature of the association between institutional commitment and student persistence behaviors. Additionally, several authors have evidenced the effects that institutional commitment exerts on persistence behaviors, with some research evidencing institutional commitment as a mediator between some predictive variables (e.g., social or academic integration) and persistence behaviors (Cabrera et al., 1992; Pascarella & Terezini, 1980; Terenzini et al., 1981; Tinto, 1975).

Currently, there is no widely accepted measure of institutional commitment; however, Davidson, Beck, and Milligan (2009) defined institutional commitment as “the extent to which students are confident in and satisfied with their selection of college or university” (p. 374). This conceptual definition aligns with both Tinto’s (1975) and Bean’s (1979) theories (Nora & Cabrera, 1993). Key components of the construct identified by Davidson et al. (2009) as being recurrent across multiple studies are (a) students’ intentions to re-enroll and earn a degree from a given institution, (b) students’ confidence in having selected the right institution, and (c)
students’ thoughts of continuing or stopping their progress toward the degree. These components effectively capture varying dimensions of institutional commitment: (a) certainty of choice, and (b) intent to persist. Specifically, institutional fit, a component of institutional commitment identified by Bean (1985), measures student confidence in his or her choice. Intent to persist was first utilized as a construct of institutional commitment by Pascarella and Terezini (1980), and it also has been suggested as an indicator of institutional commitment (Woosley, Slabaugh, Sadler, & Mason, 2005).

**Cumulative Risk**

Transactional development theory (Sameroff & Fiese, 2000) is a framework utilized within developmental research, in which it is maintained that developmental outcomes are the result of dynamic and reciprocal interactions between an individual and the environment (Sameroff & Fiese, 2000). From the transactional development theory, the cumulative risk model was developed. Research that uses the cumulative risk model and the associated cumulative risk index was initiated in 1979 when Rutter (1979) suggested that it was not any single risk factor that determined poor psychiatric outcomes, but rather the total number of risk factors. Modeling their study after Rutter’s earlier work, Sameroff, Seifer, Zax, and Barocas (1987) extended the model to include additional risk variables and outcomes. The findings of Sameroff, Seifer, Zax, and Barocas were consistent with the work of Rutter, and further evidenced that it is the cumulative nature of risk that determines outcomes, not a specific risk or a specific combination of risks (Sameroff, Seifer, Baracas, Zax, & Greenspan, 1987).

Within the cumulative risk model, risk is utilized as a group or population term that represents an elevated probability of negative outcomes (Wright & Masten, 2005). Risk factors only imply that a group of individuals possessing the risk factor are less likely to exhibit
developmental competence, but does not identify which individual(s) considered at risk will experience a negative outcome (Wright & Masten). Related to risk is the concept of resilience. Resilience is the pattern of positive adaptation under the circumstances of past or present adversity, which is a key factor in judging an individual’s resilience being “success in age-salient developmental tasks” (e.g., graduating from college) (Wright & Masten, 2005, p. 21). Resilience is dynamic, varies by context, and determines the ability to persist within a system of change (Holling, 1973; Rutter, 1987). Developmental research that is focused on resilience often focuses on protective factors, that is, factors that predict better outcomes, particularly in the context of risk (Wright & Masten).

Utilization of the cumulative risk model to investigate undergraduate student institutional commitment is justifiable for several reasons. First, while frequently this model is used to study children, development occurs throughout the life span and is often evaluated through the completion of developmental tasks. Havighurst (1956) identified developmental tasks according to (a) physical maturation, (b) cultural expectations, and (e) individual values by age. Within the developmental research literature, educational attainment is frequently utilized as a developmental task throughout the lifespan of a person, with high levels of childhood cumulative risk being found to negatively impact adult outcomes (e.g., Campbell et al., 2012; Gutman, Sameroff & Cole, 2003; Sroufe, Egeland, Carlson, & Collins, 2005).

Second, the model can be used to account for multiple variables identified as risks within the literature. These factors are associated with an increased risk of attrition. Accounting for multiple variables is important as isolated variables (e.g., economic status, demographics, social activity, academic discipline, emotional control, etc.) are limited in their utility in informing effective institutional action. Third, the cumulative risk model is a viable model that can identify
protective factors that may reduce risk. The ability to identify protective factors is important for institutions, because these factors can inform intervention practices. Identification of protective factors can inform interventions by providing insight into the modifiable variables that can buffer risk and will increase institutional commitment.

**Moderate and Vigorous Physical Activity**

Researchers (Efrat, 2011; Keating, Castelli, Ayers, 2013; Matta et al., 2013) have found positive associations between physical activity and brain function that impact: (a) cognitive performance, (b) academic performance, and (c) affective response. While there is no consensus within the literature on the amount of physical activity required to produce an effect (i.e., dose-response relationship), there is consistent evidence (Bauman et al., 2012; Lee et al., 2012) that links sedentary behaviors, lack of activity, and poor outcomes. Given the positive effects of physical activity for all individuals, there is reason to investigate physical activity as a potential protective factor to determine if levels of physical activity may moderate the risk. Physical activity is a modifiable behavior with the potential to influence variables that directly impact persistence behavior; therefore, physical activity should be explored as a protective factor.

**Problem Statement**

McQueen (2009) reported that research is being conducted worldwide to better understand the predictors of undergraduate student outcomes. Specifically, university administrators and researchers are interested in studying undergraduate student retention, as it has implications for both the student and the institution (Allen et al., 2008; American Institute of Research, 2010; Bauman et al., 2012; Bureau of Labor Statistics, 2011; College Board, 2009; Eisenberg et al., 2012; McQueen, 2009; Weng, Cheong, & Cheong, 2010). There is a need for a model of institutional action that allows institutions to translate research on student retention into
effective interventions to increase student persistence to degree (College Board, 2009; Tinto, 2006). In order to inform interventions the focus must be on modifiable variables that have been identified within the literature to influence student decisions related to persistence behaviors. Institutional commitment is the degree to which students are confident in and content with their selection of college or university (Cabrera Castaneda, & Fossella, 1992). Institutional commitment has been found to be a precursor of persistence behaviors having both direct and indirect effects on persistence decisions (Bean, 1975; Braxton & Lee, 2005; Cabrera, Castaneda, Nora & Fossella, 1992; Pascarella & Terezini, 1980; Terenzini, Wendell, & Pascarella, 1981; Tinto, 1975). Investigating variables that may alter institutional commitment may provide insight into interventions that could potentially increase institutional commitment. This current study used cumulative risk and incorporated it within a model to predict institutional commitment of undergraduate students. Moreover, this model has the ability to examine the role of moderate and vigorous physical activity as a protective factor (i.e. moderator) for students experiencing various levels of risk. Specifically, high risk would be associated with low institutional commitment; however, high reports of physical activity would buffer the impact of risk. Such a model would help identify a potential mechanism to increase institutional commitment, a determinant of persistence behaviors, and provide valuable information related to institutional intervention programs (Bean, 1975; Braxton & Lee, 2005; Cabrera, Castandeda et al., 1992; Davidson et al., 2009; Pascarella & Terezini, 1980; Terenzini et al., 1981; Tinto, 1975).

Purpose Statement

The theory that will be used within this study is the cumulative risk model. The theory was developed by Rutter (1979) and was used to study development, specifically as it relates to developmental psychopathology and intervention (Sameroff & Fiese, 2000; Sameroff &
In the cumulative risk model, it is suggested that there is no single risk factor or any specific combination of risk factors that determined poor outcomes, but rather the number of total risk factors experienced by an individual (Sameroff & Feise, 2001). As applied to this study, it is maintained that cumulative risk holds that cumulative risk index scores will be associated with undergraduate student institutional commitment; the factors of: (a) gender, (b) age, (c) high school grade point average (GPA) and (d) ACT/SAT scores were controlled. In addition, moderate to vigorous physical activity was tested as a potential protective factor (i.e., moderator) of the association between cumulative risk and institutional commitment. The predictor variable of cumulative risk was defined as the sum of a number of socio-demographic risk factors that have been identified as salient in the literature (e.g., maternal education, transfer student status, minority student, English as a second language, among others) (Lee, Olson, Locke & Michelson, 2009; Sameroff & Fiese, 2000). The moderating variable of moderate and vigorous physical activity was generally defined as the amount of moderate to vigorous intensity physical activity engaged in by the student per week.

The criterion variable of student institutional commitment was defined as a student’s score on the Institutional Commitment subscale of the College Persistence Questionnaire (CPQ; Davidson et al., 2009). Gender, age, high school GPA, and ACT/SAT scores were included as covariates, in light of salient institutional commitment research.

**Significance of the Study**

It is anticipated that the findings from this study will help to fill several gaps within the undergraduate student retention literature. The cumulative risk model accounts for numerous risk factors already identified within the literature to affect undergraduate students’ persistence behaviors and persistence to degree. As many of the sociodemographic factors found to
negatively impact persistence behaviors cannot be changed (e.g., familial income, maternal and paternal levels of education), it is imperative that research seeking to inform interventions focus on how to modify precursors of the behavior, not on changing behavior that has already occurred (i.e. student departure that has already occurred). As such, a measure of institutional commitment, a modifiable construct evidenced to directly impact persistence behaviors, was an outcome variable in the study. (Bean, 1975; Braxton & Lee, 2005; Cabrera, Castaneda, Nora & Fossella, 1992; Davison, Beck & Milligan, 2009; Pascarella & Terezini, 1980; Terenzini, Wendell, & Pascarella, 1981; Tinto, 1975). Moreover, the cumulative risk model allows for the investigation of protective factors, which may moderate risk. A variable that may serve as a protective factor is moderate to vigorous physical activity. Physical activity has benefits far beyond its potential impact on institutional commitment. As a modifiable behavior, moderate to vigorous levels of activity could easily be utilized as an intervention strategy.

Research Questions

RQ1: Is there an association between cumulative sociodemographic risk and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores?

RQ2: Is there an association between moderate to vigorous physical activity and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores?

RQ3: Is the association between cumulative risk and institutional commitment moderated by moderate to vigorous physical activity, while controlling for gender, age, high school GPA, and ACT/SAT scores (see Figure 1)?
Hypotheses

H1: Building upon the cumulative risk literature, it is expected that students experiencing a high level of cumulative risk will exhibit low institutional commitment, while controlling for gender, academic level, high school GPA, and ACT/SAT scores.

H2: Given what research suggests about the benefits of physical activity on physical and socio-emotional outcomes, it is expected that there will be a significant positive association between moderate to vigorous physical activity and institutional commitment, while controlling for gender, academic level, high school GPA, and ACT/SAT scores.

H3: It is expected there will be a significant interaction between cumulative risk and physical activity in a model predicting institutional commitment, while controlling for gender, academic...
level, high school GPA, and ACT/SAT scores. Specifically, high levels of moderate to vigorous physical activity will serve as a protective factor for students experiencing high levels of risk.

**Null Hypotheses**

\( H_{01} \): The association between the cumulative risk index score and the institutional commitment subscale of the College Persistence Questionnaire (Davidson et al., 2009) will not be statistically significant, while controlling for gender, academic level, high school GPA, and ACT/SAT scores.

\( H_{02} \): The association between moderate to vigorous physical activity and institutional commitment will not be statistically significant, while controlling for gender, academic level, high school GPA, and ACT/SAT scores.

\( H_{03} \): Moderate to vigorous physical activity will not moderate the association between cumulative risk and institutional commitment, while controlling for gender, academic level, high school GPA, and ACT/SAT scores.

**Identification of Variables**

The predictor variables used in this study were the cumulative risk index score (Sameroff & Fiese, 1993) and a combined measure of moderate to vigorous physical activity. The cumulative risk index allows risk to be quantified into a continuous score, which is created by the summation of individual factors that alone have been found to lead to negative outcomes (Sameroff, Seifer, Baracas, Zax, & Greenspan, 1987). Although each individual risk has been associated with compromised outcomes, it is the sum of the risk factors that is most predictive of future outcomes (e.g., an individual having five identified sociodemographic risks will have a cumulative risk score of five, and will be at greater risk than an individual with a score of three) (Sameroff & Fiese, 2000). Presented in Chapter 3 is a more in-depth discussion of the
instrument. The variables, which will be summed to determine a student’s cumulative risk score, were: (a) race/ethnicity, (b) English as a second language, (c) current parenthood status (i.e. does the student have a child), (d) mother’s childbearing age as determined by the age at which the student’s mother had her first child, (e) student generational status as determine by both parents’ level of education as determined by their highest degree earned, (f) parents’ current marital status (i.e. are the student’s parents widowed, divorced, or never married), (g) number of siblings the student has in his or her family, (h) the student’s employment status, and (i) the student’s transfer status. All individual variables included must be associated with negative student outcomes, as dictated by the retention literature (Sameroff & Feise, 2000). The variables are discussed in greater detail in Chapter 2 as part of the review of literature and again in Chapter 3 as part of instrumentation. Relevant literature for each variable will be provided to support the use of each variable within the cumulative risk model.

The moderator will be a measure of combined moderate to vigorous physical activity. Physical activity will be determined by student responses on the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). The IPAQ is a self-report survey that collects information about the amount of time respondents spend in vigorous and moderate activity, walking, and sitting during the 7 days prior to the survey. Craig et al. (2003) conducted a validation study of the IPAQ in 12-countries. The one-week test-retest reliability was found to be approximately .80. The IPAQ allows for self-administration (identified as a preference of the participants within the study), and is a less costly means of collecting data than accelerometers, which could be an alternative measure, but which are expensive and subject to technical problems (Craig et al., 2003). Participants’ answers will be converted to total minutes of time
spent in moderate and/or vigorous physical activity over the 7 days prior to the participants’ completion of the survey.

The criterion variable will be each participant’s score on the Institutional Commitment Subscale of the College Persistence Questionnaire (CPQ). All subscales will not be used as the aforementioned subscale was found to be the most accurate subscale to predict retention without longitudinal data (Davidson, Beck, & Milligan, 2009). Davidson et al. suggested that Institutional Commitment scores can be used to identify at-risk students during the first year, as the data from the validation study showed it to be a reasonably accurate predictor of future attrition. Components of the subscale measure a student’s confidence in institutional fit and intention to persist (Nora & Cabrera, 1993; Pascarella & Terezini, 1980; Terenzini et al., 1981). The CPQ utilizes a 5-point Likert-type scale (Davidson et al.). Responses will then be converted to a favorability score with the extremes being ±2 and neutral being equal to 0 (Davidson et al.). Mean scores are calculated for each student, indicating their level of institutional commitment (Davidson et al.). Higher scores indicate greater institutional commitment, with less risk of departure, while lower scores indicate less institutional commitment and a greater risk of departure (Davidson et al.).

Several variables were statistically controlled for: (a) gender, (b) age, (c) high school grade point average (GPA) and (d) ACT/SAT scores. Student age will be controlled for based on literature that has suggested that age impacts retention rates (e.g., Schofield & Dismore, 2010; Scott, 2005). Further, research suggests that academic year and year of enrollment impact departure decisions (Allen et al., 2008; Duggan & Pickering, 2008; Krum et al., 2009; Ma & Cragg, 2013; Willcoxson, Cotter, & Joy, 2011). Some researchers posit that age is a better measure than academic year, as some first year students who many may consider freshmen are
enrolling with college credit and thus may be classified as sophomores (Allen, Robbins, Casillas, & Oh, 2008; Duggan & Pickering, 2008; Vaquera & Maestas, 2009). The SAT/ACT scores are included as control variables as these tests are correlated with general intelligence, and they have been associated with student retention (Frey & Douglas, 2004). In addition, high school GPA was employed as a covariate, since as it is a measure of academic behavior (Frey & Detterman, 2004; Reason, 2004; Sawyer, 2013). Finally, gender will be controlled for as studies have suggested the reasons undergraduate students drop out vary depending on gender (Bean, 1985; Tessema, Ready & Malone, 2012).

**Definitions**

**Persistence to Degree**
Completing bachelor’s degree within 6 years of matriculation.

**Persistence Behaviors**
Student measure of reenrollment the following semester (Cabrera, Nora, & Casteneda, 1993; Hagedorn, 2012)

**Intent to Persist**
A student’s beliefs that he or she will re-enroll the following semester (Cabrera, Nora, & Casteneda, 1993; Davidson et al., 2009)

**Retention**
An institutional measure of student re-enrollment (Hagedorn, 2012).

**Undergraduate Student Institutional Commitment**
For the purpose of this study, undergraduate student institution commitment was defined as the score calculated by the Institutional Commitment subscale of the CPQ. Items addressed by the Institutional Commitment subscale are related to the student’s confidence in the current
university being the right fit, the likelihood the student will not only reenroll, but will earn his or her degree at the current university (Davidson et al., 2009). Validations studies demonstrated an association between persistence behaviors and institutional commitment (Davidson, Beck, & Milligan, 2009).

**Risk**

Risk indicates an increased probability of a negative outcome (Wright & Masten, 2005).

**Risk Factor**

Any measurable group characteristic or situation that predicts undesirable outcomes on a specific outcome criteria (Wright & Masten, 2005).

**Resilience**

Resilience determines the capacity to persist within a system in the presence of change (Holling, 1973). As such, resilience is the phenomenon of positive adaptations that contribute to good outcomes despite a context of risk (Masten, 2001). Resilience is not a fixed attribute, as it can change as circumstances change (Rutter, 1987).

** Cumulative Risk**

The concept that no single factor or specific combination of factors is capable of producing negative or positive outcomes, rather the power of a factor lies in the accumulation of individual factors (Sameroff & Fiese, 2000). Therefore, cumulative risk will be defined as the sum of risk conditions experienced by the participant (Sameroff, Seifer, Zax, & Barocas, 1987).

**Protective Factor**

Protective factors are any factor that predicts better outcomes, particularly in the context of risk (Wright & Masten, 2005).
Physical Activity

Physical activity was defined as any body movement produced by skeletal muscles that results in energy expenditure and comprises all movement as part of exercise, leisure-time activity, sports, household tasks, work and sleep, as measured by the IPAQ (Caspersen, Powell & Christenson, 1985). Moderate to vigorous levels will be subjective measures of the total time per week subjects performed activity lasting for no less than 10 minutes at a time. Moderate physical activity is considered any activity that causes breathing to be somewhat harder than normal, and could include carrying light loads, bicycling at a regular pace, or doubles tennis, but not walking (Craig et al., 2003). Vigorous activity is considered any activity that causes breathing to be much harder than normal, and could include heavy lifting, digging, aerobics or fast bicycling (Craig et al., 2003).

Research Summary

Non-experimental correlational design has been utilized in many studies investigating student retention (e.g., Allen, Robbins, Casillas, & Oh, 2008; Duggan & Pickering, 2008; Friedman & Mandel, 2011; Hartley, 2011; Mattern & Shaw, 2010). The purpose of the current study was to identify predictors of institutional commitment in order to identify students who are at risk of dropout. Ultimately, it was the goal of this study to provide insight into potential institutional interventions. These goals align with a correlational design (Gall et al., 2007). Surveys were used to obtain data related to the predictor, criterion, and control variables. A hierarchical regression model was used to investigate the associations between the predictor (i.e., cumulative sociodemographic risk) and criterion (i.e., institutional commitment) variables, as well as and the effect of the moderator (i.e., moderate to vigorous physical activity).
Summary

A non-experimental research study design was used to determine if a theoretical model was suitable for investigating undergraduate student institutional commitment. Furthermore, moderate to vigorous physical activity was investigated as a protective factor, which may help promote institutional commitment for those students who experience multiple risk factors. It was anticipated that this study would contribute to the undergraduate retention literature by the: (a) evaluation of the cumulative risk model as a predictor of institutional commitment, and (b) provision of insight into one potential mechanism (i.e., physical activity) for promotion of institutional commitment and buffering the impact of cumulative risk for students.
CHAPTER TWO: REVIEW OF THE LITERATURE

Introduction

Provided in Chapter Two is a review of selected literature related to: (a) undergraduate student institutional commitment, (b) cumulative risk, and (c) physical activity. The literature review will provide a summary and critique of current research that explores undergraduate student institutional commitment. In addition, cumulative risk is discussed as a corollary of Transactional Developmental Theory (Sameroff & Fiese, 2000), which is informed in a broader context by bioecological theory (Bronfenbrenner & Morris, 2006). Next, a discussion of resilience as it relates to risk and protective factors will be presented. Finally, a justification is provided for the risk factors selected for use within the cumulative risk model, as well as the potential for moderate to vigorous physical activity to serve as a protective factor within this population.

Retention and Institutional Commitment

While the terms student retention and persistence are used often as an undergraduate student outcome within the educational literature, there is no consensus on how to operationally define student retention or persistence, as each measure has flaws related to validity (Hagedorn, 2012). The flaws are inherent because of enrollment patterns that frequently occur and are not consistent with the basic definition of persistence (i.e., enrollment in college and continued enrollment until completion of a degree) (Hagedorn). Some common challenges to the retention definition include: (a) a student who enrolls at an institution for a year and stops enrollment for 1 year and then returns to complete the degree, (b) a student who enrolls at one institution and then transfers to another institution to complete the degree, or (c) a student who enrolls with a full-time load and then drops all but one course (Hagedorn; Tinto, 1975). Furthermore, persistence
and retention are not synonymous constructs as persistence is a student measure; whereas, retention is an institutional measure (Hagedorn). Therefore, retention research is concerned with enrollment at a given institution until completion of degree, whereas persistence is a student level measure and does not imply a student will graduate, only persist (Hagedorn).

Institutional commitment is identified in the literature as a component of persistence known to predict intent to persist and persistence behaviors (e.g., continued academic progress; [Tinto, 1975; Bean, 1979]). The focus of the institutional commitment construct is on continued enrollment at a given college or university, which is influenced by the “background characteristics and individual attributes…the individual brings with him [or her] into the college environment” (Tinto, 1975, p.96). Institutional commitment does not require distinction between types of departure and behavior (Bean, 1985; Tinto, 1975). Thus, institutional commitment provides institutions with a student measure that is institution-specific.

**Theoretical Frameworks**

**Retention Research.** Within the undergraduate retention literature, several theories provide the framework for investigation (Astin, 1984; Bean, 1983; Bean & Metzner, 1985; Spady, 1970; Tinto, 1970), and each theory was developed as a way to address the inadequacies of the previous theories. The inadequacy of the current undergraduate student retention theories, however, is a problem that is still discussed within the literature. McQueen (2009) pointed out a lack of reference to the affective experience of being a student within student attrition theories. Student demographics are also changing. Staff of the National Center for Educational Statistics (NCES) has found that nontraditional students constitute more than half of the student population (NCES; 2002, 2011), a population that renders many theories irrelevant (Bean & Metzner, 1985).
Tinto (2009), credited for developing one of the most widely utilized theories of undergraduate departure, criticized all current theories of student attrition, including his own, when he stated,

In a world of action, what matters are not our theories per se, but how they help institutions address pressing practical issues of persistence. Unfortunately, current theories of student leaving are not well-suited to that task. . . . for example, that student high school experiences and family context influence persistence in college, such knowledge is less useful to institutional officials because they often have little immediate control over student prior experiences or private lives...it does not tell the institution either how to effectively tap into issues of family context or whether such actions, relative to possible actions, are more likely to yield the outcomes of increased persistence that it desires. (p.6)

Despite the inadequacies, two major theories have been utilized frequently as the underpinning of retention research worldwide, Tinto’s (1975) student integration model and Bean’s (1979/1983) student attrition model (Berger, Ramirez, & Lyons, 2012; Cogen, 2010; Hagedorn, 2012; Le et al., 2005; Nora & Cabrera, 1993; McQueen, 2009; Robbins et al., 2009; Vaquera & Maestas, 2009). The theory most often used within the research is Tinto’s (1975) model (Berger, Ramirez, & Lyons, 2012; Hagedorn, 2012; Morrison & Silverman, 2012). Developed from suicide theory, Tinto’s (1975) theory of student departure is focused on student integration and it is theorized that it is the student’s interactions, or lack of interactions, with the institution that determine attrition and retention. Bean’s (1979) theory of student attrition is based upon a theory of employee turnover and posits that student attrition is similar to employee turnover, where ultimately satisfaction or dissatisfaction dictates persistence and non-persistence.
Tinto’s theory of student departure. Tinto (1975) held that inadequate conceptualizations of dropout from higher education (e.g., inadequate definitions of dropout and descriptive theory that did not explain the process) were having a notable impact on questions of policy in higher education as it is related to: (a) identification of students at-risk, (b) provision of adequate interventions, and (c) establishment of admission and transfer standards. In light of previous research by Spady (1970), Tinto (1975) viewed college as its own social system with social structures and values. This perspective led Tinto (1975) to view social conditions that affected dropout similarly to how social conditions affect suicide in the wider social system. Specifically, Tinto’s (1975) theory posited that interactions that were insufficient and values that were not congruent with the value patterns of the institution would lead to low commitment to the system. Low commitment to the system would increase the probability of leaving the institution (Tinto, 1975). Insufficient interactions and value congruence could occur in either the academic or social domains of the institution, in that an individual could be integrated sufficiently in one domain without being integrated into the other domain (Tinto, 1975). The distinction between the academic and social systems of an institution allows for different types of departure (i.e. academic suspension/dismissal versus voluntary withdrawal) to be considered when adequate integration is achieved in one domain, but not the other (Tinto, 1975).

Further, Tinto (1975) further argued that the application of suicide theory to dropout was not adequate for a predictive theory of dropout, because suicide theory only explained the conditions under which dropout may occur, but could not explain how individuals adopted the dropout behavior. Therefore, Tinto’s (1975) model considered individual characteristics and dispositions pertinent to education such as: (a) background characteristics (e.g., family background, social status, high school experiences, community of residents); (b) individual
attributes (e.g., sex, ability, race/ethnicity); and (c) educational expectations (e.g., goal commitment and institutional commitment). As part of the model, Tinto (1975) defined goal commitment as the psychological orientations the individual brings into undergraduate college setting (e.g. the expectation of completing a doctoral program), and institutional commitment as educational expectations that involved specific institutional components. The final model depicted a longitudinal process of interactions between the student and the academic and social domains of the institution (Tinto, 1975). As part of the process, experience within the system resulted in continual modification of goal and institutional commitments, which determined continued academic persistence and/or some form of dropout (Tinto, 1975).

**Bean’s model of student attrition.** Bean (1979) began to develop a theory of student attrition in order to address “serious weaknesses” (p. 5) within studies at the time. Namely, Bean stated that the studies were not inclusive of the major determinants already identified within the literature. The researchers failed to distinguish between the analytic variable and demographic correlates. Most importantly, the definitions used within the analysis made the models unsuitable for path analysis as attention was not given to the directional causality of the model or discreteness of the variable (Bean, 1979). To address these weaknesses, Bean (1979) developed a causal model that adapted theory of employee turnover in a work organization and applied it to undergraduate student attrition, where turnover was analogous to attrition.

Within Bean’s (1979) model, organization/institutional determinants affect satisfaction. Satisfaction influences organization/institutional commitment, which impacts turnover/dropout (Bean, 1979). Where employee satisfaction is significantly impacted by pay, Bean (1979) suggested GPA and the usefulness of the education received to employability as surrogates, which significantly impact undergraduate satisfaction. Through a longitudinal process,
background characteristics of the student (e.g., past academic achievement and socioeconomic status) and organizational determinants (e.g., student perceptions of academic progress, practical value of the education, communication, and area of study, undergraduate GPA, and goal commitment) would modify satisfaction (Bean, 1979). Within the model, satisfaction impacts institutional commitment (i.e. a student’s degree of loyalty), and satisfaction and institutional commitment directly impacting persistence or dropout (Bean, 1979). Bean (1983) later published the model as an article for the Review of Higher Education with modifications whereas institutional commitment was no longer part of the model and satisfaction influenced intent to leave (i.e., the estimated likelihood of discontinuing) and intent to leave directly affected dropout.

**Integrated model of student attrition.** Cabrera, Castaneda, Nora, and Hengstler (1992) investigated the convergent and discriminant validity between the theories of Tinto (1975) and Bean (1983). The results indicated that both theories were correct in the sense that college persistence was the result of a complex set of interactions among personal and institutional factors where the outcome is based on a successful match between a student and the institution (Cabrera, Castaneda, Nora, & Hengstler, 1992). Tinto’s model was found to be more robust as 70% of the hypotheses related to the model were confirmed, while only 40% of Bean’s (1985) hypotheses were confirmed. Cabrera et al. (1992) noted, however, that Bean’s model accounted for more variance in both the intent to persist and persistence. The findings from the Cabrera et al. study supported the two theories of student attrition, but there were still apparent insufficiencies in the two models, as neither theory could provide a comprehensive explanation of retention variance. As a result of these findings, Cabrera et al. (1993) tested an integrated model of student retention. The findings from the study suggested that a combination of Tinto
(1979) and Bean’s (1979/1983) theories provided better understanding of the dropout process. As part of the integrated theory, it is the interaction among the individual, environment and institution that impacts the social and academic experience of a student, which modify institutional and goal commitment, which in turn modify intent to persist and persistence (Cabrera et al., 1993). Cabrera et al. provided evidence that the inclusion of multiple characteristics, which represent interactions between the individual and the environment, were better able to inform research. Additionally, the findings underscored the need for the administrators within the institution to focus on those modifiable variables that are highly predictive of intent to re-enroll/withdraw instead of focusing on behavior that have already occurred (Cabrera et al., 1993). Taken together, the theories of Bean (1979), Cabrera et al., Tinto suggested there is a need to consider variables that are indicative of the longitudinal interactions between student and institution and impact persistence behaviors, such as institutional commitment.

**Institutional Commitment**

Within the framework of both Spady (1970) and Tinto (1975), Pascarella and Terenzini (1980,) and later Terenzini, Lorang, and Pascarella (1981), investigated the predictive validity of a measure constructed to assess institutional integration. Five integration subscales were used to operationalize the academic and social dimensions of institutional integration (peer group interactions, interactions with faculty, faculty concern for student development and teaching, academic and intellectual development, and institutional and goal commitments) (Pascarella & Terenzini; Terenzini et al.). In the both studies initial institutional and goal commitment were measured as a single 6-item Likert-type subscale (Pascarella & Terenzini; Terenzini et al.). Four questions were related to institutional commitment and two were related to goal commitment.
The four questions within the subscale related to institutional commitment were as follows: (a) It is important for me to graduate from college; (b) I am confident that I made the right decision in choosing to attend this university; (c) It is likely that I will register at this university next fall; (d) It is not important to me to graduate from this university (Pascarella & Terenzini, p.67). In both studies, the responses to the institutional/goal commitments subscale made the largest significant (\( p < .01 \)) contribution to group distinction between departure and reenrollment after controlling for covariates and the other integration subscales (Pascarella & Terenzini; Terenzini et al.).

Later, Pascarella and Chapman (1983) later conducted a multi-institutional study on the path analytic validity of Tinto’s (1979) model. In this study, institutional commitment was measured with the use of the Pascarella and Terenzini (1980) items, but without the use of intent (Pascarella & Chapman, 1983). The findings of the study suggested that social and academic integration did not directly influence persistence behaviors, but did have an indirect effect on persistence behaviors through institutional commitment (Pascarella & Chapman, 1983).

Nora and Cabrera (1993) performed a confirmatory factor analysis on the construct of institutional commitment to address inconsistencies within measurements. The findings of the suggested that institutional commitment could be broken into two groups of indicators: (a) a general factor group (e.g., institutional quality, practical value and utility of an education, student-institutional fit); and (b) affinity of values (i.e., similarity of values) (Nora & Cabrera). Also, Nora and Cabrera (1993) tested the predictive validity of each subcomponent on varying outcomes related to student persistence. Of particular interest was Nora and Cabrera’s use of intent to persist as an outcome variable, rather than part of the institutional commitment construct. Nora and Cabrera operationalized intent to persist from Pascarealla and Terenzini’s
(1980) institutional and goal commitment scale (i.e., Likert-type item asking “It is likely that I will register at this university next fall” p. 73). The outcomes indicated that institutional commitment had a direct effect on intent to persist and on actually persistence behaviors (Nora & Cabrera, 1993). However, affinity of values was not as equally predictive of persistence, providing additional evidence of a multidimensional construct (Nora & Cabrera, 1993).

In a similar manner to Nora and Cabrera (1993), Braxton, Milem, and Sullivan (2000) used intent to persist as an outcome measure in a study, in which they investigated active learning on the college student departure as part of Tinto’s (1975) student departure theory. Specifically, Braxton et al. (2000) investigated the influence of active learning on social integration, subsequent institutional commitment and student departure decisions (i.e. intent to persist) (Braxton, Milem, & Sullivan, 2000). The subsequent institutional commitment scale was also a Likert-type scale related to statements such as: (a) “it is not important to graduate from this university,” (b) “I am confident I made the right decision to attend this university,” and (c) “I am sure that this university is the right place for me” (Braxton, Milem, & Sullivan, 2000, p. 575). The findings from the path analysis demonstrated that subsequent institutional commitment exerted positive effects on departure decisions (Braxton, Milem, & Sullivan, 2000).

A follow-up study was performed by Braxton, Jones, Hirschy, and Hartley (2008) to replicate and extend the previous work of Braxton et al. (2000) by the use of actual student persistence behaviors (i.e., reenrollment the following semester) at multiple institutions (all religiously affiliated). Additionally, the subsequent institutional commitment subscale was a composite of only two Likert-type scale questions, which were related to making the right decision and the importance of graduating from the university (Braxton et al., 2008). Also, it should also be noted that one of the participant universities reported persistence behaviors with
responses related to intent to persist instead of actual persistence behaviors (Braxton et al., 2008). Results of the four hierarchical regression analyses revealed a positive relationship between social integration and subsequent institutional commitment, and subsequent institutional commitment on persistence behaviors (Braxton et al., 2008). These findings supported the previous findings of Braxton, Milem, and Sullivan (2000) (Braxton et al., 2008).

In their development and validation of the College Persistence Questionnaire, Davidson, Beck, and Milligan (2009) identified recurrent elements, which were utilized across multiple studies in regard to the failure of previous studies to produce a widely accepted measure of the construct to use as part of the institutional commitment subscale. The items identified to measure the extent of confidence in and satisfaction with an institution were: (a) intentions to re-enroll and earn a degree at the institution, (b) confidence in having selected the right institution, and (c) the amount of thought given to stopping enrollment at the institution in favor of transfer, work, or other reasons (Davidson et al.). Validation studies identified the institutional commitment subscale as a significant ($p < .01$) predictor of persistence behaviors (Davidson et al.).

Davidson et al. (2009) used intent to persist as a component of the composite institutional commitment score, rather than its own construct, which mirrored the work of Pascarella and Terenzini (1980). While it could be argued that intent to persist is a construct independent of institutional commitment, given the associations between the constructs when investigated independently (e.g. Braxton, Milem, & Sullivan, 2000; Nora & Cabrera, 1993), it may be warranted to conduct studies, in which intent is used as a measure of institutional commitment. The inclusion of intent to persist is particularly relevant given the multitude of enrollment
patterns, which result in persistence to degree that may not always be captured through traditional measures of persistence behaviors such as stop-outs.

Woosley, Slabaugh, Sadler, and Mason (2005) investigated the nature of stop-outs, which is a term used to describe students who withdraw from an institution and subsequently reenroll. Specifically, Woosley et al. (2005) investigated the extent to which goals, commitments, and intent to reenroll predicted reenrollment. Commitments were measured by use of a Likert-type scale in order to assess students’: (a) plan to continue education (i.e., educational commitment); (b) overall impressions of the institution; and (c) how the institutions ranked among the choices of institutions the student selected from (i.e., institutional commitment) (Woosley, Slabaugh, Sadler, & Mason, 2005). Also, intent was also measured using a Likert-type scale in response to a statement related to plans to reenroll after withdrawal (Woosley et al., 2005). Reenrollment was determined using university records with students classified as reenrollers if they registered for classes within 4 semesters following withdrawal (Woosley et al., 2005). The sample was comprised of 995 students of the 1,172 who had officially withdrawn from the university (Woosley et al., 2005).

Students who had higher levels of commitment were found to be more likely than students with lower levels of commitment to have intentions to reenroll (Woosley et al., 2005). Woosley et al. (2005) concluded that poor institutional commitment was apparent when students responded with uncertainty or negatively on the item relating to reenrollment. Furthermore, students who indicated intent to reenroll were more than five times more likely to do so than students who did not (Woosley et al., 2005). In interpreting these findings, Woosley et al. (2005) concluded that despite the distinction between intentions and behaviors, from an application/practice standpoint within the longitudinal process of persistence to degree, what students plan
for themselves may provide reliable information. As a dynamic variable known to influence persistence behaviors, institutional commitment is a logical variable to utilize as an outcome variable within research related to interventions aimed at promoting persistence behaviors.

**Risk and Resilience**

Once thought to be a phenomenon experienced by remarkable individuals with extraordinary capacity, Masten (2001) reported that, during the last 40 years of research, the *ordinary* nature of resilience has been demonstrated. Resilience is the positive adaption and development of an individual in response to a demonstrable risk (Masten; Masten & Wright, 2010; Rutter, 1987; Wright & Masten, 2005). The construct of resilience requires two kinds of judgments: (a) the presence of risk, and (b) assessment of the quality of the adaptation or developmental outcome as good (Masten,). Within this context, risk is considered a population term, which implies there is an increased likelihood of an undesirable problem or outcome (Wright & Masten).

A risk factor is a measurable factor that predicts negative outcomes for a specific outcome measure, which can include any type of adversity or experience, whether chronic (e.g., poverty, dysfunctional parent) or acute (e.g., acts of violence, natural disasters), that can threaten the accomplishment of a developmental task (Masten & Wright, 2010; Wright & Masten, 2005). Based on her extensive research and knowledge in the field, Masten (2001) maintains that the greatest risks are those risks that endanger the systems that produce these positive adaptive processes such as: (a) cognition, (b) regulation of emotion and behavior, and (c) the motivation for learning and engaging in the environment. Each of the positive adaptive processes identified by Masten (2001) is known as a correlate to persistence to degree within the undergraduate student retention literature (e.g., Allen, Robbins, Casillas, & Oh, 2008; Devonport & Lane, 2006;
Key Concepts of Risk and Resilience Research

Typically, the research on risk and resilience is focused on investigating risk factors and protective factors as a means to develop interventions that can foster resilience. Risk factors are defined as characteristics of a population that predict negative outcomes (Wright & Masten, 2001). Protective factors are processes or mechanisms that moderate risk and show stronger effects at higher levels of risk, meaning the effect may only matter in the presence of risk (Rutter, 1987; Wright & Masten, 2005/2010). In the next section, key research on risk, specifically cumulative risk, and protective factors will be discussed.

Cumulative Risk Score

The theoretical framework for cumulative risk index is found in the bioecological model, a theoretical system used to guide the study of human development over the life course (Bronfenbrenner & Morris, 2006). Within this model, there are four identifying properties: (a) process, (b) person, (c) context, and (d) time (2006). Process is “the core of the model” (p. 795) and involves proximal processes, which are particular forms of interaction between the individual and the environment that allow an individual’s genetic potential to be actualized (Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris). The power of any given proximal process to affect development is dependent upon the characteristics of the person’s development, the environmental contexts, and time periods of exposure to the process (Bronfenbrenner & Morris, 2006).

The transactional development model, built upon the bioecological model, is a framework utilized in developmental research, specifically as it relates to developmental
psychopathology and intervention (Sameroff & Fiese, 2000; Sameroff & Makenzie, 2003).

Within these models, developmental outcomes are a function of the combination of an individual’s biological predisposition and the individual’s experiential context (Sameroff & Fiese; Sameroff & Makenzie). Equal emphasis is placed on the individual and the environment, with neither being independent of the other, and each has a mutual effect (Sameroff & Fiese; Sameroff & Makenzie). Therefore, because individual risk factors seldom occur in isolation, all risk must be evaluated as part of a predictive model that would inform effective interventions.

The concept of cumulative risk was first utilized by Rutter (1979). Rutter (1979) contended that risk of poor psychiatric outcomes was determined not by any particular individual risk factor, but by a number of risk factors. Rutter (1979) used the sum of six risk factors (i.e., severe marital discord, low social class, large family size, paternal criminality, maternal mental disorder, and foster care placement), which were identified within the literature as factors linked to negative outcomes. Rutter (1979) found that risk scores between 1-3 did not produce a higher occurrence of child psychopathology than a score of 0; whereas, a sum of 4 or more increased risk from 2% to 20%. Werner and Smith (1982) made the same observation in their study in which they used 12 risk variables, and found that children with a score of 4 or more had significantly poorer outcomes. Appleyard, Egland, Dulmen, and Sroufe (2005) investigated the nature of the risk gradient to determine if there was a threshold effect beyond a certain number of risk factors, as proposed by Rutter (1979). The findings supported a linear model, but not the quadratic. However, these findings suggested an additive model and not a threshold model as it related to risk; thus, providing further evidence of the salient nature of the cumulative risk index (Appleyard et al.).
The precedent set by Rutter (1979) provided the context for analysis of the 4-years of data collected in the Rochester Longitudinal Study (RLS) related to social and family risk (Sameroff, Seifer, Barocas, Zax, & Greenspan 1987; Sameroff, Seifer, Zax & Barocas, 1987). Sameroff, Seifer, Zax & Barocas (1987) first investigated the cognitive, psychomotor, social, and emotional assessment of children at birth, 4, 12, 30, and 48 months of age to (a) determine the direct relationship between sets of risk factors and the criterion measures (e.g., socio-emotional and cognitive domains); (b) test the relative predictive power of the risk factors included; and (c) determine the unique variance associated with each variable after the effects of the other predictor variables were partialed out. Hierarchical multiple regression analysis was used, and the 10 predictor variables were entered as four sets of variables (Sameroff, Seifer, Zax & Barocas, 1987). The four sets of variables were (a) mental illness factors (i.e., chronicity and anxiety), (b) parental perspective (i.e., interactions), (c) family factors (i.e., stressful life events, family size), and (4) social status (i.e., socioeconomic status, education level of parents, occupation of parents, and race) (Sameroff, Seifer, Zax & Baracas, 1987). The finding of the study suggested high multiple environmental risk scores led to worse outcomes than did low multiple risk scores (Sameroff, Seifer, Zax & Baracas, 1987).

Sameroff, Seifer, Barocas, Zax, and Greenspan (1987) performed another analysis on the RLS data to examine the IQ of 4-year-old children in relation to 10 environmental variables, which were correlates of socioeconomic status, but not equivalents (i.e. maternal mental health, maternal anxiety, parental perspectives, mother interactive behaviors, maternal education, occupation of head of household, minority group status, presence or absence of a father in the home). Families were grouped according to cumulative risk scores, with cumulative risk scores of 0 to 1 being considered low risk, 2 to 3 considered moderate risk, and 4 or more being
considered high risk. From the analysis of the RLS data, several conclusions were drawn: (a) the prime determinant of outcomes was not socioeconomic level itself, but rather the number of risk factors within each socioeconomic level; and (b) the same outcomes were produced no matter the combination of risks used to calculate a specific sum (Sameroff & Fiese, 2000). The cumulative risk index allowed for multiple salient risk factors, as identified within the literature, to culminate in a single model and produce a single meaningful score.

Sameroff, Seifer, Baldwin and Baldwin (1993) returned to the RLS data to analyze the 13-year data to investigate the stability of intelligence. Again, the results supported the importance of the total number of risks, over the specific combination of risks (Sameroff, Seifer, Baldwin & Baldwin, 1993). With no single risk factor and no specific combination of risks being more likely to lead to poor outcomes, it is unlikely that universal interventions that address a specific risk factor or combination of risk factors will be effective (Sameroff & Fiese, 2000). Furstenberg, Cook, Eccles, Elder, and Sameroff (1999) replicated the study by Sameroff et al. (1993) with 20 variables and obtained the same results.

The impact of cumulative risk has also been investigated as it relates to academic growth curve trajectories from Grades 1-12. Gutman, Sameroff, and Cole (2003) utilized hierarchical linear modeling to analyze changes in students’ academic outcomes (i.e., GPA and number of absences) as a function of multiple social risk and child factors. The cumulative risk index score was determined using 10 risk variables, individually identified within the literature as increasing the likelihood of negative outcomes (Gutman, Sameroff, & Cole, 2003). The risk variables used within the index were (a) minority group status, (b) occupation of head of household, (c) maternal education, (d) family size, (e) absence of father, (f) stressful life events, (g) parental
perspectives, (h) maternal anxiety, (i) maternal mental health, and (j) parent-child interactions. High-risk students were found to have lower grades and more absences (Gutman, et al., 2003).

Within the cumulative risk literature, Pungello et al. (2010) noted that numerous researchers have found evidence of the negative impact multiple risk factors have on development from early childhood through adolescence, but little is known about the long-term effects (Pungello et al., 2010). Pungello et al. (2010), contacted young adults (i.e., 18-25), previously assessed as part of the Carolina Abecedarian Project and Carolina Approach to Responsive Education (CARE), both of which were randomized controlled trials for children who were at high risk for academic failure or developmental delays as determined by familial income status. One outcome assessed by the researchers was educational attainment (Pungello et al., 2010). Educational attainment was operationalized in three ways: (a) a continuous measure of the years taken to achieve the highest degree obtained, (b) the highest grade completed, and (c) two categorical variables associated with whether the participant was a high school graduate and if he or she had ever attended a 4-year college or university. Logistic regression and path analysis were used to analyze the data (Pungell et al., 2010). The cumulative risk score was determined by summing the number of individual risk factors (having a teen mother, maternal education less than high school graduate, parents not married, mother out of home, large family size, and frequent moves) experienced by the participant (Pungello et al., 2010). The range of cumulative risk scores experienced by the participants was 0 to 4 on an index of 6 (Pungello et al., 2010). Cumulative risk scores were found to be negatively associated with educational attainment and the likelihood of high school graduation (Pungello et al., 2010).

Campbell et al. (2012) conducted a longitudinal follow-up study on the Carolina Abecedarian Project participants to extend to the young adult findings and determine later adult
outcomes (i.e., age 30) and utilized the same operational definition as Pungello et al. (2010). Continuous variables were analyzed with the use of analyses of variance (ANOVAs), and logistic regression was used for categorical outcomes. As with other studies (e.g., Gutman et al., 2003; Pungello et al., 2010), the findings suggested that cumulative risk led to poorer educational outcomes; only 6% of the control group earning a bachelor’s degree or higher (Campbell et al., 2012).

Consistently there has been support for several assumptions regarding the cumulative risk model. While there are varying numbers of salient risk factors identified individually within the literature that are predictive of a given developmental outcome, there is individual risk factor or a specific combination of risk factors, but rather the accumulation of risk factors that best predicts the negative outcome. As such, the greater the number of risk factors experienced, the greater the likelihood of poor outcomes (e.g. Campbell et al., 2012; Pungello et al., 2010; Rutter, 1979; Sameroff, Seifer, Zax, & Barocas, 1987; Sameroff, Seifer, Baracas, Zax, & Greenspan, 1987). Additionally, while the number of risk factors and specific risk factors used within the index varied, a score of 4 or more on the index indicated high risk (e.g. Pungello et al., 2010; Rutter, 1979; Sameroff, Seifer, Zax, & Barocas, 1987; Sameroff, Seifer, Baracas, Zax, & Greenspan, 1987).

**Justification of Risk/Predictor Variables within the Cumulative Risk Model**

As discussed above, the cumulative risk index score is created by summing multiple risk factors previously established within the literature. Consistent with the work of Sameroff and Fiese (2000), various sociodemographic risks established within the retention literature are summed to create a cumulative risk score. Sociodemographic risks (e.g., minority status, parents highest level of education, number of children in the family, and number of parents in the home
[family support]), have been investigated frequently in research investigating human development and educational outcomes (e.g., Astin, 1964; Sameroff et al., 1987a/b). These risk factors are exogenous to the individual, that is, they are sociodemographic risks, which are comprised of socioeconomic and demographic characteristics and associated with long-term disadvantage. As such, sociodemographic risk can provide a more specific picture of risk rather than socioeconomic status and poverty alone (Huston, Mcloyd, & Coll, 1994; Moore, Vanivere, & Redd, 2006).

Below is a justification of individual risk factor included in the cumulative risk index. The specific risks included in the current study are: (a) race/ethnicity, (b) English as a second language, (c) current parenthood status (i.e. does the student have a child), (d) mother’s childbearing age as determined by the age at which the student’s mother had her first child, (e) student generational status as determined by both parents’ level of education as determined by their highest degree earned, (f) parents’ current marital status (i.e. are the student’s parents widowed, divorced, or never married), (g) number of siblings the student has in his or her family, (h) the student’s employment status, and (i) the student’s transfer status. The only sociodemographic risk not utilized within the index that is identified within the undergraduate student retention literature is socioeconomic risk. However, Sameroff, Seifer, Barocas, Zax, and Greenspan (1987) did not utilize socioeconomic status as a risk factor in the cumulative risk index as it was the number of risks within socioeconomic level rather than the socioeconomic level itself that determined outcomes.

**Race/ethnicity.** There is a body of literature that is specific to minority student populations and indicative of the historical differences in degree attainment. Specifically, the studies by McDaniel, DiPrete, Buchmann, and Shwed (2011) and Vaquera and Maestas (2009)
have demonstrated differences in the graduation rates between some races since the 1940s().
The current gap in educational attainment in the United States is complex, as the U. S.
demographics continue to shift. Lundy-Wagner (2012) used data from the Beginning
Postsecondary Student Study of 1996 (BPS:96/01), a study sponsored by the National Center for
Education Statistics, to analyze both institutional and student data. Specifically, Lundy-Wagner
explored completion rates by ethnicity/race and socioeconomic status. Results showed that even
when gender was controlled, completion rates were considerably higher for Asian (70.7%) and
White (62.0%) undergraduate students than for African (42.4%) or Latina/o (48.8%) American
undergraduate students (Chen & DesJardins, 2010; Lundy-Wagner, 2012). As such, within a
model, students who classify themselves as African or Latina/o American would be considered
to be at an increased risk for dropout. It is important to note that race, in and of itself, is not a
risk factor; however, it is a marker for discrimination and historical sociocultural disadvantages
that may be associated with a lack of opportunity and compromised outcomes; therefore, race
and ethnicity are indirect means of measuring other risks that may result in negative outcomes
(Garcia Coll & Magnuson, 2001).

**English as a second language.** There is evidence that students who speak English as a
second language meet many more challenges than students who speak English as their primary
language (Hechanova-Alampay, Beehr, Christiansen, & Van Horn, 2002; Roessingh & Douglas,
2012). Findings from a study by Roessigh and Douglas (2012) suggested that students who have
a primary language other than English completed their programs of study with less academic
stability and with less confidence. Also, Hechanova-Alampay, Beehr, Christiansen, and Van
Horn (2002) also found that there are often more challenges related to transition to college and
integration within the system. The difficulty in transition is thought to be a result of: (a) cultural
misunderstandings, (b) lack of social-support, and (c) inadequate English language proficiency, which inhibits academic performance (Hechanova-Alampay, Beehr, Christiansen, & Van Horn, 2002; Roessingh & Douglas, 2012). As such, students whose native language is not English are at greater risk of low institutional commitment and dropout for both social and academic reasons.

**Students’ generational status.** Students whose parents do not have a bachelor’s degree are often identified in the literature as first-generation students (Engle & Tinto, 2008). Padgett, Johnson and Pascarella (2012) suggested that first-generation students are at higher risk for dropout, which is attributed to the disadvantage of parents with no college experience and, as a result, cannot have in transmitting knowledge and expectations about the rigors of the college experience to their children. Engle and Tinto (2008) examined data from the National Center for Education Statistics’ Beginning Postsecondary Study on behalf of The Pell Institute, specifically investigating the status of low-income, first generation students. Engle and Tinto also found that 43% of low-income, first-generation students had left higher education without earning a degree within a 6 year time period; almost two-thirds of those first-generation students leaving within the first year (i.e., a likelihood of leaving during the first year nearly four times that of students who had neither risk).

Pascarella, Pierson, Woniak, and Terenzini (2004) conducted a longitudinal study to investigate the college experience and relative cognitive growth experienced by first-generation students. The findings of Pascarella et al. (2004) suggested that first-generation students across both the second and third year of college: (a) completed significantly fewer credit hours, (b) worked significantly more hours, (c) were more likely to live off-campus, and (d) exhibited less involvement in extracurricular activities than peers whose parents had high levels of post-secondary education. Pascarella et al. suggested that these differences experienced by first-
generation students were a result of family cultural capital, which plays a significant role in: (a) expectations, (b) decision-making, and (c) preparation. As such, first-generation students are at greater risk for reduced institutional commitment and ultimately dropout.

**Maternal age at first birth.** Researchers (Brooks-Gunn & Furstenberg, 1986; Fergusson & Woodward, 1999) have repeatedly identified an association between young maternal age at birth (i.e., teenage mothers) and a variety of compromised child outcomes (e.g., physical, academic, and psychosocial), which often persist through early adulthood. Poor outcomes are often attributed to the fact that teenage mothers are more likely to be classified as low-income with fewer resources, have lower maternal education, and less social support. For these reasons, undergraduate students who have a mother who was a teen at the birth of her first child, are at risk of having less support, being a first-generation student, experience economic disadvantage, ultimately making the student more likely to experience low institutional commitment and dropout.

**Parents’ current marital status.** Marital status is often related to family income and resource availability, typically because the status of divorced, widowed, or never married are associated with single-parent homes (Haveman & Wolfe, 1995). Children of single parents have been shown within the literature to have lower educational attainment (Haveman & Wolfe, 1995; Krein & Beller, 1988). Ploeg (2002) investigated the impact of disrupted families on college attendance and completion. Ploeg (2002) found that family income is not the only factor that leads to poor academic outcomes as demonstrated by a predictive model that included grant aid received by students. Even when the grant aid received by the student was controlled for, students from disrupted families were significantly less likely to attend and complete college in comparison to students with from intact families (Ploeg, 2002). Beyond resource availability,
differences in educational attainment in two-parent vs. single-parent homes have also been attributed to lack of parental involvement and supervision (Astone & McLanahan, 1994; DeDonno & Faga, 2013). In addition, there is a high-correlation between family structure and residential moves with single-parent and step-parent families had a higher residential mobility than two-parent homes (Astone & MacLanahan, 1994). As such, students from single-parent homes were considered at-risk for low institutional commitment and subsequent dropout.

**Number of siblings.** Family size has been identified as a risk for compromised outcomes. Researchers such as Steelman and Powell (1989) have suggested that large families often have fewer monetary resources. However, financial resources are not the only family resource that are diluted by large family size. Limited time and energy also contribute to an inverse association between family size and educational outcomes (Downey, 1995). Not only is the availability of the resources an issue, but the utility of the resources is an issue as well (i.e., The resources may be of less benefit due to less access to the resource such as a family computer.) (Downey, 1995). Therefore, those families with four or more children were classified as at risk in the RLS study by Sameroff, Seifer, Barocas, Zax, and Greenspan (1987).

**Current parenthood status.** Students who have children are often classified as non-traditional students because they are more likely to work and have additional responsibilities above their traditional counterparts (Bean & Metzner, 1985). Also, non-traditional students have higher risk of departure and are less likely to be integrated within the institutions (Bean & Metzner, 1985; Gilardi & Guglielmetti, 2011; Tinto, 1975). Non-traditional students also experience more threats to engagement (Bean & Metzner, 1985; Gilardi & Guglielmetti, 2011; Tinto, 1975). Lack of engagement can be attributed to parents having school, work and parenting
responsibilities (Goldrick-Rab & Sorensen, 2010). Therefore, students who report having a child were considered at risk as part of the study.

**Employment status.** The literature suggests that students who are employed are more likely to perform poorly academically because of the time required for employment (Hawkins, Hawkins, Smith, & Grant, 2005). Additionally, Furr and Elling (2000) found that students who worked 30 hours or more a week were less connected to the institution due to lack of involvement and reported negative impacts on academic performance.

Bozick (2007) investigated employment as a mechanism to overcome the financial barrier of college experienced by students at varying levels of income. Students with income ranked in the second and third quartile ranges were more likely to work and those students who worked 20 or more hours a week were more likely to dropout (Bozick, 2007). Bozick (2007) explained these findings using the selection-to-work perspective, which maintains that work and school patterns are reflective of the perceptions of the future (i.e., a student who is an academically motivated student and sees college in his or her future will not spend as much time working in order to focus on his or her education) (Bozick, 2007). As such, employment more than 20 hours a week puts a student at risk for reduced institutional commitment and departure.

**Transfer status.** Transfer status was included as a risk factor as it has been found that students who transfer into an institution are statistically more likely to depart (Duggan & Pickering, 2008; Hoyt & Winn, 2004; Lee et al., 2009). In addition, transfer students are classified in the research as at-risk, since they have previously departed another institution, and some students attending multiple institutions. Peter, Cataldi, and Carrol (2005) completed the *Postsecondary Education Descriptive Analysis Report* for the National Center for Education Statistics and found that students who attended multiple institutions were more likely to take
longer to complete their degree and were less likely to complete their degree. (Peter, Cataldi, and Carrol (2005) suggested the delay and dropout was because of difficulty: (a) in the transfer of credits; (b) in being able to meet varying graduation requirements; or (c) personal factors such as moves, job changes, or changes in family status. Therefore, students who reported previous full-time enrollment at another institution were considered to be at risk for low institutional commitment and later departure.

**Moderate to Vigorous Physical Activity as a Protective Factor**

Given the robust impact of cumulative risk on student outcomes, it is important to explore potential protective factors to reduce risk and promote institutional commitment, particularly for those students considered to be at high risk. Within the risk and resilience literature, a protective factor is a personal quality, a context, or an interaction that predicts better outcomes, particularly in the context of risk (Wright & Masten, 2005). Protective factors may or may not be the positive pole of a risk factor (e.g., high levels of social integration are the positive pole of lack of social integration, a known risk for student departure [Tinto, 1979]). One potential protective factor within an undergraduate student population is physical activity.

Physical activity benefits all individuals, but, also, it has also been shown to buffer the impact of risk across a variety of outcomes (Physical Activity Guidelines Advisory Committee, 2008). Qi et al. (2012) found that the interaction effects of higher levels of physical activity lessened the genetic predisposition to increased body mass index and obesity risk. Brito et al. (2009) found that physical activity lessened the genetic predisposition to glucose regulation and Type II diabetes. Also, physical activity was also investigated as a moderator for comorbid depressive symptoms in patients diagnosed with chronic illnesses (Herring, Puetz, O’Conner, & Dishman, 2012). Herring et al. (2012) found that physical activity lessened depressive symptoms
with greater effects for patients with higher baseline depression symptoms. Like the examples of studies where physical activity was shown to moderate risk of negative outcomes, there is reason to believe that physical activity may also moderate the association between cumulative risk and institutional commitment.

**Defining Physical Activity**

Physical activity is defined as any movement produced by the skeletal muscles of the body that results in energy expenditure, and therefore constitutes all activities performed that are categorized as occurring while sleeping, at work, and at leisure, embedded in everyday life (Caspersen et al., 1985). It is important to distinguish physical activity from exercise and physical fitness within the literature. Exercise is a subset of physical activity where the activity is planned, structured, and repetitive with the objective to improve or maintain physical fitness components, and may comprise work or leisure activity (Caspersen et al., 1985). Physical fitness is a correlate of physical activity and exercise (Caspersen et al., 1985). It is defined as a set of attributes that are related to the ability to carry out activities of daily living with vigor, alertness, and with ample energy to both enjoy activity, and respond to unforeseen emergency situations (Caspersen et al., 1985). The focus of the current study was on physical activity, as it is easily measured by self-report and provides information related to all activity including activities of daily living such as: (a) transportation, (b) leisure, (c) work, and (d) exercise.

**Empirical Evidence of the Benefits of Physical Activity.**

Increasingly, there are indications within the literature that suggest a positive association between physical activity and both brain structure and function throughout the lifespan (Brown et al., 2012; Chaddock, Pontifex, Hillman, & Kramer, 2011; Donnelly & Lambourne, 2011; Stroth et al., 2009; Voss, Nagamatsu, Lui-Ambrose, & Kramer, 2011). There is a plethora of
both cross-sectional and longitudinal research focused on the impact of physical activity, exercise, and fitness on childhood, adolescent, and elderly cognitive outcomes (Brown et al., 2012; Davis et al., 2011; Donnelly & Lambourne, 2011; Roberts, Freed, & McCarthy, 2010). The findings from several studies, both cross-sectional and randomized-clinical trials, support the association between physical activity, exercise, and fitness with increased cognition and academic performance (Brown et al.; Davis et al, 2011; Efrat, 2011; London & Castrechini, 2011; Robertset al.; Singh, Uijtdewilligen, Twisk, van Mechelen, & Chinapaw, 2012; Telford et al., 2012).

There is far less data about the effects of physical activity on the brain and cognition in young adults (Guiney & Machado, 2013; Voss et al., 2011). Voss, Nagamatsu, Lui-Ambrose, and Kramer (2011) believe the reason there is comparatively less research on cognitive enhancements associated with physical activity in young adults is because while older adulthood and childhood are phases in which brain structure and function are variable, young adulthood is considered a time of relative cognitive stability when cognitive performance peaks. While the brain is considered developmentally stable in young adulthood, evidence has suggested that physical activity does alter the brain, as brain plasticity persists across the life span (Voss et al.). Some research has emerged (e.g., Kamijo, O’Leary, Pontifex, & Hillman, 2010) that suggested that physical activity has a positive impact on cognitive control, memory, and other cognitive functions, which are salient for college performance and ultimately student persistence.

Cognitive control, a component of executive function, is the ability to suppress or override competing information, thoughts, and behaviors that are irrelevant in favor of those that are relevant (Casey, Tottenham, & Fossella, 2002). It has also been suggested that the benefits of physical activity have greater significance for those tasks that require larger amounts of
executive control. Kamijo, O’Leary, Pontifex, Themanson, and Hillman (2010) investigated the effect of aerobic fitness on cognitive control, as measured by contingent negative variation (CNV) amplitude and topography. Kamijo et al. (2012) found that those participants with lower fitness levels, as measured by VO$_{2\text{max}}$ test, relied more heavily on cognitive control processes (i.e., higher CVN amplitude) whereas the individuals with higher fitness levels maintained more constant levels of control.

Kamijo and Takeda (2010) used self-reported measures of physical activity (as reported by the International Physical Activity Questionnaire) and a task-switching paradigm to measure executive function. Kamijo and Takeda found that tasks that required greater control were completed with greater efficiency by those classified as physically. Padilla, Parez, Andres, and Parmetier (2013) reported similar results when they investigated chronic exercise levels, as measured by interviews to assess history of physical activity, and the Rockport 1-mile Fitness Walking test (i.e. VO$_{2\text{max}}$), and cognitive control as measured by the Stop Signal Task. Results from the testing implied that participants who reported higher levels of activity had a higher VO$_{2\text{max}}$, and that on versions of the Stop Signal Tasks that required more executive control, participants with higher activity levels performed faster when a response was inhibited (Padilla, Parez, Andres, & Parmetier, 2013). Additionally, Kamijo and Takeda (2009) investigated cognitive function in association with physical activity with use of a spatial priming task independent of task difficulty and found that the active group had a faster reaction time in inhibitory activities.

Stroth, Hille, Spitzer, and Reinhardt (2009) investigated the impact of endurance training on memory and affect. Participants in the study were young adults between the ages of 17 and 29 (Stroth et al., 2009). The 26 participants participated in initial fitness testing to determine
their lactate threshold (i.e., the point at which the body is presumed to transition for aerobic to anaerobic metabolism) to determine intensity level (Stroth et al.). Fitness pretests were performed on all participants, including testing to determine individual lactate thresholds (Stroth et al.). Participants were then divided into a control group and experimental group. Control group members did not change leisure time activity, while experimental group members participated in 30 minutes of running at an intensity of training determined by individual lactate thresholds (Stroth et al.). The duration of the experiment was 6 weeks (Stroth et al.). While no effects were observed for concentration performance and verbal memory, the experimental group had significant increases on visuospatial memory performance (Stroth et al).

Cross-sectional studies have also been employed to investigate the impact of physical activity on affect. Affect is a component of mood, with two major mood factors comprising self-reported mood, positive affect and negative affect (Watson, Clark, & Carey, 1988). Distinct dimensions were comprised of uncorrelated factors, positive affect “is a dimension reflecting one’s level of pleasurable engagement with the environment” (p. 347; e.g., enthusiasm, energy level, mental alertness, etc.), while negative affects is a feature of subjective distress, “and subsumes a broad range of negative mood states, including fear, anxiety, hostility, scorn, and disgust” (Watson et al., 1988, p. 347). Several researchers suggested that mood directly influences: (a) executive function, (b) cognition, (c) perceptions of social interactions, and (d) indirectly influences academic performance (Forgas, Bower, & Krantz, 1984; Olafson & Ferraro, 2001; Mitchell & Phillips, 2007; Pekrun, Elliot, & Maier, 2009). All of these components are known to impact institutional commitment (e.g., Braxton, Jones, Hirschy, & Hartley, 2008; Pascarella & Chapman, 1983).
Wichers et al. (2012) conducted an experience sampling method study with use of a within-study replication sample drawn from female twin pairs. Participants wore a digital wristwatch, which was programmed to provide 10 audible tones at unpredictable times during 90-minute time blocks for 5 consecutive days (Wichers, 2012). When cued by the watch, participants were asked to complete the experience sampling method self-assessment forms, which were used to collect data related to participant’s (a) thoughts, (b) current context, (c) appraisal of the current situation, and (d) affect (Wichers, 2012). The findings suggested that levels of positive affect were significantly impacted by a preceding increase in physical activity (Wichers, 2012); findings were supported by Mata et al. (2012) as well.

In addition, controlled studies have also been performed to investigate the impact of physical activity on affect (Mata, Hogan, Joorman, Waugh, & Gotlib, 2013; Stroth, et al., 2009). Stroth et al. (2009) investigated the effect of aerobic endurance exercise on memory and affect. While no changes in negative affect were reported by participants, the experimental group who participated in three 30-minute running sessions per week for 6 weeks reported a significant increase in positive affect and no significant changes in negative affect (Stroth et al, 2009), findings that support cross-sectional findings (Mata et al., 2012; Wichers et al. 2012).

Mata, Hogan, Jutta, Waugh, and Gotlib (2013) studied the protective effect of exercise on affective responses, specifically responses to common daily life adversities, which are repeated and can have a cumulative effect. A sample of 81 women participated in the study (Mata et al., 2013). The experimental group was comprised of 41 women who had recovered from major depressive disorder, and the control group was comprised of 40 women with no previous diagnosis of depression (Mata et al.). After initials screenings, 22 of the participants who had recovered from major depressive disorder and 20 of the control participants were randomly
assigned to an exercise condition (i.e., 15 minutes of cycling on a stationary bicycle at a comfortable speed and resistance) (Mata et al.). The rest of the participants, 19 participants who had recovered from major depressive disorder, and the other 20 control participants were assigned to a no-exercise control condition (i.e., resting quietly with eyes open for 15 minutes) (Mata et al.). Participants then viewed a sad movie, completed 2-minute information-processing filler task and then watched another sad movie (Mata et al.). Affect was assessed upon arrival and after every task (Mata et al.). It was found that all control participants (i.e., in both the experimental and control conditions) and participants who had recovered and were assigned to engage in acute exercise showed no increase in negative affect responses to repeated stressors. Those participants who had recovered and were assigned to the no-exercise condition showed higher negative affect, which suggests sensitization (i.e., an increased level of response) had occurred in those participants who recovered from major depressive disorder (Mata et al.). Moreover, results suggested that participation in physical activity may decrease the effects of repeated stressors on negative affect. (Mata et al.).

Taken together, these findings suggest the positive impact of physical activity may have indirectly on institutional commitment, which incorporates elements of academic, cognitive, and affect, as it pertains to satisfaction with the school of matriculation. Specifically, research indicates that physical activity influences to components of social and academic integrations (e.g., alertness, executive function, enthusiasm, cognition, etc.; e.g. Mata et al., 2013; Stroth et al, 2009; Wicher et al. 2012). As such, there is reason to investigate moderate to physical activity as a way to buffer the effects of cumulative risk.
Control Variables

Gender. When investigating undergraduate student degree completion rates an educational gender gap becomes evident. From 1999 to 2010, 57.4% of all bachelor’s degrees conferred in the U.S. were to women (National Center for Education Statistics, 2012). This educational gender gap has led to investigative studies, which attempted to determine why the gender gap occurred. Buchmann and DiPrete (2006) investigated the role of family background and academic achievement to help explain the growing female advantage in college completion rates. Results suggested that family background has different effects on males and females, (e.g., there is a declining college completion rate for males who have fathers who were absent or only had a high school education [Buchmann & DiPrete, 2006]). Given the currently literature, gender needs to be controlled within the experiment. The nature of the non-experimental designs requires statistical controls since gender cannot be controlled within the design.

High school GPA and standardized test scores. High school GPA and college admission test scores (ACT/SAT) have been shown to be the best predictors of college success (Geiser & Studley, 2002; Sawyer, 2013). College admissions tests are developed to provide measures of cognitive ability and have been found to be associated with general intelligence (Frey & Detterman, 2004). Moreover, high school grades provide a measure of both cognitive ability and behaviors relevant to academic performance (Frey & Detterman, 2004; Reason, 2004; Sawyer, 2013). By inclusion of these measures as covariates, measurement error due to model misspecification can be minimized.

Age. Research investigating the association between age and college dropout have produced mixed results, with some studies identifying a positive association and some identifying a negative association (Schofield & Dismore, 2010; Scott, 2005). Additionally,
research findings have repeatedly suggested that the processes that impact continued enrollment vary depending on academic level (Allen et al., 2008; Duggan & Pickering, 2008; Krum et al., 2009; Ma & Cragg, 2013; Willcoxson, Cotter, & Joy, 2011). As such, academic level may better correlate with age than year in school due to dual enrollment and advanced placement courses.

Summary

The goal of the current study is to address the need presented within the undergraduate retention research for a model of institutional action (Tinto, 2006). While undergraduate retention research has identified sociodemographic risk factors associated with undergraduate student departure, the ability to transform the information into institutional interventions that reduce the risk is limited, as evidenced by Tinto’s (2006) call for research (e.g., Mackenzie et al., 2011). It is this gap between research and applied intervention that provides the context for extending the cumulative risk research.

Educational attainment has repeatedly been investigated as an outcome measure in developmental research because of the characteristics that classify educational attainment as a developmental task (e.g., Campbell et al., 2012; Masten, 2001; Pungello et al., 2010; Sameroff & Feise, 2000). Exploring the use of a developmental model within the undergraduate student retention field extends the current literature by offering a model complementary to current undergraduate retention theory. In addition, the cumulative risk index allows for context to be considered when evaluating risk, including sociodemographic risk factors as well as protective factors that may moderate risk (Sameroff & Feise, 2000; Wright & Masten, 2005).

The body of literature on the cumulative risk model repeatedly evidences the ability of the model to predict student-level outcomes and inform effective interventions (e.g., Campbell et al., 2012; Pungello et al., 2010; Sameroff & Feise, 2000). The studies performed by Campbell et
al (2012) and Pungello et al. (2010) investigated the long-term outcomes of interventions. The interventions investigated did not alter the sociodemographic risk of the participants, but rather other modifiable variables known to impact educational outcomes (Campbell et al., 2012; Pungello et al., 2010). Despite evidence of the association between cumulative risk and undergraduate degree completion (e.g., Campbell et al., 2012), there is little known about the impact of cumulative risk on persistence behaviors, such as institutional commitment. In addition, there is limited research on the impact of potential protection factors that are modifiable.

Institutional commitment will be the criterion variable in this study. Institutional commitment is a construct related to student confidence in and satisfaction with an institution (Davidson et al., 2009). Institutional commitment serves as a theoretical precursor of dropout decisions in both major student retention theories (Bean, 1975; Tinto, 1975). Investigation of the institutional commitment construct has supported its predictive nature, providing evidence of both main and interaction effects on persistence behaviors (Bean, 1975; Bean & Metzner, 1985; Braxton & Lee, 2005; Cabrera, Castaneda, Nora & Fossella, 1992; Pascarella & Terezini, 1980; Terenzini, Wendell, & Pascarella, 1981; Tinto, 1975).

If found to be a viable model within the population, the information gained from this study may benefit institutional staff as they seek ways to reduce undergraduate student risk for dropout. Specifically, use of the model allows potential protective factors to be identified, which may promote institutional commitment among students, who experience varying levels of cumulative risk. Moderate to vigorous physical activity is beneficial for all individuals, but has been shown to have a greater benefit for those at risk for poor outcomes (e.g., Brito et al., 2009; Physical Activity Guidelines Advisory Committee, 2008; Qi et al., 2012). Moderate to vigorous
activity has also been associated with positive effects in cognitive functioning and affect (Mata, Hogan, Joorman, Waugh, & Gotlib, 2013; Stroth, et al., 2009). Both cognitive function and affect have been shown to influence institutional commitment (Braxton et al., 2008; Geiser & Studley, 2002; Sawyer, 2013). Therefore, the effects of moderate to vigorous physical activity on the association between cumulative risk and institutional commitment could provide insight into a potential protective factor. The following three chapters provide a description of the methodology used for the study, an examination of the findings, and a discussion of the results.
CHAPTER THREE: METHODOLOGY

Introduction

The purpose of this correlational study was to determine whether the concept of cumulative risk can be applied to a model of undergraduate student institutional commitment at a large, private, 4-year liberal arts university located in the mid-Atlantic region. Moreover, the purpose of the study was to assess whether physical activity moderates the association between cumulative sociodemographic risk and institutional commitment. Specifically, does physical activity serve as a protective factor for students experiencing high levels of sociodemographic risk? Provided in Chapter Three is a description of the methodology that will be used to conduct the study. Within the chapter, research design, participants, setting, instrumentation, procedures and data analysis are discussed. Also, the research questions, hypotheses and null hypotheses are restated.

Design

A correlational research design will be utilized for this predictive study (Gall, Gall & Borg, 2007). The use of a correlational designs allow predictor variables, either individually or in combination, to be investigated in order to determine the potential influence on the criterion variable (Gall et al., 2007). Correlational research design is used frequently within the student retention literature to investigate the association between a predictor and criterion variable (e.g., Allen et al., 2008; Buchmann & DiPrete, 2006; DeDonno & Fagan, 2013; Robbins, et al., 2006; Willcoxson, Cotter & Joy, 2011). Additionally, correlational design is used within the cumulative risk literature to investigate the association between risk factors and outcome variables (e.g., Sameroff, Seifer, Zax & Baracas, 1987; Sameroff, Seifer, Baldwin & Baldwin, 1993). The two main purposes of this study are (a) to test a theory about the determinant of
in institutional commitment, and (b) to determine to what degree institutional commitment may be predicted; therefore, making a correlational design is the most appropriate choice (Gall et al.). Surveys were utilized to collect data related to the predictor (i.e., cumulative risk), the moderator (i.e., moderate to vigorous physical activity), and criterion (i.e., institutional commitment) variables.

Questions and Hypotheses

Research Questions

RQ1: Is there an association between cumulative sociodemographic risk and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores?

RQ2: Is there an association between moderate to vigorous physical activity and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores?

RQ3: Is the association between cumulative risk and institutional commitment moderated by moderate to vigorous physical activity, while controlling for gender, age, high school GPA, and ACT/SAT scores (See Figure 2)?

Figure 2. Diagram of the proposed conceptual moderator model.
Hypotheses

**H1:** Building upon the cumulative risk literature, it is expected that students experiencing a high level of cumulative risk will exhibit low institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores.

**H2:** Given what research suggests about the benefits of physical activity on physical and sociodemographic outcomes, it is expected that there will be a significant positive association between moderate to vigorous physical activity and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores.

**H3:** It is expected there will be a significant interaction between cumulative risk and physical activity in a model predicting institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores. Specifically, high levels of moderate to vigorous physical activity will serve as a protective factor for students experiencing high levels of risk.

Null Hypotheses

**H01:** The association between the cumulative risk index score and the institutional commitment subscale of the College Persistence Questionnaire will not be statistically significant when controlling for gender, age, high school GPA, and ACT/SAT scores.

**H02:** The association between moderate to vigorous physical activity and institutional commitment will not be statistically significant when controlling for gender, age, high school GPA, and ACT/SAT scores.
H$_{03}$: Moderate to vigorous physical activity will not moderate the association between cumulative risk and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores.

**Participants**

A total of 358 undergraduate college students who were enrolled in any of the residential psychology courses offered during the fall semester, 2012, participated in this study. A convenience sample was utilized in this study. Convenience sampling was utilized because the sample was easily accessible, and the sample pool would provide a sample of adequate size (Gallet et al., 2007). There were several reasons why these students were used as part of the sample population. Students will vary demographically and academically, providing a sample representative of the student body. While students enrolled in upper-level psychology courses are more likely to be majoring or minoring in psychology, all students enrolled in the larger, lower-level courses were not all majoring in psychology. Several of the lower-level, high enrollment (e.g., 750 student enrollment caps per section) psychology courses are general education requirements for all students enrolled at the university, independent of their declared major. These general education psychology courses provide access to students who represent the institutional characteristics across all majors. Additionally, college students are considered acceptable study participants in research studies for a variety of fields (Cozby & Bates, 2011). Enrollment for psychology courses ranges from 750 per class in the lower-level general education courses to 20 students per class in the upper-level courses.

**Setting**

The participants were enrolled in a large, Southern Association of Colleges and Schools (SACS)-accredited, 4-year private university located in Virginia. In 2012, the residential
enrollment was approximately 12,500 students. While the participant pool was comprised of residentially enrolled students, it should be noted that the descriptive data that follows includes data from both residentially enrolled students and the more than 90,000 students enrolled in online programs. Staff of the National Center for Educational Statistics (NCES; 2013) reported the following demographic information for the University: (a) 42% male and 58% female; and (b) White 50%, Unknown 24%, African American 17%, Non-resident alien 3%, Hispanic 2%, Two or more races 2%, Asian 1%, American Indian. The first-year retention rate was 68%, the 6-year graduation rate was 46%, and the transfer rate was 27% (NCES, 2013).

The mean first-year retention rate for all institutions was between 64% - 65.2%, with highly selective institutions had a mean of 89.5% and open institutions had a mean of 58.3% (ACT, 2012; NCES, 2010). The average 6-year graduation rate was 49% and the average transfer rate is 20% (NCES, 2007/2010). The University in this study has a rolling admissions process with no deadlines for application. Also, there are no specific course requirements for applicants. The average high school GPA of admitted residential students is 3.36, average ACT composite score is 23, and average SAT scores (i.e., combined math and reading) is 1030.

The surveys were completed in an online format through the online survey application LimeSurvey ®. Also, use of the online format allows for computer administration, which reduces transcription errors. The online format allowed students to participate anonymously and alone. In addition, students could also freely return to questions to change their responses. Anonymity and freedom in response (e.g., the ability to backtrack within the survey) have been shown to reduce the distortion of social desirability distortion (Richman, Kiesler, Weisb, & Drasgow, 1999).
Instrumentation

Surveys were used to collect student data. The data collected for this study were obtained through Limesurvey®, an online survey application. Students were provided with a static website address that directed them to the survey. In the following sections of this paper, an in-depth description of the instruments that were included in the survey and were used to calculate the variable measures. Descriptions include the content, origin, and scoring. In addition to a description of each instrument, validity and reliability are discussed.

Cumulative Risk

In the cumulative risk model, it is proposed that researchers create an index, which by itself is not an instrument, but provides the framework to produce “a single, easily interpreted score” (Sameroff et al., 1987, p. 346). Sameroff et al. (1987) determined that sets of risk factors related to any outcome could be created with the use of individual variables, provided that there are noteworthy findings within the literature to substantiate the potential negative impact on outcomes for the individual variable. Therefore, the model does not provide a specific instrument, but rather a template which can be used within a variety of contexts. The cumulative risk index is calculated for an individual by summing the number of risks he or she is experiencing (Sameroff et al., 1987). In the current study, 9 risk factors were identified within the undergraduate student persistence/retention literature, as part of the cumulative risk index, which meant that participant cumulative risk scores could range from 0 to 9. The predictive validity of the cumulative risk index has been repeatedly substantiated with the use of varying numbers and combinations of risk factors as part of the index throughout the literature across a variety of outcomes (see Sameroff & Fiese, 2000, Appleyard et al., 2005).
The risk factors used within the cumulative risk model were: (a) race/ethnicity (i.e., How do you describe yourself?); (b) English as a second language (i.e., Is English your native language?); (c) current parenthood status (i.e., Do you have any children?); (d) mother’s childbearing age (i.e., At what age did your mother give birth to her first child?); (e) student’s generational status as measured by both parents’ level of education (i.e., What is the highest degree earned by your father/mother?); (f) parents’ current marital status (e.g. widowed, divorced, or never married?) (i.e., Are your parents...?); (g) number of siblings (i.e., How many siblings are in your family?); (h) the student’s employment status (i.e., What is your current employment status?); and (i) the student’s transfer status (i.e., Have you ever been enrolled at another institution?).

Each risk factor utilized within the model is consistently evidenced in the undergraduate student retention/persistence literature in regards to increased risk. Each answer was coded as a 1 for Risk or a 0 for No risk. The participants’ answers were then summed to create a cumulative risk score that could range from 0 to 9. The variables that were used to calculate cumulative risk are displayed in Table 1. The range of values for this study was between 0 and 7 (See Table 2).

**Race/ethnicity.** Following the work of Lundy-Wagner (2012) and others, respondents who reported that they were non-Caucasian or non-Asian received a score of 1, whereas respondents who reported they were Caucasian (i.e., white) or Asian received a score of 0.

**English as a second language.** Students who indicated that English was their second language received a score of 1 (Hechanova-Alampay et al., 2002; Roessingh & Douglas, 2012), and students who indicated that English was their native language received a score of 0.
Current parenthood status. Students who reported that they have children received a score of 1, and students who reported that they had no children received a score of 0 (Haveman & Wolfe, 1995; Tinto, 1975).

First-generation status. Students who reported that neither their mother nor father had a bachelor’s degree or higher received a score of 1 (Padgett, Johnson, & Pascarella, 2012), and students who reported at least one parent with a bachelor’s degree or higher received a score of 0.

Mother’s childbearing age. Students who reported their mother was younger than 20 when she gave birth to her first child received a score of 1 (Brooks-Gunn & Furstenberg, 1986), while students who reported their mother was 20 years or older when she gave birth to her first child received a score of 0.

Parents’ current marital status. Students who indicated that their parents are single, divorced, separated or widowed received a score of 1 (Haveman & Wolfe, 1995), whereas students whose parents were married received a 0.

Number of siblings. Students who reported four or more children in their family (including themselves) received a score of 1; whereas, students who reported fewer than four children (including themselves) received a score of 0 (Sameroff et al., 1987).

Student’s employment status. Students whose response indicated their employment status was 20 hours or more a week received a score of 1 (Furr & Elling, 2000; Gilardi & Guglielmetti, 2011), and students whose response indicated their employment status was fewer than 20 hours a week received a score of 0.

Student’s transfer status. A student who indicated he or she has been enrolled as a full-time student at another institution received a score of 1 (Duggan & Pickering, 2008; Hoyt &
Winn, 2004; Lee et al., 2009). Students who had never been enrolled full-time at another institution received a score of 0.

Table 1

*Variables Used For Calculating Cumulative Risk Scores*

<table>
<thead>
<tr>
<th>Risk Variable</th>
<th>Low Risk</th>
<th>High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/ethnicity</td>
<td>Caucasian or Asian</td>
<td>Non-caucasian or non-Asian</td>
</tr>
<tr>
<td>ESL</td>
<td>English as native language</td>
<td>English as second language</td>
</tr>
<tr>
<td>Current Parenthood Status</td>
<td>No children</td>
<td>Have children</td>
</tr>
<tr>
<td>First-generation Status</td>
<td>Either or both parents have bachelor’s degree</td>
<td>Neither parent has a bachelor’s degree</td>
</tr>
<tr>
<td>Mother’s Childbearing Age</td>
<td>20 or older</td>
<td>19 or younger</td>
</tr>
<tr>
<td>Parents’ Current Marital Status</td>
<td>Married</td>
<td>Single, Divorced, Separated, Widowed</td>
</tr>
<tr>
<td>Number of Siblings (including student)</td>
<td>3 or less</td>
<td>4 or more</td>
</tr>
<tr>
<td>Employment Status</td>
<td>Work 20 hours or less</td>
<td>Work 20 hours or more</td>
</tr>
<tr>
<td>Transfer Status</td>
<td>Never enrolled full-time at another institution</td>
<td>Full-time enrollment at another institution</td>
</tr>
</tbody>
</table>

Note. Low Risk scored as 0. High Risk scored as 1. ESL = English as a Second Language.

**Moderate to Vigorous Physical Activity**

Physical activity was measured with the use of the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). Participants were asked questions based on the last seven days related to the frequency (i.e., days per week) and time (i.e., hours and minutes) of vigorous and moderate activity occurring no less than 10 minutes at a time, walking and sitting (Craig et al., 2003). Participants were asked to gauge the intensity of activity according to their body’s response to the activity. Activity was classified as moderate if the subject was performing activity for no fewer than 10 minutes that made them breathe somewhat harder than
normal, and could include: (a) carrying light loads, (b) bicycling at a regular pace, or (c) doubles tennis, but (d) not walking (Craig et al., 2003). Vigorous activity was classified as activity that made the participant breathe much harder than normal, and could include: (a) heavy lifting, (b) digging, (c) aerobics, or (d) fast bicycling (Craig et al., 2003). Time was converted to total minutes spent in moderate and/or vigorous physical activity over the 7 days prior to the participant’s completion of the survey. Data was treated as a continuous variable. Total time reported for this study ranged from 0 minutes/week to 2,460 minutes/week (See Table no clue what number this will be). The IPAQ has been validated in more in 12 countries with an overall 1 week test-retest reliability of approximately .80 (Craig et al., 2003). Craig et al. (2003) found the criterion validity to be .03, a finding comparable to other self-report measures and consistent with other researchers who have tested the validity of the IPAQ in other populations (e.g. Macfarlane, Lee, Ho, Chan, & Chan, 2007; Maddison et al., 2007; Meeus, Eupen, Willems, Kos, & Nijs, 2011).

It should be noted that there are limitations inherent with self-report measures of physical activity; however, there are inherent limitations of objective measures used to validate the self-report measures as well (Prince et al., 2008). In a review of the literature, Prince et al. (2008) found no trends related to over-estimation or under-estimation of self-report in comparison to objective measures. Inconsistencies with measures, number of days measured and time-lag between self-report and objective measure, and the statistical analyses used, made meta-analysis impossible (Prince et al., 2008). Additionally, accelerometers used to objectively measure activity have limitations that can impact validity, such as the types of activities being measured and the ability to measure sedentary behavior, specifically posturing (Plasqui, Bonomi, & Westerterp, 2013; Vallance et al., 2011). Even double-labeled water (DLW) methods, considered
to be the gold standard, not only measure energy expenditure from physical activity, but also resting energy expenditures, which over-estimate energy expenditure unless corrections are made (Prince et al., 2008). Upon review, Prince et al. (2008) could come to no definitive conclusion related to the validity of self-report measures. Given the exploratory nature of the current study and the increase in cost and expense of objective measures, self-report will be utilized in this study and considered as a limitation (Prince et al., 2008).

**Institutional Commitment**

The College Persistence Questionnaire is a 53-item questionnaire developed to predict student attrition (Davidson, Beck, & Milligan, 2009). The instrument was created through the combination of six subscales (Davidson et al., 2009). The CPQ uses a 5-point Likert-type scale. Responses are then converted to a *favorability score* with the extremes being ±2 and neutral being equal to 0 (i.e., scores may range from -2 to 2). Mean scores are calculated for each student. (e.g., a student with favorability scores on the four Institutional Commitment subscale items of 0, -2, +1, and +2 will have a mean of .25). Items related to a construct that may not be applicable to all students are provided a sixth option of not applicable (e.g., A student who will be graduating will not enrolling the following semester and would utilize this option.) (Davidson et al., 2009). Items scored as six are not included in the composite score (Davidson et al., 2009). Students are then indexed, and the lower scores indicating greater risk. Negative scores show students at greater risk. The Institutional Commitment subscale is a 4-item subscale, which identifies the student's: (a) likelihood of earning a degree at the institution, (b) confidence that the institution is a correct fit, (c) likelihood to re-enroll the next semester, and (d) any thoughts of not completing the degree (Davidson et al.). With regard to predictive validity, the Institutional Commitment subscale was a significant predictor of student persistence, *p* < .000. Cronbach’s
alpha for the Institutional Commitment subscale was .78 (Davidson et al.). Chronbach’s alpha for the current study was .84 (See Table 7). Lindheimer, (2011) conducted a study to further develop the CPQ, with the addition of some items not related to retention, but institutional effectiveness (Lindheimer, 2011). Three additional items were added to the Institutional Commitment subscale to determine perceptions related to whether advantages outweighed disadvantages of attending and a question asking how loyal the student was to the university (Lindheimer, 2011). Lindheimer’s results mirrored those of original CPQ, in that Institutional Commitment was a significant predictor of persistence behaviors ($p = .001$). The original Institutional Commitment subscale will be used for this study.

**Control Variables**

Selection of the control variables was based on the literature in which it suggested that these variables influence the criterion variable; however, there was no way to control for these influences in the research design (Cohen et al., 2003). All control variables were self-reported. Participants were asked to report their; (a) gender (i.e., What is your gender? Male or Female), (b) age (i.e., How old are you?), (c) high school GPA (i.e., What was your high school GPA?), and (d) ACT/SAT score (i.e., What was your score on the ACT or SAT?). The ACT scores were converted to SAT scores using a concordance table (ACT Inc., 2008). Responses to age, high school GPA, and ACT/SAT scores were collected via self-report wherein students typed in a numerical answer. As such, data were left as continuous variables and entered into analyses as covariates. According to Cole and Gonyea (2010) research has shown overall validity of self-reported test scores are high.

Gender was dummy coded to convert the categorical response to nominal data, where male was coded as a 1 and female was coded as a zero. Control variables were collected as part
of sociodemographic data collected for the cumulative risk index. Participants’ ages, which were reported for this study were between 18 and 48. The SAT scores ranged from 610 -2180, and high school GPA ranged from 2.0 -4.7 (See Table 7).
<table>
<thead>
<tr>
<th>Theoretical Framework &amp; Research</th>
<th>Variable</th>
<th>Data Source/Measurement</th>
<th>Unit of Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Schofield &amp; Dismore, 2010; Scott, 2005)</td>
<td>Control Data Age</td>
<td>Self-report survey; #1; What is your age?</td>
<td>Years</td>
</tr>
<tr>
<td>(Buchmann &amp; DiPrete, 2006; NCES, 2012)</td>
<td>Gender</td>
<td>Self-report survey; #2; What is your gender?</td>
<td>Male/Female</td>
</tr>
<tr>
<td>(Frey &amp; Detterman, 2004; Reason, 2004; Sawyer, 2013)</td>
<td>High School GPA</td>
<td>Self-report survey; #23; What was your high school GPA?</td>
<td>4.0 Scale</td>
</tr>
<tr>
<td>(Frey &amp; Detterman, 2004; Geiser &amp; Studley, 2002; Sawyer, 2013)</td>
<td>ACT/SAT Scores</td>
<td>Self-report survey; #24; What was your score on the ACT or SAT?</td>
<td>ACT composite score (11-36) or SAT (750-2400)</td>
</tr>
<tr>
<td>Transactional Development Thoery (Sameroff &amp; Fiese, 2000; Sameroff &amp; Makenzie, 2003) (Brown et al., 2012; Davis et al, 2011; Efrat, 2011; London &amp; Castrechini, 2011; Roberts, Freed, &amp; McCarthey, 2010; Singh, Uijtdewilligen, Twisk, van Mechelen, &amp; Chinapaw, 2012; Telford et al., 2012).</td>
<td>Moderate to Vigorous Physical Activity</td>
<td>Self-report survey; International Physical Activity Questionnaire (Craig et al., 2003); Activities performed at work, as part of house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport, for at least 10 minutes at a time. Example: Now, think about all the vigorous activities which take hard physical effort that you did in the last 7 days. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for at least 10 minutes at a time. Self-report survey; IPAQ #1; During the last 7 days, on how many days did you do vigorous physical activities? Self-report survey; IPAQ #2; How much time did you usually spend doing vigorous physical activities on one of those days?</td>
<td>Total Minutes</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Days per week</td>
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<td>Hours/minutes per day</td>
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<tr>
<td>Theoretical Framework &amp; Research</td>
<td>Variable</td>
<td>Data Source/Measurement</td>
<td>Unit of Analysis</td>
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</tr>
<tr>
<td>Theory of Student</td>
<td>Institutional Commitment</td>
<td>Self-report survey; College Persistence Questionnaire Institutional Commitment Subscale (Davidson, Beck &amp; Milligan, 2009)</td>
<td></td>
</tr>
<tr>
<td>(Pascarella &amp; Terenzini, 1980; Spady, 1970; Terenzini, Lorang, &amp; Pascarella, 1981; Tinto, 1975)</td>
<td></td>
<td>Self-report survey; IC CPQ #1; How likely is it that you will earn a degree from here?</td>
<td>5 point Likert-type Scale: 1 = Very Unlikely, 5 = Very Likely</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-report survey; IC CPQ #2; How confident are you that this is the right university for you?</td>
<td>5 point Likert-type Scale: 1 = Not Confident, 5 = Very Confident</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-report survey; IC CPQ #3; How likely is it that you will reenroll here next semester?</td>
<td>6 point Likert-type Scale: 1 = Very Unlikely, 5 = Very Likely, 6 = Not applicable (I am graduating next semester)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-report survey; IC CPQ #4; How much thought have you given to stopping your education here perhaps transferring to another college, going to work, or leaving for other reasons?</td>
<td>5 point Likert-type Scale: 1 = No Thought, 5 = A Great Deal</td>
</tr>
</tbody>
</table>
Procedures

After application and approval from the Institutional Review Board, data collection began (See Appendices D and E). Three weeks prior to the end of the fall 2012 semester, course instructors emailed students, providing information about the study, including (a) a request for voluntary participation, (b) the dates of the three-week window the survey would be available online, and (c) a hyperlink that allowed the students to access the online survey. The letter can be viewed in Appendix A. Three weeks prior to the end of the fall semester was identified as an ideal time to collect data as it is after registration for Spring 2013 classes had opened for students. Many students then had already enrolled and were aware of any financial or academic restrictions related to their academic progress, which potentially increased self-awareness related to intent to return and institutional commitment. Instructors re-sent the original email one week prior to the closing of the online survey. There was no monetary incentive offered for participation in the study; however, students were eligible to receive “activity points” in the psychology course they were enrolled in by participating.

All students enrolled in any residential psychology course (i.e. any course taught within the psychology department) are required to complete a specific number of “activity points” as part of the course requirements. “Activity points” can be earned by students enrolled in the class through a variety of opportunities such as attending psychology-related events or participation in research studies. All “activity point” activities are posted on the Psychology Activities webpage. Students are notified through Blackboard ® and by email when a new activity is available. Coercion of students is eliminated, as there are more opportunities provided to earn “activity points” than are required. By offering more opportunities than are needed, students are able to select only those activities in which they feel comfortable participating. In addition, students
were able to discontinue the survey at any time without penalty and could still receive the psychology activity points.

The static web address to the survey was uploaded to the “activity point webpage,” and the psychology faculty were notified through email about the presence of survey on the “activity point webpage.” Professors were asked to send a Blackboard announcement about the survey’s presence to students so the students would know about a new opportunity available to earn “activity points,” along with the survey invitation. The survey was made available on the “activity point” webpage the last three weeks of November during the fall 2012 semester.

A web-based, self-report survey format was selected based on the ability to provide anonymity and reduce the possibility of missing data (Gall et al., 2007). Anonymity prevents Family Educational Rights and Privacy Act violations, protects student privacy, and may reduce anxiety or fear that could lead to dishonesty or non-response (Gall et al., 2007). In order to maintain anonymity, a signed informed consent form was waived. Students were able to view and print the informed consent form. Students provided consent by clicking an “I agree” button to enter the survey. The informed consent letter can be located in Appendix B.

**Data Analysis**

**Power Analysis**

A power analysis was conducted to ensure that the sample pool would be sufficiently large to provide an appropriate sample size for this study. The tool, G*Power 3 was used to determine the required sample size as suggested by Field (2013). With an alpha (i.e., probability of type I error) set at 0.05, a power (1 - beta) of 0.8, three predictor variables, 4 covariates and an \( f^2 \) of .15, the required minimum samples size was 103 (Faul, Erdfelder, Lang, & Buchner, 2007). While it has been argued that use of small, medium, or large effect sizes suggested by Cohen
(1988) will underestimate the actual required sample sizes required for multiple regression
(Maxwell, 2000), the number of complete responses to the survey surpassed the required sample
size.

**Data Screening**

Prior to the performance of the hierarchical multiple regressions to evaluate the
association among variables, assumption testing was conducted. Assumption testing to
determine skewness, kurtosis, and multivariate normality was calculated with SPSS 22.0 (IBM
Inc., Somers, NY) and the use of a probability-probability plot (p-p plot; Field, 2013). Normality
was tested with a histogram, while linearity and homoscedasticity were evaluated utilizing
scatter plots (Cohen et al, 2003). Multicollinearity was tested using zero-order correlations with
a cut-off of .8, and the variance inflation factor (VIF) (Cohen et al., 2003; Field 2013).
Multivariate outliers were assessed with Cook’s distance and Mahalanobis distances with a
distance greater than 14.07 (Field, 2013). Any identified outliers were evaluated and removed
from the sample (Cohen, 2003). The Durbin-Watson test was performed to assess for correlation
between residuals (Field, 2013). In addition, bivariate correlations and descriptive statistics for
all variables are presented.
Table 3

Explanation of Data Analysis Tests

<table>
<thead>
<tr>
<th>Data Analysis Test</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchical Multiple Regression</td>
<td>Examined the strength of the relationship between variables and the fit of the moderator model</td>
</tr>
<tr>
<td>Probability-Probability Plot</td>
<td>Assessed data for skewness, kurtosis, and multivariate normality</td>
</tr>
<tr>
<td>Histogram</td>
<td>Assessed distribution for skewness and kurtosis</td>
</tr>
<tr>
<td>Scatter Plots</td>
<td>Assessed data for linearity and homoscedasticity</td>
</tr>
<tr>
<td>Cook’s Distance</td>
<td>Identified multivariate outliers</td>
</tr>
<tr>
<td>Mahalanobis Distance</td>
<td>Identified multivariate outliers</td>
</tr>
<tr>
<td>Zero-order correlations</td>
<td>Assessed multicollinearity of predictor variables</td>
</tr>
<tr>
<td>Variance Inflation Factor</td>
<td>Assessed multicollinearity of predictor variables</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>Assessed data for correlation of residuals</td>
</tr>
</tbody>
</table>

Analysis

A hierarchical multiple regression with a significance level of .05 was used to test the hypothesis. Hierarchical multiple regression was selected because it allowed multiple predictor variables to be entered into the model in a specified sequence within “blocks” (Cohen et al., 2003; Howell, 2008). Specifically, hierarchical multiple regression allowed for continuous predictor variables identified in past research to be entered within the model first (as part of a “block”), in order of importance, followed by the new predictors last in the order of importance (entered in subsequent “blocks”) (Field, 2013). By allowing the researcher to determine the
order in which variables are entered, it can be determined if the model was improved with the addition of the new variables (Field, 2013). As such, hierarchical multiple regression is an analysis frequently used in the cumulative risk literature to test proposed models (e.g., Sameroff, Seifer, Zax & Baracas, 1987; Sameroff, Seifer, Baldwin & Baldwin, 1993) as new variables are evaluated in the context of variables already evidenced as predictors. Additionally, hierarchical multiple regression is also used as a statistical analysis within undergraduate retention research and specifically utilized in studies that used the CPQ (e.g., Beck & Milligan, 2013; Braxton et al., 2008; Davidson et al., 2009). In addition, the use of hierarchical multiple regression also allows for the investigation of a moderator variable.

The moderator model was tested following the work of Baron and Kenny (1986) and Mackinnon (2008). First, both predictor variables were centered to aid in interpretation and reduce collinearity, ultimately in order to improve model estimates (Aiken & West, 1991; Field, 2013; Mackinnon, 2008). Second, an interaction term was created by multiplying the centered predictors (Aiken & West, 1991; Field, 2013; Mackinnon, 2008). Third, variables were entered into the model as “blocks.” Block 1 contained the covariates (i.e., gender, academic level, high school GPA, and ACT/SAT scores; Cleary & Kessler, 1982; Cohen, 2003; Field, 2013). Block 2 included the centered predictor variables (i.e., the cumulative risk score and physical activity) (Cleary & Kessler, 1982; Cohen, 2003). In Block 3 the moderator (i.e., the interaction between cumulative risk and moderate/vigorous physical activity) was entered (Cleary & Kessler, 1982; Cohen et al., 2003). The overall significance of the model, as well as the change in $R^2$ for each model, was then assessed. In addition, beta coefficients were interpreted. Any significant interactions were probed and graphed following the steps outlined in Aiken and West (1991) and Mackinnon (2008).
Table 4

*Data Source Blocks*

<table>
<thead>
<tr>
<th>Data Course Blocks</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Age</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
</tr>
<tr>
<td></td>
<td>SAT/ACT Score</td>
</tr>
<tr>
<td></td>
<td>High School GPA</td>
</tr>
<tr>
<td>Block 2</td>
<td>Cumulative Risk Score</td>
</tr>
<tr>
<td></td>
<td>Moderate to Vigorous Physical Activity</td>
</tr>
<tr>
<td>Block 3</td>
<td>Cumulative Risk Score x Moderate to Vigorous Physical Activity</td>
</tr>
</tbody>
</table>

**Missing Data**

Missing data were addressed differently for analysis depending upon the variable that was missing. Students who did not identify their mother’s age at the birth of her first child where entered as a 0 risk. Of the participants, data on mother’s age at the birth of her first child was missing for 12 participants. In this way, any estimate of risk is potentially more conservative than a student’s actual level of risk. Any moderate to vigorous physical activity responses reported as a range of total number of days or a range of total minutes per day were entered using the lower value in the range of days and the mean of total minutes per day. A total of 34 cases reported levels of moderate to vigorous physical activity as a range. No cases were missing. If moderate to vigorous physical activity was missing, a 0 was entered for activity. Missing data from the high school GPA and SAT/ACT data fields were replaced with the sample mean, as is consistent with previous research (Cohen et al., 2003; Porter & Swing, 2006; Titus, 2006). Data was missing for 32 of the cases within the sample. Any cases that had missing institutional
commitment data were not included in the regression analysis. A total of 16 cases were removed from the regression analysis.
CHAPTER FOUR: FINDINGS

The purpose of this correlational study was to determine if the concept of cumulative risk could be applied to a model of undergraduate student institutional commitment at a large, private, 4-year liberal arts university. Specifically, this study examined the association between cumulative risk and undergraduate student institutional commitment. Moderate to vigorous physical activity was also tested as a protective factor, which would act as a moderator in the association between cumulative risk and institutional commitment. Presented in Chapter four is the data analysis used for: (a) assumption testing, (b) hypotheses testing, and (c) the subsequent results. Also included are: (a) descriptive data, (b) procedures for assumption testing, and (c) the results of data analysis for each hypothesis.

- **H1:** Building upon the cumulative risk literature, it is expected that students experiencing a high level of cumulative risk will exhibit low institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores.

- **H2:** Given what research suggests about the benefits of physical activity on physical and sociodemographic outcomes, it is expected that there will be a significant positive association between moderate to vigorous physical activity and institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores.

- **H3:** It is expected there will be a significant interaction between cumulative risk and physical activity in a model predicting institutional commitment, while controlling for gender, age, high school GPA, and ACT/SAT scores. Specifically, high levels of moderate to vigorous physical activity will serve as a protective factor for students experiencing high levels of risk.
Consistent with the recommendations of MacKinnon (2008) and Baron and Kenny (1986), hierarchical multiple regression was used to test the hypotheses. SPSS 22.0 for Windows software (IBM Inc., Somers, NY) and MPlus 6.0 (Muthen & Muthen, Los Angeles, CA) were used for statistical analyses. Alpha levels were set a priori at 0.05.

Assumption Testing

Prior to the conduct of the statistical analyses to test the hypotheses, the data were screened and cleaned to evaluate the sample distribution. Assumption testing was performed to evaluate: (a) linearity, (b) independence, (c) homoscedasticity, and (d) normality. An exploration of histograms and the skewness and kurtosis values for the predictor, covariates, moderator and criterion variables revealed that the data on age, institutional commitment, levels of physical activity and cumulative risk were not normally distributed. Provided in the Table 7 are the central tendency measures for predictor and criterion variables. Although, given the population surveyed, it makes sense that age and cumulative risk was positively skewed, non-normality can be problematic for regression analyses however. Specifically, parameter estimates can be biased by non-normal data, which impacts null hypothesis significance testing of models (Field, 2013). As a result, the analysis was run with the use of the bootstrapping methods in MPlus (Mothen & Mothen, Los Angeles, CA). Bootstrapping does not impose the assumptions of sampling distribution normality and as such is a robust method when assumptions are violated (Field, 2013; Preacher & Hayes, 2008). The findings in MPlus, however, did not differ from the initial regression. As such, the results presented below are those from the original regression. Cook’s distance and Mahalanobis distances were assessed in SPSS. The maximum Cook’s distance for the sample was less than 1 (.452), which suggested there were no outlier cases that impacted the model. With the use of the critical value for Mahalanobis distance of 14.09, 72
multivariate outliers were removed from the sample of 430; the final sample size was 358 (Cohen, 2003; Field, 2013).

The Durbin-Watson test value was close to 2, an indication that the residuals were uncorrelated (Field, 2013). Zero-order correlations were utilized to assess multicollinearity, and no variables exceeded the cut-off of .8 (Cohen et al., 2003). In addition, the variance inflation factor (VIF) values for all predictors within the model were well below 10, and tolerance values were above .2, which indicated that there was no strong linear relationships with other predictors (Field, 2013). In addition, the analysis explored bivariate correlations as collinearity between predictors makes it impossible to obtain unique estimates of the regression coefficient (see Table 5).

Table 5

<table>
<thead>
<tr>
<th>Correlation of Predictor Covariates, Moderator and Criterion Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IC</td>
<td>—</td>
<td>.006</td>
<td>-.113*</td>
<td>-.008</td>
<td>.076</td>
<td>-.126*</td>
<td>-.015</td>
<td>-.011</td>
</tr>
<tr>
<td>2. Age</td>
<td>.006</td>
<td>—</td>
<td>.016</td>
<td>-.172*</td>
<td>-.218*</td>
<td>.269*</td>
<td>.030</td>
<td>.222*</td>
</tr>
<tr>
<td>3. Gender</td>
<td>-.133*</td>
<td>.016</td>
<td>—</td>
<td>-.112*</td>
<td>-.218*</td>
<td>.111*</td>
<td>.021</td>
<td>.022</td>
</tr>
<tr>
<td>4. SAT</td>
<td>-.008</td>
<td>-.172*</td>
<td>-.112*</td>
<td>—</td>
<td>.342*</td>
<td>-.169*</td>
<td>-.065</td>
<td>-.048</td>
</tr>
<tr>
<td>5. HSGPA</td>
<td>.076</td>
<td>-.218*</td>
<td>-.218*</td>
<td>.342*</td>
<td>—</td>
<td>-.267*</td>
<td>-.044</td>
<td>-.087</td>
</tr>
<tr>
<td>6. Cumulative Risk</td>
<td>-.126*</td>
<td>.269</td>
<td>.111*</td>
<td>-.169*</td>
<td>-.267*</td>
<td>—</td>
<td>-.044</td>
<td>.112</td>
</tr>
<tr>
<td>7. MVPA</td>
<td>-.015</td>
<td>.030</td>
<td>.021</td>
<td>-.065</td>
<td>-.044</td>
<td>-.044</td>
<td>—</td>
<td>-.027</td>
</tr>
<tr>
<td>8. Interaction</td>
<td>-.011</td>
<td>.222*</td>
<td>.022</td>
<td>-.048</td>
<td>-.087</td>
<td>.112</td>
<td>.027</td>
<td>—</td>
</tr>
</tbody>
</table>

Note. IC = Institutional commitment; MVPA = Moderate to vigorous physical activity; Interaction = Cumulative Risk x MVPA

*p<.05

Descriptive Data

A total of 430 surveys were completed. Conservatively, this response was a 10.4% response rate based on the potential 4,135 students enrolled in a psychology class. The response rate of 10.4% is a conservative estimate as the university data provide only enrollment numbers for each course; therefore, students who were enrolled in multiple psychology courses during the
semester the survey was open were counted multiple times, which may over estimate the size of the sample pool. Over-estimation of the sample pool is probable given that 49.2% of the sample reported psychology as their major and were likely enrolled in more than one psychology course.

Assumption testing revealed that 72 of the 430 responses were identified as multivariate outliers, and these responses were removed. Consequently, 358 completed surveys comprised the sample. It should be noted that the multiple regression run prior to the removal of multivariate outliers produced the same results. Of the respondents, 31.8% \((n = 114)\) were male and 68.2% \((n = 244)\) were female. Ages of the respondents ranged from 18 to 48, and 90.2% \((n = 323)\) of respondents’ ages ranged from 18-23 (see Table 6). Of the participants, 276 (77.1%) were Caucasian, 33 (9.2%) were African American, 19 (5.3%) were Hispanic, 15 (4.2%) were Asian, and 15 (4.2%) indicated other ethnicities. In further exploration of the demographics of the sample, 124 (34.6%) participants identified themselves as a freshman, 77 (21.5%) identified themselves as a sophomore, 66 (18.4%) identified themselves as a junior, and 91 (25.4%) identified themselves as a senior.

Of the 358 participants within the sample: (a) 92 (25.7%) reported no risk factors, (b) 109 (30.4%) reported 1 risk factor, (c) 71 (19.8%) reported 2 risk factors, (d) 46 (12.8%) reported 3 risk factors, (e) 24 (6.7%) reported 4 risk factors, (f) 14 (3.9%) reported 5 risk factors, (g) 1 (0.3%) reported 6 risk factors, (h) 1 (0.3%) reported 7 risk factors, and (i) no students reported having 8 or 9 risk factors. According to Rutter (1979) and Werner and Smith (1982), an individual who experiences 4 or more risk factors would be considered as High risk; for this sample 40 (11.2%) students within the sample would be considered as High risk. See Table 6 for additional descriptive data, including the frequency of each risk factor and see Table 7 for central tendency measures for each independent and dependent variable.
Table 6

*Participant Characteristics*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>114</td>
<td>31.8%</td>
</tr>
<tr>
<td>Female</td>
<td>244</td>
<td>68.2%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>101</td>
<td>28.2%</td>
</tr>
<tr>
<td>19</td>
<td>70</td>
<td>19.6%</td>
</tr>
<tr>
<td>20</td>
<td>52</td>
<td>14.5%</td>
</tr>
<tr>
<td>21</td>
<td>74</td>
<td>20.7%</td>
</tr>
<tr>
<td>22</td>
<td>26</td>
<td>7.3%</td>
</tr>
<tr>
<td>23</td>
<td>13</td>
<td>3.6%</td>
</tr>
<tr>
<td>23-48</td>
<td>22</td>
<td>6.1%</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>33</td>
<td>9.2%</td>
</tr>
<tr>
<td>Asian</td>
<td>15</td>
<td>4.2%</td>
</tr>
<tr>
<td>Caucasian (White)</td>
<td>276</td>
<td>77.1%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>19</td>
<td>5.3%</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>4.2%</td>
</tr>
<tr>
<td><strong>Parents’ Current Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>11</td>
<td>3.1%</td>
</tr>
<tr>
<td>Married</td>
<td>276</td>
<td>77.1%</td>
</tr>
<tr>
<td>Separated</td>
<td>10</td>
<td>2.8%</td>
</tr>
<tr>
<td>Divorced</td>
<td>47</td>
<td>13.1%</td>
</tr>
<tr>
<td>Widowed</td>
<td>14</td>
<td>3.9%</td>
</tr>
<tr>
<td><strong>Employment Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 20 hours/week</td>
<td>340</td>
<td>95.0%</td>
</tr>
<tr>
<td>≥ 20 hours/week</td>
<td>18</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>ESL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESL</td>
<td>19</td>
<td>5.3%</td>
</tr>
<tr>
<td>Native English</td>
<td>339</td>
<td>94.7%</td>
</tr>
<tr>
<td><strong>Current Parenthood Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>8</td>
<td>2.2%</td>
</tr>
<tr>
<td>No Children</td>
<td>350</td>
<td>97.8%</td>
</tr>
<tr>
<td><strong>First-generation College Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-generation</td>
<td>142</td>
<td>39.7%</td>
</tr>
<tr>
<td>Second-generation or more</td>
<td>216</td>
<td>60.3%</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
</tbody>
</table>

**Mother’s Childbearing Age**

| ≤19  | 33  | 9.2% |
|≥20   | 325 | 90.8% |

**Cumulative Risk (0-9)**

| 0    | 92  | 25.7% |
| 1    | 109 | 30.4% |
| 2    | 71  | 19.8% |
| 3    | 46  | 12.8% |
| 4    | 24  | 6.7%  |
| 5    | 14  | 3.9%  |
| 6    | 1   | .3%   |
| 7    | 1   | .3%   |
| 8-9  | 0   | 0%    |

**Major (By School)**

| General Studies (includes undecided) | 20  | 5.6% |
| Music                                | 4   | 1.1% |
| Aeronautics                          | 1   | 0.2% |
| Arts & Sciences                      | 15  | 4.2% |
| Communication & Creative Arts        | 20  | 5.6% |
| Engineering & Computational Sciences | 8   | 2.2% |
| Health Sciences (Non-Psychology)     | 50  | 14.0% |
| Health Sciences (Psychology)         | 176 | 49.2% |
| Government/Law                       | 10  | 2.8% |
| Business                             | 15  | 4.2% |
| Religion                             | 18  | 5.0% |
| Education                            | 21  | 5.9% |

**Classification**

| Freshman        | 124 | 34.6% |
| Sophomore       | 77  | 21.5% |
| Junior          | 66  | 18.4% |
| Senior          | 91  | 25.4% |

Note. ESL = English as a Second Language
Table 7

Central Tendency Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
<th>Median</th>
<th>Mode</th>
<th>Min/Max</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>20.20(2.86)</td>
<td>20</td>
<td>18</td>
<td>18/48</td>
<td></td>
</tr>
<tr>
<td>SAT</td>
<td>1483.15(292.60)</td>
<td>1495.40</td>
<td>1495.40</td>
<td>610/2180</td>
<td></td>
</tr>
<tr>
<td>HSGPA</td>
<td>3.43(0.52)</td>
<td>3.50</td>
<td>3.00</td>
<td>2.0/4.7</td>
<td></td>
</tr>
<tr>
<td>Cumulative Risk</td>
<td>1.59(1.42)</td>
<td>1.00</td>
<td>1.00</td>
<td>0.0/7.0</td>
<td></td>
</tr>
<tr>
<td>MVPA</td>
<td>267.70(476.31)</td>
<td>.00</td>
<td>.00</td>
<td>0.0/2460.0</td>
<td></td>
</tr>
<tr>
<td>IC</td>
<td>1.20(0.91)</td>
<td>1.50</td>
<td>2.00</td>
<td>-2.0/2.0</td>
<td>.837</td>
</tr>
</tbody>
</table>

Note. IC = Institutional commitment; MVPA = Moderate to vigorous physical activity; Interaction = Cumulative Risk x MVPA

Results of the Cumulative Risk Moderator Model

A hierarchical multiple regression was performed to test the physical activity moderator model as suggested by Baron and Kenny (1986) and Mackinnon (2008). Of the 358 participants, 16 had missing institutional commitment data; therefore, only the 342 complete responses were included in the moderator model. Control variables (i.e., age, gender, SAT/ACT scores, and high school GPA) were entered in Block 1 of the regression. Model 1 explained 2% of the variance, R² = 0.02, Adjusted R² = 0.01, in institutional commitment, which was not statistically significant, F(4, 337) = 1.89, p = 0.11. Within Block 1, gender was the only variable with a statistically significant association with institutional commitment. The results indicated that males were significantly more likely to report higher levels of institutional commitment than females, β = 0.11, p = 0.04. Block 2 included the addition of the centered predictors (i.e., cumulative risk and moderate to vigorous physical activity). Model 2 explained 4% of the variance, R² = 0.04, Adjusted R² = 0.02, in institutional commitment, F(6, 335) = 2.04, p = 0.06, which also was not a significant contribution to the overall model. The interaction term (i.e., cumulative risk score x level of moderate to vigorous physical activity) was added in Block 3. Model 3 did not contribute significantly, F(7, 334) = 0.00, p = 0.10, to the overall model.
accounting for only 4% of the variance in institutional commitment, $R^2 = 0.04$, Adjusted $R^2 = 0.02$.

**Hypothesis 1: Cumulative Risk and Institutional Commitment**

Hypothesis 1 addressed the association between cumulative sociodemographic risk and institutional commitment. Specifically, it was hypothesized that those students with high levels of cumulative risk would exhibit low institutional commitment while controlling for gender, age, high school GPA, and ACT/SAT scores. The findings from the data analysis supported Hypothesis 1, as cumulative risk was a significant predictor of institutional commitment, $\beta = -0.12$, $p = 0.03$. Specifically, the statistical analysis revealed a negative association between cumulative risk and institutional commitment, where high levels of cumulative risk were significantly associated with low levels of institutional commitment (See Table 8).

**Hypothesis 2: Moderate to Vigorous Physical Activity**

In Hypothesis 2, it was suggested there would be a positive association between levels of moderate to vigorous physical activity and institutional commitment while controlling for gender, age, high school GPA, and ACT/SAT scores. As such, students who reported high levels of moderate to vigorous physical activity would exhibit high institutional commitment. Contrary to expectations, moderate to vigorous physical activity was not significantly associated with institutional commitment, $\beta = 0.05$, $p = 0.37$ (See Table 8).

**Hypothesis 3: Interaction Term**

It was hypothesized that there would be a significant interaction between cumulative risk and moderate to vigorous physical activity while controlling for gender, age, high school GPA, and ACT/SAT scores. Specifically, high levels of moderate to vigorous physical activity would serve as a protective factor for students who experienced high levels of risk, which would moderate the association between cumulative risk and institutional commitment. Contrary to
expectations, the interaction was not a significant predictor of institutional commitment, $\beta = .01$, $p = 0.88$ (See Table 8).

**Table 8**

*Summary of Hierarchical Regression Analysis for Variables Predicting Institutional Commitment*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Block 1</th>
<th></th>
<th></th>
<th>Block 2</th>
<th></th>
<th></th>
<th>Block 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE B$</td>
<td>$\beta$</td>
<td>$B$</td>
<td>$SE B$</td>
<td>$\beta$</td>
<td>$B$</td>
<td>$SE B$</td>
</tr>
<tr>
<td>Age</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
<td>0.01</td>
<td>0.02</td>
<td>0.04</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.24</td>
<td>0.12</td>
<td>-0.12*</td>
<td>-0.22</td>
<td>0.11</td>
<td>-0.11*</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>SAT</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.04</td>
<td>0.00</td>
<td>0.00</td>
<td>-0.05</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>HSGPA</td>
<td>0.12</td>
<td>0.10</td>
<td>0.07</td>
<td>0.06</td>
<td>0.11</td>
<td>0.04</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>Cumulative Risk</td>
<td>-0.14</td>
<td>0.05</td>
<td>-0.15*</td>
<td>0.14</td>
<td>0.05</td>
<td>0.15*</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>MVPA</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.04</td>
<td>0.05</td>
<td>0.05</td>
<td>0.01</td>
<td>0.05</td>
</tr>
</tbody>
</table>

$R^2$ | 0.02 | 0.04 | 0.04 |
Model $F$ | $F(4, 337) = 1.89$ | $F(6, 335) = 2.04$ | $F(7, 334) = 1.74$ |
$F$ for change in $R^2$ | 0.11 | 0.10 | 0.96 |
p-value | 0.11 | 0.06 | 0.10 |

Note. IC = Institutional commitment; MVPA = Moderate to vigorous physical activity; Interaction = Cumulative Risk x MVPA

*p<.05

**Summary**

Results from the statistical analysis indicated that the moderator model was not significant, $F(7, 334) = 0.00$, $p = 0.10$; however, gender, $\beta = .11$, $p = 0.04$, and cumulative risk, $\beta = -0.15$, $p = 0.01$, were statistically significant predictors of institutional commitment. Specifically, males reported higher levels of institutional commitment than females. It was found that high cumulative risk was associated with low institutional commitment. There were no statistically significant associations between moderate to vigorous physical activity and
in institutional commitment, $\beta = .05, p = 0.37$, as well as no statistically significant interaction between cumulative risk and moderate to vigorous physical activity, $\beta = .01, p = 0.88$. These findings failed to support the hypothesis that moderate to vigorous physical activity is associated with institutional commitment. Further, these findings failed to support moderate to vigorous physical activity as a protective factor, moderating the association between cumulative risk and institutional commitment. Chapter five provides an in-depth discussion of the results presented in Chapter four. Specifically, the discussion will; (a) discuss the findings of this study within the context of the undergraduate retention body of literature, (b) address implication and limitations of the current study, (c) provide suggestions for future research, and (d) provide implication for this study.
CHAPTER FIVE: DISCUSSION

The body of literature related to undergraduate student persistence continues to grow as attempts are made to determine ways to prevent undergraduate student dropout. Specifically, there is no current model capable of accounting for all the predictors of student persistence behaviors that have already been identified in the literature to increase risk. Furthermore, research has not provided information about the student-institution interaction that could provide direction for institutional action (College Board, 2009; Robbins, Allen, Casillas, Peterson & Le, 2006; Tinto, 2006). The findings from this current study extended the body of literature related to undergraduate student retention by exploring the association between cumulative risk and student institutional commitment. The study investigated whether the cumulative risk model is predictive of institutional commitment. In addition, moderate to vigorous physical activity was investigated as both a predictor of institutional commitment, and as a potential moderator of the association between cumulative risk and institutional commitment.

Summary of Findings

The findings from this study indicated that the moderate to vigorous physical activity moderator model was not statistically significant. The results did not support the hypothesis that moderate to vigorous physical activity would moderate an association between cumulative risk and institutional commitment. Despite the lack of statistical significance for the overall model, gender and cumulative risk were found to be statistically significant predictors of institutional commitment. These findings suggested that males were more likely to report high levels of institutional commitment, and high levels of cumulative risk were associated with low institutional commitment, which supported Hypothesis 1 of the study. Moderate to vigorous physical activity and institutional commitment were not significantly associated. Also, there was
no statistically significant interaction between cumulative risk and moderate to vigorous physical activity. These results did not support the hypothesis that moderate to vigorous physical activity is associated with institutional commitment.

**Discussion of Findings**

The results from the hierarchical regression suggested that the moderator model was a poor fit for the data. None of the blocks, which were entered as part of the model, significantly improved the prediction of institutional commitment. The lack of statistical significance may have been a function of the variables measured within the model. While the overall model was not significant, predictors (i.e. gender and cumulative risk score) within the model were significantly associated with institutional commitment. Specifically, the results from this study supported Hypothesis 1 that cumulative risk is significantly associated with institutional commitment. This finding suggested that the cumulative risk index is a viable model for research related to undergraduate student institutional commitment, a modifiable construct known to predict persistence behaviors. Support of Hypothesis 1 aligns with previous research (Campbell et al., 2012; Pungello et al., 2010), in which the association between cumulative risk and educational outcomes were identified at the bachelor-level.

While the current study was consistent with previous research, the current study varied from, and extended the works of Campbell et al. (2012) and Pungello et al. (2010) in several ways. First, Campbell et al. (2012) and Pungello et al. (2010) utilized six variables within the cumulative risk index, whereas the current study used nine. Of the six risk variables utilized by Campbell et al. (2012) and Pungello et al. (2010) to determine participant cumulative risk scores, the current study used three (i.e., having a teen mother, large family size, and parents not married). Despite the varying number of risk variables included in the cumulative risk index in
each of the studies, the findings were the same; there was a negative association between the cumulative risk score and the educational outcome (Campbell et al., 2012; Pungello et al., 2010). The cumulative risk literature has consistently shown that the cumulative risk model is robust no matter how many variables are included in the index (e.g., Furstenberg, Cook, Eccles, Elder, & Sameroff, 1999; Gutman, Sameroff, & Cole, 2003; Rutter, 1979; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987).

Second, Campbell et al. (2012) and Pungello et al. (2010) utilized three measures of educational attainment (i.e., years taken to achieve the highest degree earned, highest grade completed, and two categorical variables associated with high school graduation and matriculation to a 4-year institution). While the current study investigated a mediator of persistence behaviors in current undergraduate students, the outcome results were the same in all three studies. Cumulative risk was negatively associated with the educational outcome (Campbell et al., 2012; Gutman, Sameroff, & Cole, 2003; Pungello et al., 2010).

Third, Campbell et al. (2012) and Pungello et al. (2010) investigated a sample population of individuals previously classified as high risk for academic failure or developmental delays. In the current study, however, a sample population of undergraduate students with no previously identified risk was used. Again, results of the current study were consistent with previous research; cumulative risk was negatively associated with an educational outcomes (Campbell et al, 2012; Pungello et al., 2010). The consistency in findings is of particular interest as it may suggest that the effects of cumulative risk are constant at varying levels of education, in the same way the effects of cumulative risk are constant within socioeconomic status groups (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987).
The variations of risk that occur within the undergraduate student group can be evidenced in the descriptive statistics of the sample population used in the current study. Descriptive statistics revealed that: (a) 88.7% (318) of respondents reported 3 or fewer risk factors as part of the cumulative risk index, (b) 92 (25.7%) reported no risk factors, and (c) only 40 (11.2%) of students reported 4 or more risks factors. Using the cumulative risk score of 4 or greater to identify high risk as suggested by Rutter (1979) and Werner and Smith (1982), the descriptive statistics indicate that only 11.2% of the sample population would be classified as high risk. The relatively low percentage of students within the sample experiencing 4 or more risk factors, in conjunction with the large percentage of students experiencing low levels of risk, is not surprising given the findings within the cumulative risk literature.

In the evaluation of research within a cumulative risk model, it is important to note that risk is a population term, which indicates an increased likelihood of a negative outcome and does not specify which individuals will experience the negative outcome (Masten & Wright, 2005). As such, enrollment in college would be less likely for those individuals experiencing high levels of risk, but the high level of risk would not prevent an individual from enrolling. Therefore, it would be expected that a sample of undergraduate students would have a high proportion of participants experiencing very low cumulative risk scores. Likewise, it would also be expected that a small portion of undergraduate students would be considered at-risk.

This point is evidenced in the works of Campbell et al. (2012) and Pungello et al. (2010) only used participants classified as at-high risk for academic failure for developmental delays initially due to socioeconomic status. Within this high-risk population, no participant had a cumulative risk score higher than four in a cumulative risk index of six (Campbell et al., 2012; Pungello et al., 2010). While the result indicated that the cumulative risk score was associated
with poorer educational outcomes, there were participants within the control group who did attain a 4-year degree despite the risk they experienced (Campbell et al., 2012; Pungello et al., 2010). When compared to the treatment group, however, fewer participants attained a bachelor’s degree (Campbell et al., 2012; Pungello et al., 2010). Campbell et al. (2012) and Pungello et al. (2010) suggested that individuals who experience higher levels of risk were less likely to attain higher levels of education; therefore, it would be expected that an undergraduate student population would not have a high percentage of high-risk students.

From a theoretical perspective, the theory used to inform the cumulative risk model (i.e. transactional development theory) and this study, is not typically used within undergraduate retention research; therefore, the use of the cumulative risk model is appropriate. The cumulative risk model parallels all three major theories of undergraduate student retention, namely the theories of Bean (1985), Nora and Cabrera (1993), and Tinto (1979). All three major theories of undergraduate student retention posit that undergraduate outcomes are a function of the interactions that occur between an individual and the environment that alter adaptation and response (Bean, 1985; Nora & Cabrera; Tinto). Similarly, the theory that informs the cumulative risk model (transactional developmental theory) posits that outcomes are a function of adaptations made in response to interactions between the individual and the environment (Sameroff & Fiese, 2000).

The cumulative risk model is able to contribute to the body of literature as the model has the ability to effectively account for multiple factors previously identified in the literature to increase the risk of dropout. As such, the cumulative risk model has the potential to investigate the patterns of adaptation that occur in relation to the interaction between the individual and the institution which influence institutional commitment (Bean, 1985; Nora & Cabrera, 1993; Tinto,
The cumulative risk model, therefore, is complementary to current theories rather than it being a competing theory.

Moderate to vigorous physical activity was also investigated as a predictor of institutional commitment. Statistical analysis did not suggest that moderate to vigorous physical activity was a predictor of institutional commitment, thereby Hypothesis 2 was rejected. These findings were not expected, as moderate to vigorous physical activity has been evidenced within the literature to influence a variety of variables known to both directly and indirectly impact both institutional commitment and subsequent persistence behaviors (e.g., executive control, memory, affect, etc.) (e.g., Mata et al., 2013; Mitchell & Phillips, 2007; Pekrum, Elliot, & Maier, 2009; Stroth et al., 2009; Wichers et al., 2012).

There are two reasons that could potentially explain the lack of statistical significance related to levels of physical activity. First, there is the potential that physical activity could impact risk in the same way that employment impacts risk. Specifically, there could be a threshold of time at which point physical activity may negatively affect undergraduate student behaviors, and thereby increasing the risk of dropout (Bozick, 2007; Hawkins, Hawkins, Smith, & Grant, 2005).

Hawkins et al. (2005) suggested that students who were employed were more likely to exhibit poor academic performance, and were less likely to be connected to the institution because of the time requirements of employment. An additional explanation for the poor academic performance and lack of connection with the institution that resulted from employment was provided in a study conducted by Bozick (2007). Bozick (2007) used the selection-to-work perspective to explain why undergraduate students who worked more than 20 hours a week were more likely to dropout. The selection-to-work perspective implied that an academically
motivated student who sees college as part of his or her future will devote less time to work in order to focus on educational tasks (Bozick, 2007). In the same manner, it could be assumed that an academically motivated student would also devote less time to exercise in order to focus on educational tasks.

Second, the lack of a statistically significant association between moderate to vigorous physical activity and institutional commitment may be related to the time frame specified in the International Physical Activity Questionnaire (IPAQ; Craig et al., 2003). The items within the IPAQ focused on physical activity that occurred over the seven days prior to the respondent completing the survey. Given the fact that the survey was administered at the end of the semester during the holiday season, reported levels of physical activity may have varied from the average weekly levels of activity participants participated in throughout the year. The timing of the survey may explain the high percentage of students who reported no physical activity and would have resulted in a positively skewed sample distribution as seasonal variations in physical activity levels have been noted (McCormack, Friedenreich, Shiell, Corti, & Doyle-Baker, 2010). Again the survey was launched at the end of the fall semester in order to effectively evaluate institutional commitment at the end of a term. Future studies may either seek to ask questions related to the average weekly activity over a series of weeks or months if data are collected during this part of the semester or to collect data at several times throughout the semester.

Moderate to vigorous physical activity was also investigated as a moderator (i.e., protective factor) for the association between cumulative risk and institutional commitment. The findings from this study did not reveal a significant interaction effect between levels of moderate to vigorous physical activity and cumulative risk. This finding resulted in a rejection of Hypothesis 3. While literature has suggested that moderate to vigorous physical activity buffers
the impact of risk related to a variety of outcomes that affect educational outcomes (e.g., Brito et al., 2009; Herring et al., 2012; Quiet al., 2012), moderate to vigorous physical activity does not appear to buffer the impact of risk on institutional commitment.

Despite the lack of significant findings related to the interaction between moderate to vigorous physical activity and cumulative risk, these results may not necessarily be the outcome of a poorly fit moderator model as it relates to the study of undergraduate student retention. Rather the lack of a significant contribution of Model 3 may be a function of the variables utilized within the moderator model. Statistical analysis suggested the fit of model was not significantly improved with the addition of the interaction term calculated to analyze the moderation effect; however, these results may simply indicate the lack of moderation by the variable (i.e., moderate to vigorous physical activity) itself. That is, the moderator model may be well fit to investigate moderators of undergraduate institutional commitment, but was not well fit for the data utilized in this study. Therefore, further investigation of the moderator model is necessary.

It should also be noted that within Model 1, the only covariate found to significantly be associated with institutional commitment was gender. Results indicated that males were significantly more likely to report high levels of institutional commitment than females. Gender was used as a statistical control within the study because of findings presented in the body of literature; however, these results were contrary to expectation. Current literature suggests that there is an educational gender gap as it relates to persistence to degree (Buchman & DiPrete, 2006; National Center for Educational Statistics, 2012). Specifically, more women than men are completing degrees at the undergraduate level (National Center for Educational Statistics, 2012). Given that the conferral rate of bachelor’s degrees for females is higher than that of males
(National Center for Educational Statistics, 2012), it would be expected that females within the sample population would be more likely to report higher levels of institutional commitment.

Risk factors experienced by the students within the sample may provide a limited explanation for these findings. Buchmann and DiPrete (2006) conducted a study that suggested that family background characteristics influence males and females differently. One finding of the study was a declining graduation rate for men who had absent fathers (Buchmann & DiPrete, 2006). Examination of the risks experienced by the sample population revealed that 77% of the sample population reported their parents were still married either as part of a first, second, or third marriage implying the presence of a father or a father-figure. This data would imply that a large percentage of males within the sample had a father or father-figure present; however, this is merely speculation. More research is needed to fully explain the contrary findings.

**Limitations**

There are several limitations that should be noted related to this study. Generalizability of these results is limited due to the use of a convenience sample. Specifically, participants were undergraduate students enrolled in a single, evangelical university. Given the evangelical nature of the institution, it could be assumed that institutional commitment may be relatively strong as the religious affiliation of the school is a characteristic that draws many students to the institution. In addition, the sample was limited to those students enrolled in psychology courses the semester data were collected, with the majority of respondents (49.2%) identifying their major as psychology. It should also be noted that the sample population was predominately Caucasian (68.2%) and female (77.1%), which are statistics not reflective of the student body. Therefore, inferences should be made with caution. Future research should focus on extending the current study by using undergraduate students representing a variety of institutions.
The use of survey data also resulted in inherent limitations. Non-response bias is a threat to external validity as those students who chose not to participate may vary systematically from those who chose to participate. External validity was further limited by self-selection bias of those who were willing to complete the survey (Cozby & Bates, 2011). For example, students who chose to participate may have been more committed to the institution; likewise, those who chose not to participate may have been less committed to the institution. Social desirability is also a limitation of survey research. While social desirability distortion is potentially reduced through an online format that allows for anonymity and freedom in response (e.g. the ability to backtrack within the survey) (Richman, Kiesler, Weisb, & Drasgow, 1999), it should still be considered a limitation.

Causality can only be theoretically inferred, given the lack of time-order precedence within the correlational design (i.e., all measures were collected at the same time; Gall et al., 2007). Moreover, the model may not include all salient variables, which predict institutional commitment, and it may contain measurement error in the observed variables (Gall et al., 2007). In the future, researchers should investigate additional factors known to increase risk as part of the cumulative risk index.

It should also be noted that while the outcome measure of the current study was a modifiable construct identified as a mediator of persistence behavior, persistence behaviors cannot be inferred. Again, the decision not to measure actual persistence behaviors was based on literature that indicated that research should not focus on a past behavior that cannot be changed (i.e. dropout) (Cabrera, Nora, & Castaneda, 1993; Tinto, 2006). As such, it was not the goal of this study to investigate actual persistence behaviors.
Implications for Practice

The findings of this study suggest that the total accumulation of risk factors may be a viable indicator of undergraduate student risk for departure. This finding is of particular importance as it relates to research investigating institutional commitment and potentially subsequent persistence or dropout. While this study utilized a theoretical framework employed within developmental research, the findings reaffirm the importance of undergraduate student retention research that accounts for the myriad of transactions that occur between the student and the institution. Moreover, this study provides a model (i.e., cumulative risk model) that is capable of accounting for variables that may affect the transactions that occur between the student and the institution.

From an administrative standpoint, the findings suggest institutional staff may need to consider factors beyond isolated academic indicators when they seek to identify students at risk for dropout. While indicated by research, evaluating risk based on multiple risk factors at the institutional level would prove problematic as it would be difficult to obtain the necessary information related to the risk of dropout from the students. The difficulty for institutions is that legally they cannot require students to provide information related to some of the risk factors evaluated as part of this study (e.g., ethnicity, family status). These factors cannot be required because of potential discrimination that could result.

While moderate to vigorous physical activity was not found to be either predictive of institutional commitment or to moderate the association between cumulative risk and institutional commitment, there is reason to continue investigating physical activity and its impact on undergraduate students. Given the benefits of physical activity apart from institutional commitment as identified within the review of literature, physical activity should be encouraged
within the undergraduate population. Encouraging physical activity is also suggested in light of previous research that has demonstrated the positive effect of physical activity on cognitive control, executive function, memory, and affect (Kamijo et al., 2010; Kamijo & Takeda, 2010; Stroth et al., 2009). Additionally, evidence supports the positive effects of physical activity on disease prevention (e.g. coronary heart disease, cancer) and mental health (e.g. depression; Physical Activity Guidelines Advisory Committee, 2008).

**Recommendations for Future Research**

This study was designed to provide additional insight into undergraduate student retention. Specifically, this study sought to address the call for a model that would allow research to be translated into effective interventions (College Board, 2009; Tinto, 2006). To address this call, the current study utilized a moderator model to investigate cumulative risk, moderate to vigorous physical activity, and the interaction between cumulative risk and institutional commitment as a predictor of institutional commitment. Given the findings of this study, additional research is suggested in several areas.

Further research should focus on investigating the association between the cumulative risk model and institutional commitment, and ultimately longitudinal retention rates. Specifically, additional risk factors identified within the student retention literature should be incorporated within the cumulative risk index to determine the extent to which cumulative risk is associated with the index. Additionally, further research should seek to determine whether the lack of statistical significance within the moderator model is due to the variable selected as the moderator within this study or whether the lack of statistical significance was due to a poorly fit model. Given the potential of the model to inform intervention research, and given the need for
a model of institutional action within the undergraduate student retention research this is an important area of future research.

There is also reason to continue to investigate levels of physical activity in relation to undergraduate student persistence to degree. For example, studies have suggested that freshman seminars that included physical activity components were more effective. Specifically, Porter and Swing (2006) found in a study of 45 institutions that health education (e.g., impact of alcohol, importance of physical activity, etc.) was one of only two components of first-year seminars that had an impact on early intentions to persist. Additionally, it would be interesting to include other health-related components in conjunction with physical activity levels (e.g., body composition, maximum oxygen uptake, and calorie consumption), to provide a more clear picture of health behaviors that may reduce undergraduate student risk.

Given recommendations within the undergraduate retention literature, the outcome variable used within this study was a mediator of persistence behaviors instead of persistence behaviors (Cabrera, Nora, & Castaneda, 1993). Additional research may seek to evaluate the impact of cumulative risk on actual persistence behaviors. As well, research could longitudinally investigate cumulative risk in relation to persistence to degree.

**Summary and Conclusion**

The results from this study indicated that cumulative risk is a significant predictor of institutional commitment. This finding is consistent with literature that supports cumulative risk as a predictor of educational outcomes (Campbell et al., 2012; Pungello et al., 2010). Although it was hypothesized that moderate to vigorous physical activity would serve as a predictor of institutional commitment and a moderator for the association between cumulative risk and institutional commitment, this was not the case. While physiological and physical activity
literature supports these hypotheses, the current results did not support the hypotheses. Future research should continue to examine the extent to which cumulative risk predicts institutional commitment.

Undergraduate student persistence to degree completion will continue to be an area of concern for universities and students alike. As the student retention body of literature continues to expand, research will need to move beyond merely identifying risk and begin to focus on factors that will help lower risk of dropout for undergraduate students. The use of the cumulative risk model will aid in such research, as it allows context to be considered. This model also supports the search for protective factors that may lower risk (e.g., study skills courses, teaching techniques utilized in the classroom, etc.).

The current study is one step in the process of answering the call for a research model that is capable of driving institutional action that will ultimately reduce the rate of undergraduate student attrition (College Board, 2009; Tinto, 2006). While a model was identified as capable of accounting for multiple risk factors already identified though undergraduate retention research, more research must be done. The benefits of undergraduate students persisting to degree extend far beyond the student and affect the institution and society as a whole. Researchers must continue making progress in identifying effective ways to prevent undergraduate student dropout. After all, it is our children and grandchildren that will benefit from our work.
REFERENCES


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APPENDICES

Appendix A

November 9, 2012

Brianne Kilbourne
IRB Exemption 1447.110912: A Cumulative Risk Model of Undergraduate Student Persistence and Depression

Dear Brianne,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required.

Your study falls under exemption category 46.101 (b)(2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects’ responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects’ financial standing, employability, or reputation.

Please note that this exemption only applies to your current research application, and that any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption, or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

Fernando Garzon, Psy.D. Professor, IRB Chair
Counseling (434) 592-4054
Liberty University | Training Champions for Christ since 1971
Appendix B

CONSENT FORM

A CUMULATIVE RISK MODEL OF UNDERGRADUATE STUDENT PERSISTENCE AND DEPRESSION

Brianne Fariss Kilbourne
Liberty University
School of Education

You are invited to be in a research study of undergraduate student retention. You were selected as a possible participant because you are an undergraduate student as indicated by your enrollment in an undergraduate psychology course, and therefore can best answer questions related to factors that have the potential to impact undergraduate student persistence to degree completion. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by: Brianne Fariss Kilbourne, School of Education, Liberty University

Background Information:

The purpose of this study is to test the cumulative risk model, a model used in child development and early intervention, as a predictive model for undergraduate student persistence and depression. Within the cumulative risk model we are testing to determine the association of behaviors, personal characteristics, and physical activity to student persistence and depression.

Procedures:

If you agree to be in this study, we would ask you to do the following things: Follow the website link provided and complete an online survey consisting of 97 questions. (The survey should take you no more than a 30 minutes to complete.)

Risks and Benefits of being in the Study:

The study has a few risks. Some of the questions on the surveys may become personal in nature or bring up past events, but severe emotional disturbance is unlikely. If you do become distressed, please contact the Student Care Office in 1830 Green Hall, (434) 5822651, or studentcare@liberty.edu. No one is required to participate, and you may discontinue your participation at any time without penalty.

The benefits to participation are: (a) the information gained will help identify those behaviors and traits that may increase a student’s chances of persisting to degree completion, and (b) the information gained will help identify those behaviors and traits that may decrease a student’s risk of developing depression. Knowledge of these associations may help institutions create interventions to improve student success.

Compensation:
There is no monetary compensation, but you will receive one psychology activity credit. If you decide to participate, you are free to not answer any questions or to quit the survey at any point (there is no penalty for leaving at any point and you will receive psychology activity credit). If you decide not to participate, other opportunities are available to receive psychology activity credit.

Confidentiality:

The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records. The online survey is anonymous, and you will not be asked to provide your name or any identification numbers. Data are gathered only through the online survey and stored only with the researchers. No one outside the researchers (who do not know who you are) will see the information you submit for the online survey.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University. If you decide to participate, you are free to not answer any question or withdraw at any time without affecting this relationship.

Contacts and Questions:

The researchers conducting this study are: Mrs. Brianne Kilbourne, Dr. Brianne Friberg, and Dr. Beverly Mahoney. You may ask any questions you have now. If you have questions later, you are encouraged to contact Mrs. Brianne Kilbourne at, 1971 University Blvd., Suite1892 Green Hall, Lynchburg, VA 24502, 434-592-4684, bkilbourne@liberty.edu or Dr. Brianne Friberg, 1971 University Blvd, DeMoss Hall, Lynchburg, VA 24502, 434-592-4065, bfrifberg2@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at fgarzon@liberty.edu.

You may print a copy of this information to keep for your records.

Statement of Consent:

By clicking “agree,” you affirm that you have read and understood the above information. You have asked questions and have received answers. You consent to participate in the study.

IRB Code Numbers:

IRB Exemption 1447.110912

IRB Expiration Date: November 9, 2013