Exploration of Temporal Changes in Exercise Behavior, Perceived Fitness, and Identity in Former High School Athletes Entering College

Paula-Marie Ferrara
University of Tennessee, Knoxville, ferrara@hope.edu

Follow this and additional works at: https://trace.tennessee.edu/utk_graddiss

Part of the Exercise Science Commons

Recommended Citation

This Dissertation is brought to you for free and open access by the Graduate School at TRACE: Tennessee Research and Creative Exchange. It has been accepted for inclusion in Doctoral Dissertations by an authorized administrator of TRACE: Tennessee Research and Creative Exchange. For more information, please contact trace@utk.edu.
To the Graduate Council:

I am submitting herewith a dissertation written by Paula-Marie Ferrara entitled "Exploration of Temporal Changes in Exercise Behavior, Perceived Fitness, and Identity in Former High School Athletes Entering College." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Kinesiology.

Kelley Strohacker, Major Professor

We have read this dissertation and recommend its acceptance:

Scott E. Crouter, Rebecca A. Zakrajsek, Pamela S. Angelle

Accepted for the Council:

Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)
Exploration of Temporal Changes in Exercise Behavior, Perceived Fitness, and Identity in Former High School Athletes Entering College

A Dissertation Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Paula-Marie Martinez Ferrara
August 2021
Acknowledgements

If I were to thank everyone who has supported me over the last four years, this acknowledgements section would be longer than the dissertation itself. So, before I go any further, thank you to each and every person who has encouraged me, uplifted me, vented with me, laughed with me, cried with me, prayed with and for me, and brought me coffee and/or food as a way of supporting me as I pursued my Ph.D. I am eternally grateful to each of you.

To Dr. Kelley Strohacker—thank you! You had the monumental task of taking a non-thesis Master’s student with little to no research background and turning her into an academic professional. Through the ups and downs of the last four years you have been both a mentor and a friend to me, and the depth of my gratitude is unlimited. Thank you for your encouragement, your limitless advice, your critiques (yes, those too), and your constant persistence in pushing me beyond my limits. I leave this program a better researcher, teacher, and person because of you, and I look forward to our continued friendship as colleagues in the future.

To my committee—Dr. Scott E. Crouter, Dr. Rebecca A. Zakrajsek, and Dr. Pamela S. Angelle—thank you each for stepping out of your comfort zones with this crazy amalgamation of a dissertation project. Dr. Crouter, thank you for always setting the standard and pushing my limits with your firm critiques, difficult questions, and gentle encouragement. Whether in research, teaching, or in my conduct as an exercise and academic professional, I will always think back to the example you have imprinted on me over the last four years. Dr. Zakrajsek, thank you for your joy! Not only have you been a knowledgeable teacher and instrumental collaborator, but you have also been an inspiration and an example to me for what it means to seek fulfillment and joy in life. Thank you for your constant reminders to always look on the bright side. To Dr. Angelle, thank you for enabling my inner mad scientist! This dissertation
(literally) would not have happened without you, and I am so grateful to you for agreeing to be on my committee, always taking time to answer my incessant questions, and for your constant enthusiasm for my work.

To Dr. Brittany S. Overstreet and Dr. Jessica Kutz Fleming, thank you both for your mentorship and friendship. Dr. Overstreet, thank you for taking the chance and recommending UTK to me in the first place! While in the years since I graduated from UD our relationship has evolved from that of mentor/mentee to friends and colleagues, I will always see you as one of the greatest sources of wisdom and best examples of professionalism in my life. Dr. Kutz Fleming, while we did not have much time at UTK together, you have become one of my most valued mentors during my time here. Thank you for always challenging me to think outside the box, for having a sympathetic ear whenever I needed it most, and for constantly pointing out to me that even the most complicated problems tend to have the simplest solutions.

To my family—my parents, Len and Alice, my sister and brother, Teresa and John, my brother-in-law Chris, and my sweet nephews, Luke and Conor—thank you for your incessant prayers, encouragement, and for keeping me motivated to pursue my goals. You’ve been around far longer than only the past four years, but whether it has been through random text messages, long phone calls, late night video chats, or our few-and-far-between in person visits, you have successfully pushed me through the tear, fears, and disappointments that inevitably come along with the grueling process of earning a Ph.D. Thank you for always making me laugh, smile, and giving me the kick in the pants I sometimes needed that only family members can provide. I love you with all my heart.

To the beautiful, wonderful communities of friends I found in Knoxville, especially my lab mates, the Knoxville Open Water Swimmers, and my communities at Holy Ghost and St.
John XXIII Catholic Churches—thank you for keeping me grounded in my faith, keeping me sane, and reminding me that I am still a human being even outside of work. Y’all are what made Knoxville home for me. Words cannot describe how much I love you and how much I will miss you as I move forward from Knoxville. Thank you for becoming my second families and making my time here worthwhile.

\emph{Gloria Patri, et Filio, et Spiritui Sancto}
Experts recommend physical activity promotion to preserve former high school athletes’ (FHSAs) post-sport transition quality. Specific understanding regarding behavioral changes over time after retirement is unknown and necessary for program development. The purpose of this mixed methods study was to document temporal changes to exercise behavior, perceived fitness, and identity in FHSAs, understand their exercise experiences over time, and explain why observed changes occurred. **Methods:** Participants completed eight online surveys from the beginning of their college fall to spring semesters. Questions assessed bodyweight, perceived fitness (Likert scale 1-5), aspects of self-reported exercise, perceived barriers (Likert scale 1-5), and identity (Likert scale 1-7). Quantitative analyses included hierarchical mixed modeling procedures, idiographic visual analysis, and calculation of intraclass correlation coefficients (ICCs) to determine within-person response consistency over time. A subsample completed a personalized, semi-structured interview incorporating their survey data. Resultant qualitative data underwent thematic analysis. **Results:** Thirty-five participants (85.4% retention, 28 women, 18±0 years) completed the survey portion of the study. At the group level, no statistically significant changes were observed in the primary outcomes. However, idiographic assessments revealed considerable intra-individual variation, with most variables demonstrating “poor”-“fair” consistency (ICC .271-.654). Only bodyweight (ICC=.987), athlete identity (ICC=.788), and exercise identity (ICC=.898) exhibited “good”-“excellent” consistency. Fourteen individuals completed interviews, yielding five themes: adapting to transition, from “athlete” to “athletic exerciser”, motivational determinants to exercise, within-person pre-condition, and environment. **Discussion:** While group level findings indicated participants maintained relatively high levels of exercise, identity, and ‘good’ perceptions of fitness, noted variability suggests
average values were not representative of individuals’ responses. Such variation in exercise behavior seems indicative of general college freshmen and was explained by participants’ time devoted to schoolwork, exercise-specific social supports in college, and COVID-19 restrictions. While FHSAs’ sports backgrounds provided a degree of exercise-related competence and ability to self-regulate behavior, they struggled with balancing fitness losses and expectations. Further, while past research implies identity is an antecedent to exercise, a cyclical relationship was conceptualized from participants’ qualitative data. Future directions should explore this relationship further, other former athlete populations’ behavior, and ways of nurturing FHSA’s exercise-related competence and self-regulatory capacity.
# Table of Contents

**CHAPTER I: INTRODUCTION**

- Background of the Problem .................................................................................................................. 1
- Statement of the Problem ......................................................................................................................... 6
- Purpose of the Study ................................................................................................................................. 6
- Importance of the Study ............................................................................................................................ 7
- Research Questions ..................................................................................................................................... 8

**CHAPTER II: LITERATURE REVIEW** ........................................................................................................ 10

- Transition Defined ...................................................................................................................................... 10
- Athlete Transition .......................................................................................................................................... 12
- Physical, Psychological, and Emotional Health of Former Athletes ......................................................... 19
- Physical Activity Behavior of Former Athletes ............................................................................................ 43
- Theories for Why Physical Activity Changes in Former Athletes ............................................................... 59
- Developing Physical Activity-Based Transition Programs for Athletes ....................................................... 66
- The Critical Need for Pre-Efficacy Research in Behavioral Intervention Development ............................... 81

**CHAPTER III: METHODOLOGY** ............................................................................................................... 87

- Research Questions .................................................................................................................................... 87
- Methodology ................................................................................................................................................ 87
- Study Overview .......................................................................................................................................... 90
- Population .................................................................................................................................................. 91
- Data Collection Procedures .......................................................................................................................... 94
- Data Analysis ............................................................................................................................................ 104
- Position Statement ..................................................................................................................................... 107
- Validity, Reliability, and Trustworthiness ..................................................................................................... 107
- Risks to Participants and Associated Protections ......................................................................................... 109
- Summary .................................................................................................................................................... 111

**CHAPTER IV: RESULTS** ......................................................................................................................... 112

- Participant Demographics ........................................................................................................................... 112
- Survey Results .......................................................................................................................................... 115
- Interview Results ....................................................................................................................................... 133
CHAPTER V: DISCUSSION

Integration II – Interpretations of Mixed Data

Limitations

Contributions From and To Mixed Methods

Summary of Major Findings and Future Directions

Conclusions

References

Appendices

Vita
List of Tables

Table 1. Demographics Of All Participants. ................................................................. 113

Table 2. Demographics Of Interview Participants.......................................................... 114

Table 3. Ranges Of Survey Completion Dates From The First To Last Participant. .......... 116

Table 4. Examination Of Within-Person Consistency Based On Intraclass Correlation Coefficients (ICCs) From Surveys 1-8; Factors Appear In The Order They Were Presented In On The Surveys. ............................................................................................................................ 132

Table 5. Qualitative Themes Constructed From Interviews. ........................................ 153
List of Figures

Figure 1. Data Collection, Analysis, And Integration Per The Explanatory Sequential Design. Uppercase Denotes Prioritized Data Strand; Lowercase Denotes Secondary Data Strand. .......... 92

Figure 2. Changes In Self-Reported Bodyweight Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ................................................................. 117

Figure 3. Changes In Global Fitness (I.E., Aggregation Of Perceived Muscular Strength, Muscular Endurance, Agility, Aerobic Fitness, And Flexibility) Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ...................................................... 118

Figure 4. Changes In Participants’ Activity Scores Over Time According To The Godin Leisure Time Exercise Questionnaire (A), With Median Split From Low (B) To High (C) Standard Deviation........................................................................ 121

Figure 5. Changes In Strenuous Intensity Exercise Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ................................................................. 122

Figure 6. Changes In Moderate Intensity Exercise Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ................................................................. 123

Figure 7. Changes In Light Intensity Exercise Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation........................................................................ 124

Figure 8. Changes In Aerobic Exercise Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. Asterisk (*) Indicates Significant Change Over Time (P<.01). 125

Figure 9. Changes In Muscle Strengthening Exercise Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ...................................................... 126

Figure 10. Changes Over Time To Participants’ Perceived Barriers To Exercise Regarding Time (A), Self-Discipline (B), Health (C), Social Support (D), And Other External Factors (E)...... 127

Figure 11. Changes In Athlete Identity Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ................................................................. 129

Figure 12. Changes In Exercise Identity Over Time (A), With Median Split From Low (B) To High (C) Standard Deviation. ................................................................. 130
CHAPTER I: INTRODUCTION

Background of the Problem

Emerging research suggests that, as high school athletes retire and discontinue organized sport, they can experience detrimental transition experiences as they enter college and could later be susceptible to declines in health. Approximately 97% of high school athletes do not continue to play intercollegiate sports (Brown, 2012) and are subject to variable transition experiences out of sport and upon entering college (Helms & Moiseichik, 2018; Lubker & Etzel, 2007; Lyons et al., 2018). Without organized sport, herein defined as sports activities requiring mandatory participation in training sessions and competitions (e.g., varsity sports, college club sports), members of this population may exhibit feelings of loss as they transition to their freshman year (Helms & Moiseichik, 2018). Although a protective effect on health as a result of past sports training and genetics has been theorized (Laure & Binsinger, 2009), former high school athletes’ (i.e., those who do not continue organized sport in college or beyond) long-term health outcomes are currently unknown. With discontinued training, if a sufficient portion of time is not replaced with physical activity, members of this population may still experience unfavorable health outcomes. In recent decades, the protective effect of past sport participation on health has been challenged through research conducted primarily in professional and collegiate athletes. For example, short-term detraining (10-30 days) has been shown to negatively impact insulin sensitivity, plasma lipids, and body composition in professional athletes (Liu et al., 2008; Rogers et al., 1990). When detraining is prolonged, these changes are likely to lead to more serious consequences. National organizations, such as the National Football League (NFL), have documented increased risks for comorbid disorders related to physical inactivity (e.g., cardiovascular disease, osteoarthritis) in retired athletes (Arliani et al., 2014; Baron et al., 2012;
Chang et al., 2009; Davies et al., 2016; Schwenk et al., 2007). Similarly, former college athletes have been shown to exhibit similar health deficits, such as lower health-related quality of life (Simon & Docherty, 2013), as well as worsening mental health (Kerr et al., 2014; Simon & Docherty, 2013, 2017) and body composition (Kerr et al., 2014; Simon & Docherty, 2017) compared to the general public. In response to these aforementioned research findings, experts are calling for physical activity promotion in former athletes at all levels of play, to prevent later health problems (Helms & Moiseichik, 2018; Lubker & Etzel, 2007; Russell et al., 2017; Simon & Docherty, 2013; Witkowski & Spangenburg, 2008).

While the long-term health outcomes of former high school athletes are mostly unknown, researchers purport that continued participation in sporting activities (Helms & Moiseichik, 2018; Lubker & Etzel, 2007) and physical activity intervention (Lubker & Etzel, 2007) is warranted to improve the transition experience of those who do not pursue intercollegiate sports participation. Former high school athletes have been shown to participate in a wide variety of activities in college, including intramural sports and non-University provided competitive leagues (Helms & Moiseichik, 2018), club sports, exercise classes, and “drop-in” activities (e.g., pick-up basketball, racquetball) at university recreational centers (Helms & Moiseichik, 2018; Lyons et al., 2018). However, aside from the types of activities former high school athletes take part in during college, virtually no evidence exists indicating whether they engage in these practices at health-promoting levels, nor how their fitness changes as a result of these practices. Conversely, emerging evidence exists showing that former college athletes (i.e., those who do not continue organized sport after college) experience substantial decreases in physical activity (Calfas et al., 1994; Sparling & Snow, 2002), with 24-60% of sample populations failing to meet the Physical Activity Guidelines for Americans (PAGA; Reifsteck et al., 2016; Sorenson et al.,
Additionally, while non-athlete alumni seemingly maintain or increase physical activity levels following graduation, former college athletes are more likely to report decreases in physical activity levels within five years of graduation, and in some cases, engage in less activity than non-athlete alumni (Reifsteck et al., 2013). This trend, which seems to prevail decades later (Calfas et al., 1994; Simon & Docherty, 2017; Sparling & Snow, 2002), may potentially result in the observed decreases in aerobic fitness and muscle strength (Simon & Docherty, 2017), physical function, and overall health-related quality of life (Simon & Docherty, 2013) in former college athletes compared to previous non-athlete alumni. As such, due to limited evidence available, it is not unreasonable to assume that former high school athletes may reflect changes in their physical activity and fitness seen in their college counterparts.

Perceptions of identity have been hypothesized as contributing to former athletes’ transition experiences and potentially relate to their post-sport activity levels. Athlete identity (i.e., how strongly an individual identifies as an athlete; Brewer et al., 1993) is a volatile factor that has been shown to majorly affect former athletes’ transition quality (Lally, 2007). In former high school athletes, more salient athlete identity (Lubker & Etzel, 2007) and feelings of loss associated with retirement (Helms & Moiseichik, 2018) can relate to distress in the transition to college. Athlete identity is also theorized to correlate with former athletes’ physical activity behavior (Reifsteck et al., 2013; Reifsteck et al., 2016) and exercise identity how strongly an individual identifies as an exerciser; Reifsteck et al., 2016), a behavioral correlate in the general population (Anderson & Cychosz, 1994). It is recommended that athletes actively diminish their athlete identity prior to retirement and focus on developing new life roles to maintain transition quality (Grove et al., 1997; Lally, 2007; Lally & Kerr, 2005). However, emerging research demonstrates positive correlations between athlete identity, exercise identity, motivation to be
active, and self-reported physical activity (Reifsteck et al., 2013; Reifsteck et al., 2016). This implies that as athletic identity naturally decreases as athletes transition out of sport (Houle et al., 2010), exercise identity and activity level may decline as well. Like previous research, however, it is unclear if such relationships examined in samples of former collegiate athletes apply to the population of former high school athletes.

In addition to the lack of research specifically assessing post-retirement physical activity, fitness, and perceptions of identity of former high school athletes, the existing literature poses two other important deficiencies that must be addressed prior to developing behavioral interventions tailored to various former athlete populations. The first involves the disconnect between researchers’ stated aims and approaches to data collection when attempting to understand former athletes’ physical activity changes. Previous studies have purportedly focused on general ‘physical activity’ (i.e., movement completed by the body that requires energy from the skeletal muscles; Caspersen et al., 1985) as an outcome, with results based on self-report questionnaires, such as the Patient-Reported Outcomes Measurement Information System (Cella et al., 2010) and the Godin Leisure-Time Exercise Questionnaire (Shephard, 1997). However, the use of questionnaires has been criticized as insufficiently accurate for obtaining estimates of total physical activity due to individuals’ inability to remember time spent in physical activities that are habitual, incidental, or intermittent (Sallis & Saelens, 2000). Thus, easier-to-remember physical activity behaviors, such as vigorous, structured exercise (i.e., planned, structured movement completed with the goal of maintaining or improving one or more components of physical fitness; Caspersen et al., 1985) or sporting activities are likely to be overreported. Because of this, distinctions between domains of physical activity have not been explicitly addressed in the literature. Behavioral measurements of ‘exercise’ can be more accurate in terms
of activity frequency, intensity, time, and type, and may provide more definitive details regarding former athletes’ behavior post-sport. As such, measuring these exercise-specific factors may be more worthwhile in understanding transition-related behavior changes, as it provides a more precise method in exploring how behavior changes with time after athletes retire.

The second limitation relates to the notion that virtually all research pertaining to changes in physical activity behavior of former athletes has been cross-sectional in nature. The duration of athletes’ transition out of sport is not necessarily bound by time in an absolute sense, but specific to the individual’s ease of adaptation (i.e., moving from being totally preoccupied with the transition to integrating it into life), which is influenced by their balance of resources and deficits, pre-post environment, and sense of competency, well-being, and health (Schlossberg, 1981). Regardless of how long it takes for any athlete to adapt to the transition out of sport, all share a similar beginning point to their transition (i.e., their final practice or competition) which culminates in the cessation of training and potential onset of decreased physical activity.

Documenting and explaining temporal variability in target health behaviors, their antecedents, and their consequences, has been strongly encouraged by researchers in behavioral psychology (Dunton, 2017; Dunton & Atienza, 2009). As such, examining changes in behavior and its associated transitional factors (e.g., perceptions of fitness, barriers, and identity), and why such changes occur, immediately following the cessation of sports training (or as close to this time as is feasible), may be most beneficial, initially, in determining key intervention strategies to mitigate deleterious changes in former athletes’ exercise behavior during the transition period.
Statement of the Problem

Overall, there is a lack of research examining how exercise behavior, fitness, and perceptions of fitness and identity change in former high school athletes during the timeframe when they are transitioning out of sport and into college. To date, many qualitative studies have explored various aspects of athletic retirement, including current athletes’ views of retirement (Torregrosa et al., 2015), former athletes’ retrospective struggles with identity post-sport (Lavallee & Robinson, 2007), factors that facilitated successful transitions (Raabe et al., 2017), and individuals’ readiness to retire, emotional responses, and coping strategies, (Park et al., 2013b). However, few have considered examining physical activity or exercise maintenance, specifically. As such, why observed behavioral changes may occur in former athletes once sports training ceases is also currently unknown.

Purpose of the Study

The purpose of this explanatory-sequential mixed methods study (Creswell, 2014) was to document temporal changes to perceived fitness, exercise behavior, and athlete and exercise identity in former high school athletes in their freshman year of college. Further, we sought to understand this population’s general experiences relating to exercise participation during this time period and explain why observed changes in the quantitatively measured variables occurred through individuals’ lived experiences. While measuring fitness via objective in-person testing was initially proposed to document changes over time, due to restrictions put in place from the COVID-19 pandemic, tracking individuals’ changing perceptions of fitness was used as a more feasible alternative. This study sought to recruit college freshmen who participated in organized sport during their senior year of high school and were transitioning to college, but did not continue to play organized sport in their first year. Per the explanatory-sequential design,
changes to participants’ perceptions of fitness, self-reported exercise behavior, and athletic and exercise identity were measured over a period of six months spanning their freshman fall and spring semesters. Then, results from these quantitative measurements were used to influence qualitative methods designed to explore a subset of participants’ experiences with exercise and perceptions of changes in the aforementioned factors. In doing so, these methods provide empirical insight into the fluctuations of measured factors over time, as well as an exploration of why observed changes occurred over the designated study period.

**Importance of the Study**

To date, only two formal programs exist to help athletes maintain physical activity levels after retiring from sport. The first is the Boiler Life After SporT (BLAST) program at Purdue University (Charter, 2017; Wilcoxson & Link, 2019), which focuses on four areas of wellness (nutrition and fitness, professional development, financial literacy, and health and wellness) to help athletes in their last or second-to-last year of eligibility prepare for their transition out of sport. However, to date nothing has been published regarding the program’s development, nor its success as athletes retire and move on from college. The second intervention is the Moving On! program implemented at the University of North Carolina, Greensboro. Moving On! is a four-session program grounded in self-determination theory (SDT; Deci & Ryan, 2012) and identity theory (Burke & Reitzes, 1991) that assists current college athletes in their last year of eligibility in transition planning, goal setting, and exploring new physical activity practices (Reifsteck & Brooks, 2018). Initial responses to the pilot study testing this program were positive by former athlete participants (Reifsteck & Brooks, 2018), with the authors suggesting adaptation of their framework for other college athletic transition programs, pending student-athletes’ athletic environment and opinions of program necessities (Brooks et al., 2019). The Moving On!
program provides preliminary insight into the potential benefits of behavioral interventions in supporting positive athlete transition and the feasibility of certain methods. However, as such interventions are likely to be complex and multifaceted, robust pre-efficacy research is needed to empirically define and test active intervention components prior to efficacy and effectiveness testing in randomized controlled trials. Premature examinations of efficacy can result in promising interventions being abandoned rather than refined in early stages (Czajkowski et al., 2015). As such, the Obesity-Related Behavioral Intervention Trials (ORBIT) Model was developed as a flexible and iterative framework to support small-scale, foundational research that informs future directions of intervention development (Czajkowski et al., 2015). To efficiently build, refine, and optimize novel behavioral interventions, exploratory methods, such as qualitative studies and ecological observational studies, are necessary to inform later hypothesis-driven phases (Czajkowski et al., 2015). Data from this exploratory mixed-methods study will enhance our knowledge of athlete transition in retirement by providing information on an athlete population that is under-researched in exercise and fitness. Further, results will provide a basis from which future, hypothesis-driven research may be directed for this population and may inform methods to be used when exploring other athlete populations’ behavior.

**Research Questions**

Per the mixed methods design of this exploratory study, three questions are posed: one based on the quantitative portion of the methods, one based on the qualitative, and one based on the integration of results from the two forms (i.e., strands) of data (Creswell, 2014):

**Question 1:** How do former high school athletes’ perceptions of fitness, self-reported exercise behavior, and identity change over the course of their freshman year when not participating in organized sport at the college level? (Quantitative)
Question 2: What are participants’ experiences with exercise over their freshman year? (Qualitative)

Question 3: Based on participants experiences, why do observed changes to the measured factors occur in this population over the course of their freshman year? (Mixed Methods)
CHAPTER II: LITERATURE REVIEW

Transition Defined

Transitions occur throughout one’s lifetime and are an unavoidable aspect of life. Schlossberg’s Model of Transition (1981), anecdotally regarded as the ideal for defining the transition process, has been used as the antecedent for modern models of transition for specific populations and transition types due to its versatility. This model dictates that a “transition can be said to occur if an event or non-event results in a change in assumptions about oneself and the world, and thus requires a corresponding change in one’s behavior and relationships” (Schlossberg, 1981, p. 5). This definition stems from Crisis Theory (Lindemann, 1965) which states that when the equilibrium of an individual’s environment, patterns of everyday life, or usual problem-solving methods are disrupted, they experience tension, feelings of discomfort, or strain, resulting in anxiety, fear, guilt, shame, helplessness, and disorganization of function. Some transitions can be dictated to an extent by social convention, age, and be instigated by obvious expected life changes (e.g., getting married, having children, career retirement) while others can be more unexpected (e.g., losing a job, getting indefinitely quarantined due to a pandemic) or instigated by non-events (e.g., being bypassed for an expected job promotion) (Schlossberg, 1981). A psychosocial transition necessitates “the abandonment of one set of assumptions and the development of a fresh set to enable the individual to cope with the new altered life space,” (Parkes, 1971, p. 103) thus a transition may provide the opportunity for psychological growth or the danger of psychological deterioration (Moos & Tsu, 1976). Regardless, all transitions cause a certain level of stress and require adaptations from the individual experiencing the process (Schlossberg, 1981).
The Key to Transition: Adaptation

Adaptation is defined as a process by which individuals shift from being completely preoccupied with the transition they are experiencing to integrating it into his or her life (Schlossberg, 1981). The length of time it takes for adaptation to occur is variable, as the “ease of adaptation to transition depends on one’s perceived and/or actual balance of resources to deficits in terms of the transition itself, the pre-post environment, and the individual’s sense of competency, well-being, and health,” as well as their assumptions regarding these factors before and after the transition (Schlossberg, 1981, pp. 7-8). Schlossberg’s Model assesses a person’s adaptation to transition from the changing ratio of their resources to deficits to determine why individuals react to the same type of transition differently at certain points in their life.

The Transition/Adaptation Relationship

Based on Schlossberg’s Model (1981), three sets of factors mediate the transition/adaptation relationship. The first is the characteristics of the transition: role change, or whether one’s perceived role has been gained or lost; affect regarding transition, whether it is positive or negative; the source of the transition (i.e., internal or external), the timing, or whether it was “on-time” based on social convention or not, onset (i.e., sudden or gradual), duration (i.e., permanent, temporary, or uncertain) and degree of stress (Schlossberg, 1981). The second factor is the effect of the pre-/post-environment on adaptation, which is based on the interpersonal and institutional support systems available to an individual, and whether the physical setting a person is in has been compromised or changed due to transition (Schlossberg, 1981). The third determinant to adaptation is the characteristics unique to the individual, where factors such as psychosocial competence, sex, age or life stage, health state, race or ethnicity, socioeconomic status, values, and previous experience with similar transitions all affect an individual’s ability to
adapt to their given situation (Schlossberg, 1981). However, not all of these factors have equal salience to an individual’s adaptation and are dependent on the particular type of transition.

**Athlete Transition**

In the realm of sports, athletes can go through various transitions while still participating in active competition, such as the transition from one level of competition to another (i.e., high school to college, college to professional), the transition from one sporting environment to another (e.g., moving to a new city, state, or country to play in), or the transition from one team to another (i.e., when an athlete gets traded or transfers schools). The focus of the present study was the transition out of sport when an athlete retires and leaves organized competition. In the past, athlete retirement was perceived as a finite event, analogous with retirement from typical working careers (Stambulova et al., 2009; Wylleman et al., 2004). As such, athletes’ retirement from sport was described using popular theories of the time that associated it with aging and social death. This caused retirement to be perceived negatively by athletes, a thought which still pervades to some extent today (Stokowski et al., 2019). More recently, a shift has occurred in researchers’ understanding of retirement as a process versus a single event. Athlete transition from retirement is a coping process (Stambulova et al., 2009) and the resulting adaptations can be affected and characterized by changes to an individual psychologically, physically, emotionally, and by how these changes affect one’s quality of life.

**Normative vs. Non-Normative Transition**

Athletes can experience a normative transition, which is relatively predictable, or a non-normative transition, which has low predictability and can pose more challenging experiences (Stambulova et al., 2009). As an example, if athletes can retain autonomy and choose to retire, or if retirement is anticipated temporally (i.e., graduation from college, expiration of a contract) and
they have adequate time to prepare for it, they may be more likely to experience a normative transition (Taylor & Ogilvie, 1994). On the other hand, if an athlete is forced out of sport before he/she is ready to retire due to circumstances perceived outside of their control (i.e., deselection, injury, age), they may be more likely to experience a non-normative transition (Taylor & Ogilvie, 1994). Both types of transition may be experienced positively or negatively by the individual pending certain individual, social, and environmental factors (i.e., the cause of transition, financial and social support, individual’s perception of transition; Schlossberg, 1981), with the latter characterized by difficulties with transferring their identity, dealing with feelings of loss, and other negative psychological, physical, and emotional changes (e.g., depression, anxiety, substance abuse).

**Frameworks of Athlete Transition**

**Early Conceptualizations of Athlete Retirement**

Initial conceptualizations of athlete transition were first compared to the psychological transition frameworks of thanatology and social gerontology. Thanatology refers to the “social death” of an individual, where he/she experiences isolation and exclusion from a group—in the case of athletes, a sports team or culture (Rosenberg, 1984). Social gerontology likens athlete transition to other types of social retirement transitions via six theories (Greendorfer & Blinde, 1985; Rosenberg, 1984): (a) disengagement theory, where the individual and society separate to allow younger generations to take over; (b) subculture theory, where the individual remains active in a role despite cultural/social norms; (c) activity theory, which states lost roles are replaced with new ones so people may maintain overall activity level; (d) continuity theory, which states time and energy from previous roles are reallocated to remaining ones; (e) exchange theories, which dictate an individual’s role is transferred to a new one, allocated to other roles.
shared with the original, or their energies are refocused to new roles to allow maximum return, respectively; and (f) social breakdown theory, where the individual views retirement as threatening, isolates themselves from society, and internalizes negative feelings. Thanatology and social gerontology have been abandoned when describing athletes’ transition out of sport due to a lack of empirical evidence. However, these early frameworks have led researchers to conceptualize more empirically backed models depicting this transition as a temporal process that develops gradually, rather than a singular event.

Models Depicting Athlete Transition as a Process

Blinde and Stratta (1992) seem to be some of the first researchers to conceptualize athlete retirement as a process rather than a finite event. Blinde and Stratta compared athletes’ emotional response to retirement to the process of dealing with the death of a loved one (Kübler-Ross & Kessler, 2009), where an athlete experiences (a) denial, or disbelief, at the revelation of retirement; (b) anger at the ramifications of no longer being considered an athlete; (c) bargaining, via attempting to stay involved in a sport or sports culture; (d) depression, or distress, associated with the first three stages; and (e) acceptance, where identity/role can then be transitioned to something new. The authors surmised that individuals may move back and forth between these stages, but that those who prolong their time within the first four, primarily the ‘depression’ stage, experience more distress in transition than those who are able to reach the ‘acceptance’ stage (Blinde & Stratta, 1992).

A later theoretical framework based on Schlossberg’s transition model (1981) is Taylor and Ogilvie’s (1994) Conceptual Model of Transition, which contains five stages that describe athlete transition. Stage 1 discusses the four main causes of athletic career termination, namely age, deselection from a team, injury or physical disability, and free choice. The cause of
transition does not necessarily dictate distressful reactions from transitioning athletes, but more so on their adaptation to transition seen in stages two and three (Lally, 2007). Stage 2 relays five interpersonal factors affecting an athlete’s transition: (a) self-perceptions and interpersonal skills developed from youth sport; (b) self-identity, or whether the athlete can define their self-worth outside of sport; (c) perceived control of their retirement situation; (d) social identity and its restrictions; and (e) tertiary contributors consisting of personal, social, and environmental variables (e.g., socioeconomic status, sex, marital status). Stage 3 takes into account available resources for adaptation to career transition, such as coping strategies to reduce transitional difficulties, social support from family, friends, and former coaches, and pre-retirement planning where an athlete considers future occupational, educational, and social paths while still in sport (Taylor & Ogilvie, 1994). These last two stages directly affect Stage 4 of the model—the quality of career transition, as dictated by the level of distress felt by the individual. Overall, the goal of previous stages is to avoid distress in the quality of transition, which can be characterized as feelings of loss, identity crisis, and maladaptive behaviors, such as alcohol dependence, suicide ideation, and drug use (Park et al., 2013a). However, if such distress is unavoidable, this leads to the Stage 5 of career intervention, which Taylor and Ogilvie (1994) frame in terms of techniques implemented by mental performance consultants (MPCs) or the athlete’s former sport organization. Career transition is characterized by a variety of stressors that interact with one another. Due to this complexity, intervention is not always feasible for organizations, thus the authors stress the utilization of MPCs in these situations and highlight their role in aiding athletes through processes such as cognitive restructuring, stress management, emotional expression, and helping them broaden their social identity and social network (Taylor & Ogilvie, 1994).
While Taylor and Ogilvie’s model (1994) highlights the intricacies of how normative and non-normative transition affect quality of life, as well as the importance of intervention methods to improve said quality, a weakness of the model is that it does not take into account other life factors that may be affecting the athlete outside of sport. The model from Wyllemen et al. (2004) rectifies this weakness by utilizing a holistic life-span model to explain transition experiences spanning the individual’s athletic and post-athletic careers. A unique aspect of this model is the inclusion of transitions that occur in other domains of life (i.e., academic, psychosocial, professional) and their effect on athlete transition and the development of the person over time. As a visual reference, each domain of this model is “layered” atop the others from being most to least athlete-centric, and shows how each domain changes as the athlete ages. The first layer of the model represents the stage of transition athletes face in athletic development from initiation to mastery (Bloom & Sosniak, 1985) and beyond to discontinuation. The second layer reflects transitions occurring psychologically (e.g., childhood to adolescence to adult). The third layer represents psychosocial changes relative to athletic development (e.g., athlete-coach relationships, the team as a family). The last layer represents academic and vocational transitions (e.g., high school and college graduation, starting a career; Wylleman et al., 2004). A strength of this model is that it shows the interaction between different domains of athletes’ lives including both athletic and non-athletic transitions. The model also provides a reasonably generalizable timeline of common life transitions that can be applied to multiple athlete populations. However, a weakness of this model is its inability to take into account intraindividual variation. While individuals may experience similar life experiences at roughly the same time, “individual fanning out” can occur, where individuals vary from the seemingly generalizable pattern (Neugarten, 1979). Further, while the authors provide several techniques
for MPCs to utilize to prepare athletes for transition, they concede that the model does not include non-normative transitions (Stambulova et al., 2009), such as career-ending injuries, non-events (Schlossberg, 1981) like deselection, or resulting effects of these transition types on transition quality.

**Transition Quality**

Based on Taylor and Ogilvie’s model (1994), factors relating to the quality of career transition depend on the causes of career termination, factors related to the adaptation of career transition, and available resources to the athlete. Transition in and of itself does not necessarily cause distressful reactions (Lally, 2007), but certain components within these factors may contribute more negatively than positively and cause a more unsuccessful transition. For example, an athlete who retires due to injury or deselection may be prepared to have a more negative initial experience to transition than an athlete who chooses to retire of their own free will. With that said, antecedents to these factors also contribute to the quality of transition. For example, even though retirement may be voluntary, antecedents for choosing to leave sport may stem from more negative factors (e.g., bad relationships with coaches or teammates, chronic injury, burnout; (Kerr & Dacyshyn, 2000; Park et al., 2013a).

While these factors contribute to quality of transition, the manifestation of distress after retirement can overall be attributed to the significant life investment athletes commit to sport and their perceptions of transition prior to retirement. Depending on when athletes begin playing a sport and the level of play they end up retiring in (e.g., high school, college, professional/semi-professional), they may contribute a substantial amount of time to training and competition—sometimes years and decades of their life. As such, their development and social- and self-identities are greatly influenced by sports participation (Taylor & Ogilvie, 1994). Once sport is
taken away in retirement, an athlete is more prone to feelings of loss and confusion that can contribute to unsuccessful transition. Individuals who are role-restricted by their background in sport only have forms of support consisting of teammates, coaches, and others related to their athletic entourage for much of their life until retirement (Park et al., 2013a). Social support has been shown to be a key contributor to easing the transition experience (Park et al., 2013a; Raabe et al., 2017). However, for the role-restricted athlete whose only form of social support are related to sport, they may be less likely to prepare for transition than an individual with a more diverse social network (Park et al., 2013a) and may experience a worse transition once these athletics-based supports are diminished or taken away entirely. Further, based on the principles of thanatology and social gerontology, retirement can still be viewed in a negative light by current athletes (Stokowski et al., 2019) and can incite feelings of avoidance and fear. For this reason, athletes are sometimes unwilling to participate in pre-retirement planning or develop contingency plans for their future beyond sport (Gorely et al., 2001; Petitpas & Champagne, 2000). Without willingness to consider the future and forward-thinking on part of the athlete, unsuccessful transitions may be more likely for them than successful one. In the most severe cases, negative transition experiences have resulted in violent and criminal behavior, as well as suicide ideation. Perhaps one of the more dramatic examples of these consequences is showcased Showtime’s 2016 documentary, Running For His Life: The Lawrence Phillips Story, which shows the difficulties with post-retirement transition from professional sport experienced by former professional football running back Lawrence Phillips (Briganti and Greenburg, 2016). A combination of parental neglect, impaired behavioral health, disappearance of his social status after retirement from professional sport, and suicide ideation are thought to contribute to
Phillips’ criminal activity and may have culminated in his suicide while serving a 31-year prison sentence (Breech, 2016).

**Summary of the Athlete Transition Process**

Transition is a dynamic process that occurs over time, with the individual moving through various stages from “pervasiveness to boundedness” (Schlossberg, 1981, p. 15). Adaptations are key to the individual processing the transition and are affected by characteristics of the transition itself, the pre- and post-transition environment, and the characteristics of the individual experiencing the transition. Due to its versatility, various aspects of Schlossberg’s Model (1981) have been used to describe different types of transitions and to create models of transition for certain groups—including athletic populations. While past models likened athlete retirement to a singular event, more recent models agree that retirement is a transitional process that athletes adapt to over time. Athletes can undergo a normative or non-normative transition and adapt positively or negatively due to the influence of various external (e.g., social support, adaptation resources) and internal (e.g., identity renegotiation, role restriction) factors, the significant life investment they have put forth toward sport, and whether or not they have participated in pre-retirement planning. While positive transition experience result in successful adaptations to life post-sport, negative transition experiences can lead to more serious consequences (e.g., criminal behavior, suicide ideation). Transition quality can be categorized by a variety of factors, including changes to former athletes’ physical, psychological, and emotional health post-sport.

**Physical, Psychological, and Emotional Health of Former Athletes**

The health of former athletes, while not entirely conclusive, can be an indicator of transition quality after retiring from sport. The advent of concussion-based research in sports has
anecdotally led to a push for national organizations to be more transparent with the health of their current and former athletes. As such, research on the health of athletes who have played on the national and international stage (e.g., NFL, National Hockey League, Olympics) has been published regarding a number of health concerns, including but not limited to lingering effects of injury (Schwenk et al., 2007), cardiovascular disease (CVD; Baron et al., 2012; Chang et al., 2009), osteoarthritis (OA; Arliani et al., 2014; Davies et al., 2016), depression (Schwenk et al., 2007), anxiety (Davies et al., 2016), issues with body image and eating disorders (Stephan et al., 2003; Stirling et al., 2012), substance abuse (Cottler et al., 2011), and suicide ideation (Lindqvist et al., 2014). As a result, the study of the physical, mental, and emotional health of various former athlete populations has gained traction in recent years.

**At the Professional Level**

Recent research suggests that after retiring from sport, former professional athletes are at risk of certain health disparities common in the general population. In 1990, the NFL Players Association requested an investigation by the National Institute for Occupational Safety and Health (NIOSH) due to concerns about player longevity and CVD risk. The 1994 report indicated that players that had played between 1959-1988 experienced decreased overall-mortality, but higher CVD mortality in linemen compared to non-linemen and in those with higher playing-time body mass index (BMI; Baron & Rinsky, 1994). Because this report was limited based on a small number of CVD-related deaths exhibited in the sample population (n=38), Baron et al. (2012) conducted a 16-year follow up to expand the understanding of players’ mortality as they aged.

In this study, Baron et al. (2012) utilized the same sample of 3439 former NFL players constructed from the 1990 NFL pension fund database who had played between 1959 and 1988
(retired 26.8±8.7 years; median age 57 years). Vital statuses of former players were ascertained from the NFL pension fund death records, Social Security Administration Death Master File, and Internal Revenue Service Records, and mortality was compared to that of the general population using NIOSH records. While overall mortality and mortality due to cancer and CVD was significantly lower compared to the general population, defensive linemen’s risk for CVD mortality (standard mortality ratio [SMR] 1.42, 95% confidence interval [CI] 1.02 to 1.92) and cardiomyopathy (SMR 5.34, 95% CI 2.3-10.5) was increased compared to the general population (Baron et al., 2012). Further, internal analyses revealed that non-Caucasian players’ CVD mortality was also increased (hazard ratio 1.69, 95% CI 1.06-3.85). Further, when adjusted for age, race, and calendar year, researchers concluded that those with a playing-time BMI ≥30 kg/m² had a twice as higher risk for CVD mortality, and that African-American players and defensive linemen had a higher CVD mortality rate even after adjusting for playing-time BMI (Baron et al., 2012). Subsequent studies have shown that NFL players show signs while still in play that may be indicative of future CVD risk.

Due to increased muscle mass in athletes over that of the general population, BMI is not an ideal method of estimating adiposity, as it can provide false-positive measurements and place athletes in higher, unhealthy weight classifications that are not indicative of their body composition. While obese BMI has been posited as a positive indicator of increased mortality among the NFL, researchers caution utilizing it as an accurate predictor, not just in football, but also other sports and leagues where players may not achieve obese status and where lower BMI categories have been associated with player mortality (Markowitz, 2018). As an example, Chang et al. (2009) sought to compare cardiovascular risk factors and coronary atherosclerosis in retired NFL players to two groups of community controls and found that other CVD risk factors were
greater predictors of atherosclerosis than BMI. For the first group, 150 former NFL players (retired 21.8±10.1 years, ages 51.2±9.7 years) were matched one-to-one with participants from the Dallas Heart Study (DHS) based on age, ethnicity (59.3% African-American), and BMI (31.5±4.2 kg/m²), while in the second group 200 former NFL players (retired 24.8±12.2 years, ages 55.2±11.9 years) were matched with individuals from Aerobics Center Longitudinal Study (ACLS) on the same criteria (ethnicity ratio not provided, BMI 31.7±4.7 kg/m²), with two controls for every former player. Cross-sectional measurements of coronary artery calcium (measured via computed tomography [CT]) and CVD risk factors (e.g., hypertension, history of smoking, sedentarism [defined in the study as performing <30 minutes of activity <3 times/week]) were compared between former players and control groups. Overall, former NFL players exhibited significantly lower reports of diabetes, hypertension, metabolic syndrome, and sedentarism, but higher rates of cholesterol and LDL concentrations, and significantly higher rates of impaired fasting blood glucose and diagnoses hyperlipidemia (Chang et al., 2009). While no significant differences were found when comparing CAC scores, the researchers concluded that age (odds ratio 1.12, 95% CI 1.08-1.17, p<.001) and hyperlipidemia (odds ratio 1.40, 95% CI 1.06-1.84, p=.02) were the most significant predictors of CAC over BMI (odds ratio 1.02, 95% CI 0.94-1.10, p=.69; Chang et al., 2009).

An epidemiological review by Laure and Binsinger (2009) suggests that quality of life, and by extension mortality, in former athletes may be associated with more “athlete-specific” disorders rather than comorbid conditions that are more prevalent in the general population. The authors of this review found that the overall incidence of chronic conditions, such as coronary artery disease and type II diabetes, is lower in former “elite” athletes than the general population, with exceptions shown for asthma and osteoarthritis (Laure & Binsinger, 2009). Anecdotally,
these disorders can be attributed to the high-intense training that athletes undergo while still competing and any injuries they sustain as a result. Additionally, mortality rates in the athlete populations included were found to be lower than the general population, indicating a longer lifespan than the average person (Laure & Binsinger, 2009). In addition to their practice of regular physical activity in sports training, the researchers attributed these results to enhanced physiological and genetic profiles of athletes (Laure & Binsinger, 2009). However, Laure and Binsinger (2009) alluded that other factors beyond training and genetics (e.g., doping habits, injury from training, drastic career changes occurring after retirement) that were not taken into account in their review may impact the morbidity of former athletes more severely than the general population.

For clarification, the term “elite” is nebulously-defined in the sports literature, with researchers utilizing the term in relation to their studies’ goals rather than on a definite definition (Swann et al., 2015). The term “elite” can be used in an absolute sense, where a small group of exceptional individuals distinguishable from the masses is observed to determine how they perform successfully, or in a relative sense, where one group of athletes is compared to another (e.g., experts versus novices; Ericsson et al., 2018). Further, Swann et al. (2015) proposed a “continuum of eliteness or expertise” [p. 10] and a complex algorithm for researchers to adequately define “elite” status in their sample athlete populations based on athletes’ standard of performance, success at their highest level of play, experience level, and competitiveness nationally and internationally. Laure and Binsinger (2009) defined “elite” using the aforementioned relative approach, including studies in their review utilizing populations at a “high level,” which they defined as athletes who played at the national level or professionally. Regardless of definition, their findings have been echoed in other studies.
Expanding beyond American football, in a study by Arliani et al. (2014), researchers aimed to compare the prevalence of knee osteoarthritis (OA) in former soccer players to non-professional athlete controls. In the study, 27 former professional male soccer players (30-55 years old) and 30 age-matched controls had measurements of knee OA, knee physical function, and quality of life in relation to knee OA compared. Prevalence of OA was non-significant in the dominant leg between former athlete and control groups (66.6% to 46.7%, \( p = .081 \)), but significantly higher in the non-dominant legs of former athletes (66.6% to 43.3%, \( p = .028 \)). Former athletes also exhibited significantly higher pain (\( p = .005 \)), worsening knee OA symptoms (\( p = .002 \)), and lower knee-related quality of life (\( p < .027 \)) based on the Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales, as well as worse MRI scores indicative of knee OA and significantly worse functional capacity when MRI and KOOS scores were compared (\( r = -0.608; p = 0.001 \) based on Spearman correlation). While increased rates of OA are not necessarily unexpected in former athletes when compared to the general population, the effect on musculoskeletal morbidity in former athletes was demonstrated in a questionnaire study by Davies et al. (2016) involving former elite (defined as playing at the university or professional level) male rugby players. Researchers in this study sought to establish the prevalence of morbidity and measure health-related quality of life in this population and quantify differences in morbidity between former rugby players and the general population compared by age. Cross-sectional, self-reported measurements for morbidity were taken across a cohort of former rugby players (\( N = 259 \), median age 62.0 years, range 24.2-95.0 years) and compared to two groups of age-matched controls. The first group comprised of 5186 individuals (median age 64.0 years, range 50.0–99.0 years) from the English Longitudinal Study on Aging, and the second included 2981 participants (median age 52.0, range 24.0–90.0 years) from the Health Survey for England.
Chi-square tests revealed former rugby players reported significantly more problems related to mobility \((p<.001)\), pain/discomfort \((p<.001)\), and completing “usual activities” \((p<.001)\) than the general population. Further, in participants ages 50 years or older, significantly higher morbidity was found in former rugby players in regard to osteoarthritis \(4.00, 95\% \text{ CI } 3.32–4.81\), joint replacement \(6.02, 95\% \text{ CI } 4.66–7.77\), and site-specific joint replacement at the hip \(6.42, 95\% \text{ CI } 4.69–8.79\) and knee \(5.64, 95\% \text{ CI } 3.72–8.57\).

Beyond physical health, in recent years, the mental and emotional health deficits in former professional populations have also come to light. In a study by Schwenk et al. (2007), 1617 former NFL players completed a survey with the goal of comparing symptoms of depression to self-reported pain and difficulties transitioning out of sport. Respondents had played in the NFL for \(7.1\pm3.6\) years, had been retired a median of 25.0 years, and had primarily retired due to deselection \((34.6\%)\), free choice \((34.6\%)\), and injury \((29.1\%)\). Respondents were largely separated into two categories of those reporting no to mild depression \((84.5\%)\) and moderate to severe depression \((14.7\%)\), ratios that mirrored the general population. Similarly, respondents were also separated into two groups based on reporting pain as not or somewhat common \((51.8\%)\) or quite or very common \((47.6\%)\). Of the sample, 10.9\% reported high pain and depression scores, 37.2\% reported high pain, low depression scores, 40.0\% reported low pain, high depression scores, and 48\% reported low scores for both. High pain/depression scorers were 32x more likely to report trouble sleeping as those low scorers in both areas (Schwenk et al., 2007). Further, this group exhibited high odds ratios \((\geq11.2, p<.001\) for all) in relation to the transition problems of financial difficulties, marital/relationship problems, aging, and problems associated with maintaining fitness and exercise (Schwenk et al., 2007). All of these issues were also strongly correlated in the groups exhibiting either/or moderate to severe depression or quite
or very common difficulty with pain. While the survey was limited in that specific causes of pain could not be ascertained, the authors concluded that the frequency at which former players reported pain put them at an additional risk for depression and transitional difficulties (Schwenk et al., 2007). This is not unreasonable, as the findings in the study by Davies et al. (2016) echo these results. Davies et al. (2016) reported issues relating to health-related quality of life were most highly reported in pain/discomfort (73.8% of the sample) and mobility (47.4%), the rates of which were twice as high as control groups. Further, while 85% of the former rugby players in this sample reported no issues with depression and anxiety, anxiety was twice as prevalent compared to the control populations, which the authors allude related to diagnoses made while they were still in sport to when they transitioned in retirement (Davies et al., 2016).

The immediate effects of transition on mental health were studied in a survey study by Stephan et al. (2003), which aimed to evaluate repercussions of the transition out of sport on bodily self-esteem, the adjustment process, and perceptions of the physical self and global self-esteem. In this study, 16 former French Olympic athletes (8 women, ages 30.6±3.7 years, 7 sports represented) who retired immediately following the 2000 Sydney Olympic Games, and 16 age/gender/sport-matched elite athletes (defined as currently playing with national teams) were surveyed four times (i.e., every 3 months) over a year following 6-8 weeks from their career termination. Based on repeated measures ANOVAs, significantly lower levels ($p<.001$ for all) of perceived self-worth, self-esteem, physical condition, and physical attractiveness were exhibited by former athletes following retirement than current athletes, with the greatest decreases in these factors occurring within the first three months of transition, based on mean scores (Stephan et al., 2003). Similar results regarding body image were found in an interview study with former elite rhythmic gymnasts (defined as those who had previously competed at the international level) by
Stirling et al. (2012). In this study, eight former gymnasts (ages 19.9±2.67 years, 8-24 years, retired 2.8±1.6 years) completed semi-structured interviews designed to explore their perceptions on how the transition out of retirement affected body satisfaction and weight control behaviors. Findings were interpreted as participants experienced an increase in body dissatisfaction following their retirement, which resulted in unhealthy weight control behaviors such as food restriction, calorie counting, laxative/diet pill use, and excessive exercise (Stirling et al., 2012).

Substance abuse is another area of retired athlete mental health that has also gained increasing attention in recent years. In a study by Cottler et al. (2011), researchers aimed to evaluate the relationship between pain associated with sports and opioid use/misuse in former NFL players. A telephone survey was conducted in 644 former NFL players (ages 48.3±9.24 years, played for 7.6±3.8 years, retired 17.7±8.47 years) sampled from the 2009 Retired Players Association Directory. In the survey, respondents were asked about their pain level as it related to past sports participation, current alcohol use, and prescription opioid use while they were still playing in the NFL and in the last 30 days from the telephone survey. Current opioid use was 7% in the sample—three times higher than that of the general population. Based on responses, 52% of respondents utilized prescription opioids during their time in the NFL, with 63% indicating they received their prescription from a non-medical source or a combination of doctor and other illicit sources (i.e., teammates, coaches, athletic trainers, family members). Further, 71% of this subsample indicated misusing opioids during their time in the NFL, and of these, 15% reported misuse in the last 30 days. Multivariate analyses indicated that undiagnosed concussions were the only predictor of current misuse versus using opioids as prescribed (adjusted odds ratio [AOR] 4.25, 95%CI 1.12–16.22). Further, current misuse versus non-use was also predicted by
current significant pain (AOR 8.33, 95%CI 1.98–35.04), undiagnosed concussions (AOR 3.51, 95%CI 1.98–35.04), and heavy drinking (AOR 3.48, 95%CI 1.63–7.41).

The effects of illegal substance abuse during sport and its potential effect on mortality were also highlighted in a study by Lindqvist et al. (2014). In this study, researchers aimed to investigate mortality and causes of death in former elite (defined as ranking in the top 10 nationally in their sports) Swedish male power athletes who were active in the sports of wrestling, power lifting, Olympic lifting, and throwing events in track and field from 1960-1979, and who were suspected of anabolic steroid use while still active in sport. Death certificates of 174 former elite Swedish power athletes were acquired from the Swedish National Board of Statistics and Swedish Epidemiological Center. Total number and specific causes of death were compared to the general population of males in Sweden based on age and calendar time of death. The most common causes of death reported were cardiac/vascular diseases (37.9%), malignant diseases (21.3%), suicide (12.1%), and accidents (10.3%). Overall, the mortality rate due to malignant disease was lower in former athletes compared to the general population. Further, the mortality rate between the ages of 20-50 years—the time during and immediately following most participants’ athletic careers—was an excess of 45%, though when analyzed over the total study period, this was not significantly higher than the mortality of the general population. However, suicide rate was two to four times higher than that of the general population for those who had died between the ages 30-50 years, a similar timeframe for when athletes were still competing or had recently retired. Based on these data, the authors predict the use of anabolic steroids may have played a part in the observed increased mortality and suicide rates in the former athlete population (Lindqvist et al., 2014).
At the College Level

The “Working” College Athlete

Due to a lifestyle and career centered around sport, declining trends in health are not entirely unreasonable to see in former professional athletes. However, similar effects are now being documented in athletes at other levels of competition—most notably, college athletes. This is potentially due to the substantial commitment college athletes put forth to training for their sport in school (National Collegiate Athletic Association, 2016), as well as the increasing “celebritization” of college athletes that has occurred in recent decades. In line with the National Collegiate Athletic Association (NCAA) regulations (Berkowitz, 2016), college athletes cannot spend more than 20 hours per week in-season participating in required athletic activities (e.g., training, competitions), with lower thresholds for off-season training and some exceptions dictated for athletes that train year-round (e.g., swimming, gymnastics, track and field). However, some colleges have been able to circumvent these regulations, with estimates showing that Division I (DI) college athletes may spend as much as 40 hours per week—the equivalent of a full-time job—partaking in athletics-related activities (Jacobs, 2015). This is due in part to statutes such as computation rules, where universities count certain events (i.e., competition and travel days) as only three hours long, despite potentially taking an entire day to complete on part of the athletes (Berkowitz, 2016). Only as recently as 2017 did the NCAA propose new regulations to combat these loopholes, such as prohibiting athletic activity for at least eight hours following competition and requiring the implementation of “student-athlete time management plans” to assure athletes are not blindsided by increased commitments to their athletics schedules (Berkowitz, 2016). Even so, the NCAA will not enforce these rules, allowing conferences to pick and choose which regulations to implement (Berkowitz, 2016).
Anecdotally, college athletes have received a heightened celebrity-status in recent years, and as such, celebrity-like behavior and consequences in this population have also become apparent. Beyond ticket sales at the stadium, college athletics earn billions of dollars for institutions and private companies in a season through televised competitions and merchandise sales. Between 2004 and 2013 it was shown that across 126 football subdivisions, total revenue increased by a median of 33.6 million dollars, with 68-81% generated from revenue (e.g., ticket sales, radio and television rights receipts, alumni contributions, guarantees, royalties, NCAA/conference contributions; Sanderson & Siegfried, 2015). In 2015, the Southeastern Conference (SEC) became the first college athletic conference to earn over a billion dollars from athletic receipts, followed closely by the Big Ten, which earned $905 million (Branch, 2011).

Increased revenue from sport may put pressure on coaches and administrators to perform well, at times sacrificing the health of their athletes (Russell et al., 2017). At the same time, a number of student-athletes have been caught in scandals involving trading their own autographs, jerseys, and other memorabilia for profit or services (Branch, 2011; Dohrmann & Epstein, 2011), causing coaches, athletics programs, and larger universities to come under fire by the NCAA. With increasing revenue from college athletics, arguments of exploitation of student-athletes, and reporting of such scandals, the NCAA is now considering paying student-athletes for use of their likenesses and allowing them to earn money from paid promotions (Dwyer, 2019, October 29; Edelman, 2020; Miller, 2011). Based on these data, college sport can almost be likened to an actual career for student-athletes, but unlike actual professionals, their time in athletics is more finite. Only 2% of college athletes go on to play at the professional level (National Collegiate Athletic Association, 2018), potentially exposing the remaining 98% of this population to
increased difficulty in transition from to the dramatic change in lifestyle and absence of organized sport in their lives.

**Health-Related Consequences of The Celebrity-Mentality**

Many profit-athletes—NCAA college athletes whose estimated market value exceeds the NCAA-approved compensatory value for financial aid toward tuition, fees, room and board, books (Kidd et al., 2018)—pragmatically disassociate from their perceived role as a student to focus on their role as an athlete (Adler & Adler, 1985). Further, many of these athletes who focused on high-level sport from a young age often do not have non-sport career aspirations and are inadequately prepared for the post-sport transition (Adler & Adler, 1991; Beamon, 2012; Beamon & Bell, 2011; Cummins & O’Boyle, 2015; Wylleman & Reints, 2010). With the increasing stress of college sports on the athletes involved, notable stress-related health deficits occur in athletes while still in college. In 2013, the NCAA’s Sport Science Institute established the Mental Health Task Force in response to increasing rates of depression, anxiety, prescription drug abuse, and excessive drinking across current male and female collegiate athletes (Burnsed, 2013). Such issues are alarming precursors to negative physical and mental health consequences that can manifest and have been observed in the former college athlete population.

In terms of physical health, similar to professional athletes, a slight protective effect as a result of training is apparent in former college athletes. Beginning in 1916, the Harvard Alumni Study, later termed the College Alumni Study, is an ongoing cohort study examining the effect of physical activity on long-term health in college alumni from graduation to death in relation to coronary artery disease, stroke, diabetes, hypertension, different forms of cancer, obesity, and overall mortality (Simon, 2002). From repeated surveys in an initial population of over 21,000 participants, to date the study has yielded repeated evidence that individuals who played varsity
sports in college have a significantly lower risk of developing CVD and early death up to the age of 50 years (Paffenbarger & Lee, 1998), and are half as likely to die from stroke than previous non-athlete alumni (Paffenbarger & Williams, 1967). However, more recent research suggests that, in athletes that have graduated more recently, the risk for certain comorbid disorders is no different than that of previous non-athlete alumni. In a cross-sectional epidemiological study by Sorenson et al. (2015), lifespan exercise and health outcomes were examined between current student athletes, former student athletes, and previous non-athlete alumni. A total of 496 current students and alumni completed surveys assessing demographical information, history of intercollegiate sports participation, health-related quality of life, health inventory relating to joint, bone/muscle, cardiopulmonary, neurological, psychosocial, and other clinical disorders, previous week’s exercise, and respondents’ perceptions of health and exercise. Results indicated that aside from greater joint health concerns reported by older former college athletes (>43 years), risk of cardiopulmonary health disparities increased with age regardless of sex and was comparable between former athletes and non-athletes. The researchers related this finding to respondents’ compliance with the PAGA (p=.02, Cohen’s d=-.50, probability of clinically important difference=14%), which was independent of intercollegiate sports participation (Sorenson et al., 2015). These findings echo Paffenbarger & Lee (1998), who indicated that the “protective effect of early athleticism” [p. 31] was shown to wane over time if a physically active lifestyle was not maintained post-graduation.

Similar to what is seen in former professional athletes, joint and musculoskeletal issues stemming from training and injuries accrued in sport seem to contribute to the main physical health concerns exhibited in college athletes. In a survey study by Simon and Docherty (2013), the authors explored the effect of injuries accrued in college sport on former DI athletes’
physical activity and health-related quality of life. A total of 275 surveys were collected from a sample of former athletes (n=232 surveys, ages 53.4±7.1 years) and non-athlete alumni (n=225 surveys, ages 53.6±6.8 years) recruited from a Midwestern university’s alumni database. Information regarding respondents’ demographics and injury history from sport were collected, as well as measures of their physical function, fatigue, pain interference, sleep disturbances, anxiety, depression, and satisfaction with social roles using the Patient-Reported Outcomes Measurement Information System (PROMIS). Univariate analyses showed that, when based on the combined dependent variables measured using the PROMIS, former college athletes exhibited significantly lower health-related quality of life compared to non-athletes (F_{7,449}=113.25, p<.001). Further, when taken individually, former athletes scored significantly worse than former non-athletes (p<.001 for all) on five of the seven PROMIS scales (physical function, fatigue, pain, depression, and sleep disturbances). Former athletes also reported more major and chronic injuries than non-athlete controls (70% vs. 33%, X^2=40.01, df=11, p<.001) and more diagnoses of osteoarthritis (40% vs. 24%, X^2=7.24, p=.007; Simon & Docherty, 2013). These findings were expanded upon in a later cross-sectional study by Simon and Docherty (2017). A sample of former DI athletes (n=100, ages 53.1±7.4 years) and non-athlete alumni (n=100, ages 51.4±7.3 years) underwent a series of physical fitness assessments including a 1-mile walk to test cardiorespiratory endurance, a sit-to-stand test to assess lower body muscular strength/endurance, a push-up test to assess upper body strength/endurance, a half sit-up test to assess core muscle endurance, sit-and-reach and back scratch tests to assess lower and upper body flexibility, respectively, and a BodPod assessment to evaluate body fat percentage. Univariate analyses revealed that former athletes had significantly higher body fat (mean difference=7.6%, p<.001) with 63% of the population indicated to be in the above average or
risk category (versus 46% in the non-athlete group), slower mile time (mean difference=2.42 minutes, \( p = .03 \)), and fewer sit-to-stand (mean difference=4.3 repetitions, \( p = .01 \)) and push-up repetitions (mean difference=8.9 repetitions, \( p = .01 \)) than former non-athletes (Simon & Docherty, 2017). Further, higher percentages of former athletes over non-athletes reported receiving chronic injuries in college (60% vs. 18%), needing to take time away from college due to injury (78% vs. 20%), experienced current limitations to activities of daily living (21% vs. 0%) and sport/recreational activities (57% vs. 6%), and receiving a diagnosis of osteoarthritis (43% vs. 10%). While not specifically tested, the researchers allude that the higher injury rate due to college sports impacted the worse fitness outcomes observed in former athletes over non-athletes in the study (Simon & Docherty, 2017).

Recently, alarming mental and emotional health discrepancies in former college athletes have gained more attention in addition to physical health deficits noted in this population. In a cross-sectional study by Kerr et al. (2014), researchers aimed to examine the physical and mental health of former male and female collegiate athletes in relation to known correlates. Former college athletes (N=797, 52.8% female, 86.1 non-Hispanic Caucasian, ages 22-51 years with 79.4% between 25-44 years) representing 29 different sports and retired on average for 14.5 years from collegiate sport completed an online questionnaire assessing demographics, sports history, and medical history using the Veterans RAND 23-Item Health Survey (VR-12). The VR-12 produced two composite scores pertaining to physical and mental health in the population, respectively, the results of which were then compared to normative data from the U.S. general population using t-tests and ANOVAs. When stratified by age and sex, physical (53.0±6.1 vs. 50.0 ±10.0, \( p < .001 \)) and mental (51.7±9.4 vs. 50.0±10.0, \( p < .001 \)) composite scores were similar to normative scores from the general U.S. population. In terms of physical health,
within former athletes, those that had played low/non-contact sports exhibited significantly higher physical composite scores \((p<.001)\), while those that had retired due to a career-ending injury \((p<.001)\) and those who had sustained 3+ concussions \((p=.06)\) exhibited lower physical composite scores. Interestingly, in terms of mental health, no association was found between concussion and mental composite scores \((p=.06)\). However, the most commonly reported mental medical conditions included anxiety (16.2%), depression (10.4%), eating disorders related to binging and purging (5.8%), and alcohol dependence (5.8%), of which the latter two conditions were reported at higher rates than the general population as indicated by the World Health Organization at the time \((Kessler et al., 2005; Kessler et al., 2013)\). The authors conclude that, while observed physical and mental health appears similar between former college athletes and the general population, certain health deficits may be associated to previous experiences and injuries from sport that warrant monitoring post-retirement \((Kerr et al., 2014)\).

Kerr et al. \((2018)\) expanded their previous findings in a later study, the purpose of which was to examine associations between concussion history in sport and adverse health outcomes in former collegiate football players 15 years after their retirement from sport. A sample of 204 former NCAA football players (ages 33-38 years, 65.2% between the ages of 34-36 years, 75.5% Caucasian) who had played at least one season between 1999 and 2001 completed a survey assessing concussion history and health utilizing the Veterans RAND 36-Item Health Survey, the depression module of the Patient Health Questionnaire, and the 4-Item CAGE alcohol dependence questionnaire. The majority of respondents \((84.3\%)\) reported attaining at least one concussion during their college football career, with 22.1% and 39.2% of the sample reporting physical and mental composite scores, respectively, indicating worse health than the general U.S. population. Further, 19.1% indicated having moderate to severe depression and 24.8% exhibited
alcohol dependence. Using multivariable binomial regression models, it was found that worse mental health was exhibited by those who had sustained 3+ concussions versus those who had reported never having a concussion (adjusted prevalence ratio $[PR]=2.5$, $95\% \ CI \ 1.3-4.9$). When controlling for BMI, moderate to severe depression was more prevalent in former athletes who reported receiving 3+ concussions over those who reported never receiving one ($PR=4.2$, $95\% \ CI \ 1.0-16.2$), as were lower physical composite scores in those receiving 3+ concussions versus those reporting having 1-2 ($PR=2.6$, $95\% \ CI \ 1.3-5.0$; Kerr et al., 2018). No associations were found relating concussion history to alcohol dependence. The researchers acknowledged that their sample was limited due to its size and the fact that it only utilized former athletes from one sport. However, they also suggest that, in light of the study’s findings, further actions should be taken in terms of concussion prevention in contact sports (Kerr et al., 2018).

**High School and Youth Athletes – The New Concern?**

While high school sports do not get nearly as much media attention as college and professional-level competition, celebritizing tendencies in high school, and even youth, athletics is anecdotally on the rise. With lay media coverage ranging from televised broadcasts of the Little League World Series® and local and national high school competitions, to regular internet updates on National Signing Day for the top U.S. high school football players, youth and high school athletics at the national and international level are gaining increasing attention by the general population. In high school athletes, specifically, with the increasing rate of tuition in the U.S. (Martin, 2017), these individuals are under pressure to sign with colleges and earn partial or full scholarships to higher education via athletics, of which signing and commitment press-conferences receive media attention reflective of the NFL draft (USA Today, 2021). Further, in research conducted by the NCAA, parents were found to have inaccurate expectations that their
child would go on to compete at the professional level or in the Olympics after competing in college (National Collegiate Athletic Association, 2016), potentially adding further pressure to high school athletes (Russell et al., 2017). While health outcomes specific to former high school athletes’ who do not continue play in college are currently unknown, 97% of this population does not go on to play intercollegiate sports (Brown, 2012), exposing this population to detrimental transition experiences similar to what is seen in their college and professional counterparts. As such, while health-based research within this population is scarce, what literature does exist points to some similar detriments to physical and mental health in former high school athletes that echo that of former college and professional athletes with discontinued athletic participation.

Admittedly, the majority of health-related research that focuses on former high school athletes includes samples combining former high school and college athletes and is concussion-related, particularly in former football players. In a study by Schmidt et al. (2018), researchers compared postural-control performance between former high school football players with and without a history of concussion. Former high school football players with (n=11, ages 50.5±7.5 years) and without (n=11, ages 50.8±6.6 years) a history of receiving 2+ concussions during their high school football careers, and with no experience playing at the college or professional level, completed the last three conditions of the Sensory Organization Test to assess postural control. Results were compared using linear (i.e., equilibrium scores) and nonlinear (i.e., entropy, or balance regularity) metrics, the latter of which is posited to be more precise in detecting postural changes. While no differences were found in the linear comparisons between groups, on two of the three conditions of the Sensory Organization Test, participants with a history of concussion exhibited more regular medial-lateral sample entropy (i.e., regularity) values for the most challenging condition (i.e., balancing with eyes closed on a swaying surface) than participants
without concussion (0.90±0.41 vs. 1.30±0.35; mean difference=0.40, 95% CI=0.74, \(p=0.02\)), indicating a deficit in intricate postural control (Schmidt et al., 2018). The authors indicate that, even if a head-on collision is not diagnosed as resulting in a concussion, concussion-related consequences may still manifest. As such, subclinical concussion-related deficits can persist for years after the onset of injury beyond the proposed 7–10-day recovery period (Schmidt et al., 2018).

While few studies have looked at the long-term effects of concussion on cognitive impairments in former high school athletes, detrimental effects of concussion were further studied by Montenigro et al. (2017), who demonstrated the potential negative consequences. In this study, the researchers aimed to develop a metric to quantify cumulative repeated head impacts, use said measure to examine associations between repeated head impacts and long-term clinical outcomes, and evaluate its predictive properties. A sample of 93 former high school (n=17, ages 43.6±11.6 years) and collegiate (n=76, ages 47.7±14.2 years) football players with a history of concussion from sport (median [IQR]=20 [3] concussions reported) participated in this study by completing a series of objective cognitive and self-reported behavioral/mood tests. From their data, in combination with impact frequencies derived from helmet accelerometer studies, researchers calculated “cumulative head impact index” (CHII) scores for each participant. While analyses between the former high school and college athlete sub-populations were not conducted, a dose-response relationship was found between CHII for the entire population and risk for later-life cognitive impairment (\(p<0.0001\)), self-reported executive dysfunction (\(p<0.0001\)), depression (\(p<0.0001\)), behavioral dysregulation (\(p<0.0001\)), and apathy (\(p=0.016\)).
Mental health trends in former high school athletes seem to be more reflective of experiences observed in their older athlete counterparts. In a survey study by Veliz and McCabe (2015), the purpose of which was to examine if past interscholastic sports participation was associated with potential substance abuse disorders in young adulthood, data was taken from 3442 young adult college students (ages 19.98±1.53 years, 56.8% female, 72.5% former high school athletes, 96.9% not participating in college sports) who participated in the 2013 Student Life Survey, a larger survey study measuring aspects of student life characteristics and behaviors. Multiple logistic regression models were conducted to examine if respondents who had previously participated in high school sport had higher odds ratios than alcohol and drug use than those who had not. Survey results showed that those who had participated in high school sport had 50% higher odds (AOR=1.52, 95% CI 1.22-1.89, p<.001) than previous non-athletes for potential alcohol use disorders based on the CAGE alcohol dependence questionnaire, but no association was found for drug abuse (AOR=.986, 95% CI 36-1.32, p not available) based on the Drug Abuse Screening Test (Veliz & McCabe, 2015). Further, it was found that those who played multiple sports in high school had higher odds ratios for alcohol (AOR=1.15, 95% CI 1.06-1.25, p<.001) and drug abuse disorders (AOR=.949, 95% CI .844-1.06, p not available), and that those who played specific sports also exhibited higher odds for alcohol (football: 7.2% of sample, AOR=1.52, 95% CI 1.06-2.17, p<.05; crew: 2.2% of sample, AOR=1.85, 95% CI 1.11-3.08, p<.05) and drug abuse (lacrosse: 5.9% of sample, AOR=2.03, 95% CI 1.33-3.09, p<.001; Veliz & McCabe, 2015).

In a study by Green et al. (2013), who examined binge drinking patterns in interscholastic sports participation from high school to college, the researchers found that exposure to organized athletics was associated with higher percentages of binge drinking. The study examined findings
from the 1999 and 2001 Harvard School of Public Health College Alcohol Study, which involved 24,799 students (83.5% under 24 years, 82.7% Caucasian, 57.4% female, 25.5% seniors) from 119 institutions across the U.S. completing a 20-page pen-and-paper questionnaire that asked respondents to report personal characteristics, activities, and behavior related to alcohol consumption (Wechsler et al., 2000). The authors report that odds ratios were computed using logistic regression to determine differences in alcohol use between athletes and non-athletes in high school and college, and by age, sex, and race/ethnicity, however the paper only reports frequencies of those who reported engaging in binge drinking in these subpopulations. Regardless of athlete status, binge drinking occurrences doubled across the population with the transition from high school to college (Green et al., 2014). Additionally, exposure to organized athletics seemed to have a lasting effect on binge drinking; while current college athletes exhibited the highest level of binge drinking (58% of the sample), former high school athletes reported the second highest rate (51%), which was comparatively higher than students who had never played sport (35%; Green et al., 2014). This delayed effect held across all racial subdivisions of the sample population, with anywhere from 8% to 15% of former high school athletes reporting more binge drinking than their non-athlete counterparts. Further, additional findings showed that this pattern was more prominent in former female high school athletes, who reported binge drinking 16% more than previous non-athlete females (Green et al., 2014).

While there is a dearth of research looking specifically into the long-term health of former high school athletes, pressing concerns related to early sports specialization in youth athletes that persist through high school and beyond suggest more research examining long-term health should be conducted in this population. Globally, “youth athlete” is a broad definition for individuals under adult age, usually between 7-18 years, who play organized sports
However, this age range is flexible, with many organizations using different criteria to define their youth athlete age ranges by sport-specific criteria. As examples, the Special Olympics defines “young athletes” as those between the ages of 2-7 years with or without intellectual disabilities (Olympics, 2021), American Youth Football contains separate divisions for ages ranging from 6 years and under to 15 years (American Youth Football, 2017), USA Triathlon combines youth and junior athletes to be between the ages of 7-15 years (USA Triathlon, 2021) and American Youth Cheer (American Youth Cheer, 2016) and World Rowing include divisions up to 18 years old (World Rowing, 2021). As such, research in the realm of “youth” athletics can be confusing, as researchers can define the age ranges of their populations by those specified by these sport-specific organizations, or by national/international age standards, which can also vary. For example, the United Nations defines ‘youth’ as any individuals between 15-24 years old (United Nations, n.d.), while the U.S. defines the classification in three stages: early adolescence (14 years or younger), middle adolescence (15-17 years), and late adolescence/early adulthood (18-24 years) (Youthpolicy.org, 2014).

Regardless of definition, several literature reviews released in recent years synthesize what limited literature exists to show that youth athletes can be susceptible to several health concerns caused by early sports specialization, that can also lead to long-term consequences. In a literature review by Baker et al. (2009), early sports specialization was defined by four parameters: when children begin sport at an early age, become involved in one sport only (as opposed to several sports), begin focused, high-intense, sport-specific training, and participate in sports competition. The review highlights that, while early specialization can result in expertise development, research also points to an association between early specialization and a host of negative consequences relating to physical, psychological, and social development (Baker et al.,
2009). These results were echoed in another review by Jayanthi et al. (2013), which showed that early sport specialization led to higher injury rates, increased psychological stress, and quitting sport at a young age, with no evidence indicating that intense training and specialization before puberty was necessary to achieve elite status (defined as expert or non-novice athletes; Jayanthi et al., 2013). In terms of musculoskeletal health, research points to the overall benefits to site-specific bone mineral density and strength in former high school and youth athletes over non-athletes due to increased joint loading in still formative stages of bone development (Kudlac et al., 2004; Zanker et al., 2004; Raczynska et al., 2007; Ward et al., 2019). However, a literature review by Feeley et al. (2016) synthesizes how early specialization, particularly in the sports of ice hockey, swimming, gymnastics, and baseball, can lead to overuse injuries and potential long-term decreased physical ability, suggesting future research be conducted to define injury risk in young athletes that specialize early. Further, following the passage of Title IX (Harvard University, 2021) in 1972, female sports participation in high school increased from 7% across the U.S. to 42% in 2010 (National Federation of State High School Associations, 2021). As a result of increased sports participation, specialization, and high-intense training, the female athlete triad was defined by the American College of Sports Medicine (ACSM) in 1992 after experts noticed a pattern of menstrual dysfunction, low energy (with or without an eating disorder), and decreased bone mineral density in adolescent and young adult female athletes (Nattiv et al., 1994; Yeager et al., 1993). In a review by Thein-Nissenbaum (2013), research was highlighted examining how the declined bone-mass accrual in adolescence and young adulthood as a result of ‘the triad’ could have later detrimental effects on bone health in women in their 30s and 40s. While research regarding the occurrence of the triad in current high school (Barrack et al., 2008, 2010; Hoch et al., 2009; Nichols et al., 2006; Rauh et al., 2010; Thein-Nissenbaum et
al., 2011) and college athletes (Cobb et al., 2003; Rumball & Lebrun, 2004; Smolak et al., 2000) is extensive, further studies examining the long-term effects on former female athletes’ health is now warranted.

**Summary of Post-Sport Athlete Health**

Research maintains that occurrences of certain chronic conditions (e.g., CVD, cancer, metabolic disorder) remain lower than that of the general population in former professional and college athlete populations post-retirement (Chang et al., 2009; Davies et al., 2016), potentially due to a protective effect exhibited by their history of athleticism (Paffenbarger & Lee, 1998). However, issues relating to bone and joint health (Arliani et al., 2014; Davies et al., 2016), complications due to concussion (Kerr et al., 2018; Montenigro et al., 2017), as well as increased issues with various aspects of mental health (Cottler et al., 2011; Kerr et al., 2014; Lindqvist et al., 2014; Schwenk et al., 2007; Stephan et al., 2003; Stirling et al., 2012), remain the most pressing issues for these populations’ long-term health, potentially due to the high intensity of training they undergo as athletes and injury history from sports. While limited research has been conducted exploring high school and youth athletes long-term health, similar physical and mental long-term health trends are suggested based on injury history (Montenigro et al., 2017; Schmidt et al., 2018) and early specialization in sports (Baker et al., 2009; Feeley et al., 2016; Jayanthi et al., 2013; Thein-Nissenbaum, 2013). Overall, many of the mentioned physical and mental health problems can be negated by a variety of treatments and lifestyle habits, including practicing healthy levels of physical activity after athletes transition out of organized sport.

**Physical Activity Behavior of Former Athletes**

Physical activity has been shown to negate many of the physical, mental, and emotional health declines exhibited by former athletes in the general populations (Physical Activity
Guidelines Advisory Committee, 2008; 2018) and its promotion is recommended to improve athletes’ transition quality as they retire from sport (Park et al., 2013b). For those former athletes who are unable to turn sports participation into a viable career, declines in physical activity levels are expected after retirement, as few can maintain fitness levels for competition without the necessary resources (e.g., coaches and trainers, facilities, equipment). However, while some former athletes are able to maintain health-promoting levels of physical activity once they retire, recent research suggests that some exhibit substantial declines in their behavior that could negatively affect their transition and health. As such, it is not unreasonable to speculate that decreased physical activity may be a contributor to the declined health exhibited in various former athlete populations, and by extension, negative transition experiences.

**Effect of Physical Activity on Physical and Mental Health**

Physical inactivity is a growing concern, not just in the former athlete population, but across the entire adult population of the U.S. A leading contributor to multiple noncommunicable diseases (e.g., CVD, cancer, metabolic disorder), physical inactivity also increases the risk of premature mortality (Lee et al., 2012) and is estimated to cost Americans an extra $117 billion in healthcare each year (America’s Health Rankings, 2021). As a result, completing regular exercise and physical activity has been increasingly promoted as a way of combatting both disease and rising healthcare costs. The PAGA, which are backed by both the ACSM (Garber et al., 2011) and U.S. Office of Disease Prevention and Health Promotion (U.S. Office of Disease Prevention and Health Promotion, 2018), state that adults should complete 150 minutes/week of moderate aerobic physical activity, as well as muscle-strengthening activities for all major muscle groups at least twice per week on non-consecutive days (Piercy et al., 2018). While these are the minimum thresholds recommended to gain health benefits, research shows that even if
the minimum requirements of the PAGA are not met, relative risk for all-cause mortality can still improve. Translated to metabolic-equivalent (MET) values (i.e., the amount of oxygen consumed while at rest [3.5 ml O₂/kg of bodyweight/min]), research shows that, when compared to individuals who report completing no activity, completing less than the recommended minimum of 7.5 metabolic-equivalent (MET) hours/week of physical activity is associated with a 20% decrease in risk for all-cause mortality (hazard ratio [HR] 0.80, 95% CI 0.78-0.82), while completing 1-2 times the recommended value results in a 31% decrease in risk (HR 0.69, 95% CI 0.67-0.70; Arem et al., 2015). However, currently only about 20% of American adults report meeting both the PAGA’s recommendations (Stutts, 2002).

Studies contributing to the PAGA show the negative and significant associations between physical activity and various diseases and disabilities among the general population that are also exhibited in former athlete populations. For example, osteoarthritis risk is a rising concern in former athlete populations for those who played or sustained injury from contact sports (e.g., football, soccer, rugby; Arliani et al., 2014; Davies et al., 2016; Laure & Binsinger, 2009). While there is no cure for osteoarthritis, completing moderate-to-vigorous land- or water-based activities that are low stress on joints (e.g., swimming, cycling, walking) has been shown to mitigate pain and inflammation in joints, which can markedly improve quality of life and physical function (Bartels et al.; Fransen et al., 2014). Further, while BMI is not the most optimal measurement of body composition in athletes, reports of BMI in the overweight and obesity ranges are also concerns in former athlete populations. From a review of meta-analyses and systematic reviews, the 2008 Physical Activity Guidelines Advisory Committee (PAGAC) Scientific Report concluded that completing 13-26 MET-hours/week (300 minutes of moderate, or 150 minutes of vigorous intensity activity) resulted in 1-3% loss in weight and consistent
weight stability over time (Irwin et al., 2003; McTiernan et al., 2007; Slentz et al., 2005). Further, when added to a dietary restriction intervention, weight loss can increase to over 5% of body weight, as an individual will utilize excessive fat stores within the body to create energy (PAGAC, 2008). This was expanded upon in the 2018 PAGAC Scientific Report, which provided further evidence of completing at least 150-300 minutes of moderate intensity activity minimizes weight gain and improves weight stability (Blanck et al., 2007; Brown et al., 2016; French & Stables, 2003; Lee et al., 2010; Moholdt et al., 2014; Sims et al., 2012). Similarly, increasing aerobic physical activity by only 2000 steps/day has been shown to improve blood glucose control within muscles (Ponsonby et al., 2011; Yates et al., 2015; Yates et al., 2014) and decrease symptoms associated with metabolic syndrome (Huffman et al., 2014). Such improvements can aid in weight loss, prevent weight gain, and improve risk of cardiovascular mortality exhibited by former athletes (Baron et al., 2012; Chang et al., 2009; Tucker et al., 2015).

More recent analyses included in the 2018 PAGAC Scientific Report has shown that physical activity can also improve mental health issues reported in the general population that are also common in former athlete populations. While a dose-response has yet to be defined, varying types, intensities, and durations of physical activity have been shown to reduce depressive symptoms and improve overall quality of life in those with and without clinical depression (Tavares et al., 2014). Similarly, meta-analyses examining interventions designed to promote the aerobic (Wipfli et al., 2008) and muscle strengthening PAGA (Gordon et al., 2017) have shown improvements in acute and chronic feelings of anxiety. Further, a meta-analysis by Kredlow et al. (2015) indicates that both acute (seemingly defined in the analysis as a single bout of moderate-to-vigorous activity) and various forms of regular (time ranges not provided in
analysis) exercise can improve various aspects of sleep and wake-time quality (e.g., sleep time, sleep efficiency, time awake). Beyond disease status, the 2018 PAGAC Scientific report demonstrates that physically active individuals sleep, feel, and function better than those who are inactive, alluding to an overall improved quality of life. As such, by inciting former athletes to maintain healthy levels of moderate-to-vigorous physical activity early on in their retirement from sport, the quality of their transition, later physical and mental health, and overall quality of life may be improved.

**Post-Sport Physical Activity Changes in Relation to Post-Sport Health**

While still training, athletes far surpass the recommended PAGA and reap the benefits of improved physical fitness (Sorenson et al., 2015). However, recent research suggests that the aforementioned health disparities in this population may be caused in part by drastic declines in physical activity following retirement. Previous research conducted in the late 20th century perpetuated the belief that former athletes tend to stay active after retiring from sport by demonstrating an association between competitive sports participation and physical activity later in life (Greendorfer & Blinde, 1985; Strawbridge, 2001). As a result, former athletes were thought to have markedly improved physical and mental health over non-athletes (Paffenbarger & Lee, 1998). However, researchers speculate that, as the subjects of these studies are from over half a century ago, these data may not be as applicable to current athletes in the early 21st century, due to marked changes in sports culture in the U.S. over the last several decades (Russell et al., 2017). Regardless, exercise and physical activity behavior in former athletes has gone largely unstudied by researchers, and what limited research that does exist connecting sport participation and adult physical activity is mixed at best (Seefeldt et al., 2002).
While an explicit connection has yet to be solidified, mental and physical health deficits former athletes exhibit after retirement from sport may be exacerbated by substantial decreases in physical activity behavior after retirement. Short-term detraining studies (10-30 days) have shown changes in insulin sensitivity, plasma lipids, and body composition in populations including elite-level (no definition provided) kayakers (Liu et al., 2008; Rogers et al., 1990) to endurance-trained masters athletes (Rogers et al., 1990). When detraining is prolonged, these effects may lead to later, more serious consequences (e.g., CVD, metabolic syndrome, high BMI and fasting plasma glucose, low high-density lipoproteins; Baron & Rinsky, 1994; Miller et al., 2008). Further, musculoskeletal complications from previous training and past injuries accrued from sports is posited to cause decreases in physical activity in former college athletes, resulting in worsening body composition (Kerr et al., 2014; Simon & Docherty, 2013) and fitness (Simon & Docherty, 2017) in formerly injured college athlete populations over those who were previously uninjured and able to maintain higher levels of activity. Paffenbarger and Lee (1998) noted a similar effect with former college athletes’ health and physical activity maintenance, implying that the protective effect on health of early athleticism in college declined unless physical activity was maintained throughout one’s lifetime. While more research is needed in this area, researchers are now agreeing that former athletes are exhibiting detrimental consequences to health after their retirement from sport, which may cause or be due to substantial decreases in physical activity in this population post-sport. As such, researchers are now calling for physical activity promotion in these populations (Simon & Docherty, 2013; Sorenson et al., 2015).
Former Professional Athletes

Very few studies have explored former athletes’ physical activity behavior in-depth. Anecdotally, measures of physical activity in studies involving professional athletes are peripheral to other variables (e.g., factors associated to disease risk, measures of physical function associated with injury). As such, when reported, physical activity behavior is given little detail that would indicate measurable change according to the FITT-VP Principle, which indicates activity frequency, intensity, time, type, volume, and progression used in exercise testing, prescription, and to assess long-term behavior (ACSM, 2017). For example, in the aforementioned study by Chang et al. (2009), the researchers noted that former NFL players exhibited significantly lower rates of sedentarism (defined in the study as <30 minutes of moderate physical activity completed 3 times/week or <405 MET-minutes/week) compared to non-athlete controls from the DHS (35% vs. 60% respectively, \(p<.05\)). However, other descriptive details of their physical activity behavior remain unknown, such as what proportion of the sample were meeting the PAGA, as well as the frequency, intensity, time, and types of activities they took part in. Similarly, in the study by Stirling et al. (2012), also mentioned previously, the qualitative analysis revealed that one of the perceived facilitators of changes in body composition was decreases in physical activity after retirement from sport. Participants explained that lower levels of physical activity exacerbated their weight gain and loss of muscle mass, but context regarding contributing factors to their declined physical activity or current physical activity levels were not provided. Studies that do specifically analyze changes in physical activity in former professional athletes shed light on their behavior. However, these studies are few and far between and similarly do not provide enough detail to truly understand behavior, nor reasons for how or why physical activity changes post-sport.
In a cross-sectional study by Woitas-Slubowska (2006) conducted in Poland, the author aimed to assess the influence of a professional sports career on participation in recreational physical activity in male ex-athletes. The study included 372 respondents (ages 18-51, split into juniors [18-34] and seniors [31-51]), of which 175 were former professional athletes (career span: 1-18 years, length of retirement and demographics unknown,) and 197 non-athletes (demographics unknown). Respondents completed a questionnaire analyzing the forms of physical recreation they had completed in the previous day, and the time and frequency completing physical activities during the previous week. Comparisons were made between the frequency of participation and forms of physical activity and the length of individuals’ sports careers and “sports level” (i.e., the sports class achieved by ex-athletes during their careers). Chi-square analyses revealed that former athletes in general ($X^2=2.035$ times/week, Cramer’s V: 0.23, $p<.001$) and when split by age (juniors: $X^2=14.25$, Cramer’s V: 0.31, $p<.01$, seniors: $X^2=14.07$, Cramer’s V: 0.25, $p<.01$) complete physical recreational activities more frequently than previous non-athletes, with similar results found for the time spent doing these activities (total: $X^2=37.34$ hours/week, Cramer’s V: 0.312 $p<.001$, juniors: $X^2=10.38$, Cramer’s V: 0.26, $p<.01$, seniors: $X^2=26.60$, Cramer’s V: 0.35, $p<.01$). However, a significant portion of the population (24-47%, p not provided), primarily in the junior category, stated they did not report doing physical recreation the day before, as they did not have time (Woitas-Ślubowska, 2006). While the results from this study indicate former professional athletes may be more active than previous non-athletes ranging from young to middle-age, critical information regarding their behavior is missing. Particularly, respondents were limited to indicating whether they participated in walking or sports as their forms of recreational activity, limiting understanding of
the intensity of their activities. Further, this study was cross-sectional, and as such it is not clear as to whether respondents’ answers are truly indicative of their physical activity behavior.

In several follow up studies by Backmand et al. (2001; 2003; 2009), researchers attempted to understand how physical activity affected depression and anxiety (Bäckmand et al., 2003; Bäckmand et al., 2009) and physical function (Bäckmand et al., 2009) in former elite athletes from a previous longitudinal study (Bäckmand et al., 2001). In the original study, researchers attempted to assess mood and personality changes from middle to old age in former elite athletes, who were defined as athletes who had represented Finland in various sports at least once in the Olympics, European Championships, World Championships, or other inter-country competitions between 1920-1965. A cohort of 1336 individuals, (56.7% former athletes) were surveyed in 1985 for anxiety, depression, and related contextual factors (e.g., physical activity level, marital status) and were followed up ten years later. Former athletes were split into five cohorts based on sport type: endurance (n=134, 70.4 years, range 54-92), powercombat (n=185, age 64.7 years, range 48-90), powerindividual (n=120, age 65.4 years, range 49-85), team (n=261, age 61.5 years, range 46-86), shooting (n=58, age 69.7 years, range 47-90), each of which was compared to the control group (age=62.5 years, range 49-91 [frequencies from 1995 follow up]). Analysis of covariance was used to test for differences between the psychological scales when comparing the groups while adjusting for age. While in the original study, no significant differences were found for measures of anxiety, and former endurance (p<.05) and team sport athletes (p<.01) were found to be less depressed than controls (Bäckmand et al., 2001), in a later follow up, it was found through multinomial logistic regression that those who played combat sports had an increased risk for depression compared to controls (OR=3.0, 95% CI 1.1-8.3, p<.05; Bäckmand et al., 2009). Further, physical activity levels seemed to modulate...
the risk of depression in both former athletes and controls over time. For the follow up studies physical activity measurements were converted and divided into quintiles based on MET-hours/day (Quintile I: <.41 MET-h/day to Quintile V: >6.43 MET-h/day). Between 1985-1995, an increase in one MET-hour/day significantly decreased depressiveness by 8% across all participants (95% CI 1-14%; Bäckman et al., 2009). Participants in the three lowest quintiles compared to the highest quintile tended to have a higher risk for depression by the end of the study, with those who increased physical activity from pre- to post-measurements exhibited a protected effect against anxiety (OR=0.9, 95% CI 0.8-1.0, p<.05). While this series of studies shows the benefits of physical activity on mental health in former professional athletes, again, specific measurements relating to the FITT-VP Principle are not provided.

**Former College Athletes**

Understandably, a majority of former athletes report a decrease in their activity post-sport after stopping training and competition (Reifsteck et al., 2013; Reifsteck et al., 2016; Sorenson et al., 2015). However, recent studies conducted with former college athletes show that those in this population may not be any more active (Reifsteck et al., 2013; Sorenson et al., 2015) or even less active (Reifsteck et al., 2013; Simon & Docherty, 2017) than non-athlete alumni after retiring from sport, with potentially large portions of these sample populations not meeting the PAGA.

In the aforementioned cross-sectional survey study by Sorenson et al. (2015), researchers sought to document lifespan exercise behavior and attitudes, and evaluate the relationship between exercise and cardiopulmonary health, in former DI college athletes. No details are given regarding how exercise was measured, and it is implied the researchers may have assessed general physical activity, rather than exercise, based on their verbiage. However, the researchers mention that participants’ self-reported data was compared to the PAGA and imply that
frequency, intensity, and time were measured, but that types of activities could not be
distinguished. Among current students (n=411, 92.5% current athletes, ages 19.7±1.3 years),
student athletes reported more than 15 hours of exercise per week over 4 hours/week in non-
athletes (p<.001, Cohen’s d=0.99) with 86% meeting the PAGA compared to non-athletes
(Sorenson et al., 2015). Current student athletes also reported significantly higher perceptions of
exercise importance than current non-athletes (p<.001, d=1.96). In comparison, former athlete
and non-athlete alumni did not exhibit appreciable differences in exercise behavior, with only
40% of both populations reportedly meeting the PAGA, and similar ratings of exercise
importance (Sorenson et al., 2015). Further, while non-athlete alumni demonstrated consistent
exercise patterns across three age strata (not provided) compared to current non-athlete students,
former athletes reported significantly lower exercise volumes compared to current student
athletes and were approximately 10% as likely as current student athletes to meet the PAGA.
Additionally, regardless of sports group, alumni who were compliant with the PAGA exhibited
significantly better cardiopulmonary health (younger alumni: p<.05, effect size [ES] =-0.71;
older alumni: p=.05, ES=-0.64; Sorenson et al., 2015).

Findings from Sorenson et al. (2015) were echoed in a study by Reifsteck et al. (2013),
the purpose of which was to examine the relationship between athlete identity and physical
activity in former DI and DIII athletes. Participants (N=105) were college alumni who had
graduated between the years of 2005-2010. Of this sample, 53.3% were former DI athletes
(60.7% female, ages not provided), 17.1% were former DIII athletes (61.1%, ages note
provided), and the remaining 29.6% were alumni from the DIII institution sampled from who did
not participate in intercollegiate sport. Participants completed an online survey assessing athletic
identity, self-reported exercise based on the Godin Leisure-Time Exercise Questionnaire
(Shephard, 1997), stage of exercise (i.e., stage of behavior change), and answered a single question answering whether they were more, less, or were completing about the same level of physical activity as when they were in college. In DIII participants, a two-way ANOVA was used to compare the effects of athlete status and gender on physical activity levels. While male participants exhibited higher physical activity levels than female participants ($F(1,45)=9.72$, $p<.01$), no interaction effect was found ($F(1,45)=.672$, $p=.417$) and no significant differences were found in physical activity participation between athletes and non-athletes, implying that the two groups were exhibiting similar amounts of physical activity ($F(1,45)=1.354$, $p=.254$). When comparing former DI and DIII athletes’ physical activity levels to that of non-athlete alumni, male alumni were significantly more active than their female counterparts ($F(1,99)=9.068$, $p<.05$). However, again an interaction effect between athlete status and gender was not found ($F(2,99)=2.760$, $p=.068$) and physical activity did not differ based on athlete status ($F(2,99)=1.065$, $p=.349$), indicating that regardless of division played, activity levels were similar to that of non-athlete alumni after retirement. Further, chi-square analyses revealed that while higher proportion of former athletes reported being in the ‘maintenance stage’ with their physical activity behavior (i.e., exercising regularly for >6 months) (67.5% vs. 35.4%, $X^2(4)=10.922$, $p=.027$), similar proportions of former athletes and non-athletes reported being in the inactive stages of ‘precontemplation’, ‘contemplation’, and ‘preparation’ (21.6% vs. 32.3%, respectively, $X^2(4)=1.960$, $p=.743$), and former athletes were more likely to report decreases in their physical activity level after college compared to non-athletes ($X^2(4)=29.404$, $p<.01$).

Because of the scales used in this study, understanding what proportions of former athletes and non-athletes were meeting the PAGA could not be determined. Additionally, differences in the
terminology and tools used in this study make it difficult to interpret whether researchers collected data regarding general physical activity or exercise.

While decreasing physical activity levels to the point that they are similar to that of non-athletes may not be clinically significant, some research has shown that former college athletes physical activity declines to the point of being below that of previous non-athlete alumni and potentially the recommended PAGA. Given former college athletes backgrounds in sports training, such findings are surprising. In the previously mentioned study by Simon and Docherty (2017), researchers aimed to evaluate differences in physical fitness between former DI athletes and previous non-athlete alumni. In addition to evaluating their fitness levels through testing, participants also self-reported their current aerobic and “anaerobic” exercise level as part of a questionnaire assessing their medical status and sport and injury history. Former Division I athletes self-reported completing 1.5-2.2 hours/week of aerobic exercise, while former non-athletes reported 5.8±2.7 hours/week \((F(1,198)=52.43, p<.01)\), indicating former athletes were significantly less aerobically active than non-athletes. Further, former DI athletes reported completing 0.5±1.3 hours/week of “anaerobic” exercise, while previous non-athletes reported 2.9±1.5 hours/week \((F(1,198)=46.19, p<.01)\). While the reported comparison between former athletes and non-athletes is stark in this study, no detail is given to the type of tool used to measure participants’ current exercise. The intensity at which aerobic exercise was completed at or what the authors mean by “anaerobic” exercise is also not clear. “Anaerobic” may be referring to participants’ muscle strengthening exercise behavior, however findings are reported as hours/week as opposed to bouts/week. Given these limitations, caution is recommended in comparing these results to the PAGA.
Former High School Athletes

While little research has been conducted examining physical activity behavior in former high school athletes, what does exist is the only among the athlete transition literature also relates physical activity to this population’s transition experiences out of sport and into college (Helms & Moiseichik, 2018; Lubker & Etzel, 2007; Lyons et al., 2018). Helms and Moiseichik (2018) shed some light on this subject in a study that attempted to determine (a) the extent to which former high school athletes experienced transitional loss after terminating high school sport in college, (b) the extent to which former high school athletes’ participation in college recreational sports programs associated with greater subjective well-being, and (c) how athlete identity and sport role loss related to college recreational sports involvement and subjective well-being.

Within the study, 82 college freshmen (57.3% male, 42.7% female, demographics not provided) who formerly competed in high school sport for at least two years at the varsity level completed a survey assessing athletic identity, satisfaction with life in relation to overall subjective well-being, feelings with loss associated with the transition out of sport, and recreational sports involvement. Participants were categorized into low- and high-involvement groups for recreational sports activity based on the cumulative percentage of total distribution. Based on index rank of the scale used to measure recreational sports involvement, on average participants reported taking part mostly in competitive, non-university sponsored sports (e.g., races, sports leagues; 17.6±4.4) and intramural sports (10.53±4.64), while they were least likely to take part in drop-in activities at the on-campus recreation center (e.g., swimming, fitness classes; 6.47±1.25).

Further, based on independent t-tests it was found that individuals who reported the most involvement in recreational sports (41.6±10.82) exhibited significantly higher levels of loss ($t(54)=-2.37$, $ES=.63$, 95% CI -11.33 - - .94, $p<.05$) in their sports role compared to those who
reported the least amount of recreational sports involvement (35.46±8.14). Further, an ANOVA examining perceived sense of loss and recreational sports involvement’s relation to life satisfaction revealed that, for individuals who exhibited high senses of loss, higher recreational sports involvement was significantly more associated with higher levels of life satisfaction ($F(1,17)=15.93, p<.001$) than those who reported low levels of involvement. No significant differences were found in those who experienced low senses of loss. The authors conclude that recreational sports participation can negate feelings of loss associated with retirement from high school sport (Helms & Moiseichik, 2018), though how maintaining general physical activity affects former high school athletes’ transition remained unexplored. Further, specific details regarding frequency, intensity, and time devoted to these activities remain unknown.

Insight into the different types of physical activity beyond recreational sports was highlighted in a study by Lyons et al. (2018), the purpose of which was to explore the impact of sports disengagement on identity renegotiation in former high school athletes no longer playing sport at the college level. In this qualitative study, three one-on-one interviews were conducted at the end of the first month of school, end of the first semester, and end of the whole academic year with college freshmen who had devoted at least 20 hours/week in high school athletics and were not currently playing college varsity sports (N=18, 55.6% male, 44.4% female, age range 18-22 years). The first interview sought to explore participants insights into the role transition that occurred in their transition from high school athlete to non-athlete college freshman. The second interview was designed to understand their transition more fully in regard to their identity renegotiation. The third interview had participants reflect and project on their role transition, identity negotiation, and how they envisioned establishing a new identity in the future. By the end of the study, 16.7% of participants completed only the first interview, the same proportion
completed the first two, and the remaining 66.6% had completed all three. The thematic analysis revealed three themes: (a) role transition, (b) identity negotiation, and (c) reflection and projection. Particularly, findings in the second theme emerged relating to how participants had re-engaged with physical activity during their first semester. Participants discussed engaging in organized activities (e.g., joining a kickboxing gym) to unorganized activities (e.g., pick-up basketball), and while most participants discussed focusing on only one activity, some (exact quantities not provided) explained engaging in a wide variety of activities relating to intramural sports, club sports, and pick-up games. In the first theme, it was revealed that the majority of participants (n=11) voluntarily chose to discontinue athletic participation in college. As such, the authors allude that participants’ chose the activities mentioned in the second theme to replace their former competitive sports, and that much of participants’ experiences and motivations relating to each theme was facilitated through building camaraderie with others (Lyons et al., 2018). Unfortunately, measurements of frequency, intensity, or time were not conducted in this study, therefore understanding of participants overall physical activity behavior is unknown.

Summary of Post-Sport Athlete Physical Activity Behavior

Overall, the understanding of former athletes’ physical activity behavior at any level of play is limited due to the few existing studies examining physical activity specifically, incomplete reporting of physical activity behavior based on the FITT-VP principle, and the cross-sectional nature of the studies that do exist. What research that does examine physical activity in former professional and college populations posits that these populations exhibit drastic declines in physical activity post-sport that vary in relation to the general population/non-athlete alumni (Reifsteck et al., 2013; Simon & Docherty, 2017; Sorenson et al., 2015). Injury history seems to be a contributor to these declines which, when completed at unhealthy levels,
can result in negative consequences on health (Simon & Docherty, 2017; Sorenson et al., 2015). If, however, former athletes can maintain healthy levels of activity, they reap health benefits similar to that of the control groups in these studies (Bäckmand et al., 2009; Sorenson et al., 2015; Woitas-Ślubowska, 2006). Former high school athletes remain largely understudied compared to their older counterparts, but what research exists exhibits that this population experiences transitional difficulties associated with retiring from sport and moving on to college that are improved if they remain active in college (Helms & Moiseichik, 2018; Lubker & Etzel, 2007; Lyons et al., 2018). However, whether or not former high school athletes remain active at healthy levels once they retire from sport remains largely unknown due to limited detail regarding their behavior provided in these studies.

**Theories for Why Physical Activity Changes in Former Athletes**

Several theories are posited to support the notion of continued physical activity in former athlete populations following their retirement from sport (Russell et al., 2017). According to continuity theory, individuals continue to partake in activities they are used to as an adaptation to aging (Atchley, 1989). While the contexts of sport and physical activity differ (Tracey & Elcombe, 2004), based on continuity theory, individuals who partake in sport would continue to be physically active due to similar aspects, such as enjoyment and the maintenance of fitness (Russell et al., 2017). Additionally, Whaley (2004) suggests that the concept of possible selves (Markus & Nurius, 1986) influences the relationship between competitive sport participation and lifespan physical activity. In other words, a former athlete may hope to maintain fitness, or alternately fear becoming out of shape, thus will continue staying physically active to achieve their ideal future self (Whaley, 2004). Standage and Duda (2004), who studied the motivational processes behind older adults’ physical activity behavior, suggest self-efficacy theory (Bandura,
1986; Bandura et al., 1999) as a predictor for maintaining lifelong physical activity. Self-efficacy, an individual’s self-confidence in performing a task within a given context, is strongly influenced by past experiences and accomplishments regarding the given task. As such, former athletes’ previous accomplishments in sport may influence their physical activity choices, biasing them to similar activities that relate to sport(s) they have participated and were successful in in the past (Russell et al., 2017).

More recent research suggests other factors that may prevent athletes from continuing lifelong physical activity as they transition out of sport. Tracey and Elcombe (2004) suggested three key factors that contribute to the disconnect between competitive sport and later physical activity maintenance: (a) unique behaviors specific to sport (e.g., chronic injuries, performance-enhancing substance abuse), (b) utilitarian attitudes toward physical activity (i.e., the “training mentality”), and (c) long-term impact of athlete identity. Russell et al. (2017) expanded on their hypothesis regarding the effect of injury on lifespan physical activity by positing that, not just the physical, but also the psychological detriments incurred from injury are additional barriers former athletes face when trying to stay physically active after retirement. Further, several researchers posit that SDT (Deci & Ryan, 2000) may be useful framework in predicting and manipulating former athletes’ motivation to be physically active (Reifsteck et al., 2016; Ryan & Patrick, 2009; Standage & Duda, 2004). Organized sport is prominent with extrinsic motivators that athletes take advantage of (e.g., recognition, playing time, scholarship maintenance, contract renewal). However, if athletes do not possess intrinsic motivation to be physically active, transitional challenges to stay active may arise, as intrinsic motivation has been shown to foster continued engagement with physical activity and enhanced well-being (Ryan & Patrick, 2009). Further, without the camaraderie of their teammates, athletes are likely to foster feelings of
isolation and fear in their loss of social support (Fuller, 2014), which may affect their perceived relatedness in relation to physical activity behavior maintenance. Because this feeling of relatedness is fostered within the social construct of a sports team in a training setting, the absence of their team and coaches can result in athletes’ initial discontinuation of physical activity post-sport (Ferrara et al., 2021a). Paired with a loss of competence at no longer practicing a sport they have worked for years to master and potential underdeveloped autonomy, athletes may be underprepared in maintaining their physical activity after retirement (Ferrara et al., 2021a).

**Athletic and Exercise Identities**

In particular, recent research suggests a distinct connection between the continuation of physical activity after sport retirement in relation to the post-sport transfer of athlete (Helms & Moiseichik, 2018; Reifsteck et al., 2013) and exercise identity (Reifsteck et al., 2016) in former college and high school athletes; no research examining identity in relation to former professional athletes’ physical activity currently exists. Athlete identity is the degree to which individuals identify as an athlete (Brewer et al., 1993), while exercise identity is defined as when an individual’s self-concept is based on perceptions of past exercise behavior and directs future exercise behavior (Anderson & Cychosz, 1994). To date, athlete identity, in particular, is a well-established factor that affects the quality of former professional (Sanders & Stevinson, 2017) and college athletes’ (Beamon, 2012; Harrison et al., 2013) transitions out of sport. Athlete identity changes over time after retirement from sport (Douglas & Carless, 2009; Lally, 2007; Park et al., 2013a), with more salient (i.e., higher) levels of identity associated with more difficulties in adjusting to post-retirement life. As a result, experts suggest that athletes should make efforts to suppress their athlete identity prior to retirement to ease their transition (Grove et al., 1997;
Lally, 2007; Lally & Kerr, 2005). However, based on continuity theory, more recently researchers are suggesting that retention of athlete identity, to a degree, is necessary to maintain happiness and reduce cognitive dissonance (Allen Collinson & Hockey et al., 2007; Cuskelly & O'Brien, 2013; Helms & Moiseichik, 2018).

Post-Sport Identity and Physical Activity in Former College Athletes. To date, research examining the relationship between post-sport identity and physical activity has been limited primarily to former college athletes. In the aforementioned study by Reifsteck et al. (2013) where identity was studied in relation to self-reported physical activity, persisting athletic identity significantly correlated with self-reported physically activity levels in former DI and DIII athletes ($r=.428, p<.001$), but not in non-athlete alumni ($r=.196, p=.291$). Further, the ANOVA revealed that no differences in the salience of athlete identity between former DI and DIII athletes ($F(2,99)=2.082, p=.130$). Based on these findings, in a later study Reifsteck et al. (2016) then integrated the concept of integrated motivation (i.e., belief that a behavior is part of an individual’s identity (Deci & Ryan, 2000) to identity theory (Burke & Reitzes, 1991) to determine (a) if former athletes’ athletic identity transferred to exercise identity after retirement from sport, and (b) the stability of their motivation to stay active post-sport. Participants in this study included 282 former DI college athletes (ages 27.73±3.5 years, 66.5% women, 86.5% Caucasian) who reported being regularly physically active (defined in the study as completing moderate to vigorous physical activity 3-5 times per week for 20-60 minutes per session; Marcus et al., 1992) Participants completed an online series of measures assessing motivation to exercise, exercise identity, athlete identity, and self-reported exercise. Utilizing path analysis, researchers identified that athlete identity, exercise identity, and the interaction between the two significantly predicted physical activity, however the total indirect effect of exercise identity
exhibited stronger predictive power on physical activity based on the p-value, with slight disagreement with the bootstrapped bias-corrected confidence interval \( p<.05, 95\% CI -0.05-.593, \) standardized coefficient=.156). Further, exercise identity significantly predicted each of the motivation subscales within SDT for exercise, but primarily identified regulation \( p=.01, \) standardized coefficient=.173) and introjected regulation, though with slight disagreement between the p-value and confidence interval \( p=.056, 95\% CI -.211-.007, \) standardized coefficient=.051; Reifsteck et al., 2016).

**Post-Sport Identity and Physical Activity in Former High School Athletes.** In general, only recently has athletic identity been studied in relation to former high school athletes’ transitions out of sport and into college. A cross-sectional study by Lubker et al. (2007) found evidence that the salience of athletic identity affected former high school athletes’ transition to college and was affected by sports disengagement. The purpose of this study was to understand how reported athletic identity and adjustment patterns to college differed in a cohort of freshmen \( N=317, \) male 52.1% female, ages 17-19\] and how disengagement from sport affected their transition. The population was divided into three cohorts: disengaged athletes \( n=133, \) former high school non-athletes \( n=106, \) and first-year college varsity athletes \( n=78. \) Respondents completed a 3-part questionnaire assessing demographics, athletic identity, and individual’s adjustment to college through the Student Adaption to College Questionnaire (Baker & Siryk, 1999), and were divided into three categories (low, medium, high) based on their athletic identity scores. A 3x2 ANOVA was employed to measure the effect of sport status on gender. In general, male participants (regardless of athlete status) exhibited higher athletic identity scores than females \( F(1,312)=18.27, p<.001 \) and significant differences were found between athlete groups \( F(1,312)=120.4, p<.001 \), with current college varsity athletes exhibiting
the highest scores (40.8±6.7), non-athletes scoring lowest (19.6±9.3), and disengaged athletes scoring significantly different and between both groups (27.6±10.0). In terms of college adjustment, overall females reported significantly better adjustment to college than males regardless of athlete status \((F(1, 316)=7.15, p<.05)\). Initially, the medium athletic identity group scored significantly lower than the high and low groups in terms of adjustment, however post-hoc analyses indicated the groups were not significantly different in terms of adjustment \((p>.05)\).

Lastly, a hierarchical regression analysis was used to examine the predictive power of seven independent variables (i.e., intramural sports participation, recreation center use, perceived level of social support, control over sports disengagement, expectation to play in college, being recruited to play in college, being offered a scholarship to play in college) on college adjustment. Only two variables, perceived level of social support and control over sports disengagements, significantly predicted scores on different subscales of the Student Adaption to College Questionnaire.

While Lubker et al. (2007) does not measure physical activity specifically, nor find engagement in physical activity to be a substantial factor in former high school athletes transitions, the researchers suggest that interventions be put in place to aid this population with the dual transition of leaving sport and entering college, and that these interventions include kinesthetic means of adaptation (i.e., promoting recreational physical activity and intramural sports participation). Further, findings from Lubker et al. (2007) were reflected in the aforementioned studies by Lyons et al. (2018) and Helms et al. (2018). While athletic identity was not explicitly measured in Lyons et al.’s study, within the themes of ‘role transition’ and ‘identity renegotiation’, participants indicated that their autonomy in discontinuing sports in college and creation of new social networks, particularly ones where they bonded with other
former athletes experiencing the same transition, aided in their adjustment to college. Lyons et al. (2018), in contrast with Lubker et al. (2007), found that engagement of physical activity aided former high school athletes’ in their transition and identity renegotiation after loss of the athlete role from high school. Further, in the study by Helms et al. (2018), a Spearman rank correlation was conducted to analyze the association between athletic identity and transitional loss of the sport role. This showed a significant positive relationship between the two factors (r=.6183, p<.0001, coefficient of determination=.3823), indicating that individuals who reported more salient athletic identity also experienced a greater loss related to their exit from sport. While identity was not examined directly in relation to recreational sports involvement in this study, the authors conclude that the high level of participation associated with satisfaction in transition was facilitated through maintained perceptions of the sports role and athletic identity (Helms & Moiseichik, 2018).

**Summary of Theories Behind Former Athletes’ Physical Activity Changes**

While their backgrounds in sports training may prime former athletes to maintain healthy levels of physical activity after retiring, certain factors, such as the loss of their team, the long-term impact of injuries, and issues with transferring motivation from sport to regular physical activity, may make them susceptible to unhealthy declines in activity post-sport. While virtually no research has been conducted in former professional athletes, limited research conducted in former college and high school athletes suggests that athlete and exercise identity may play a pivotal role in athletes’ maintenance of physical activity levels after retiring (Reifsteck et al., 2013; Reifsteck et al., 2016) and that physical activity maintenance may improve their transition through continued identity facilitation (Lubker & Etzel, 2007; Lyons et al., 2018). Diminishing athlete identity is posited as necessary in improving overall transition experiences (Lally, 2007),
however the previous findings suggest that, to a degree, athlete identity may need to be maintained in the former athlete population to also maintain transition quality (Allen Collinson & Hockey, 2007; Cuskelly & O’Brien, 2013; Helms & Moiseichik, 2018; Russell et al., 2017). Diminishing athlete identity entirely may in fact hinder physical activity behavior after retirement and further reduce the quality of transition. With this said, identity is not stagnant (Douglas & Carless, 2009; Lally, 2007), and as all research to date regarding this phenomenon has been cross-sectional, further understanding of how identity changes over the transition out of sport is necessary to determine how it relates to physical activity, and to aid in the promotion of physical activity in former athlete populations.

**Developing Physical Activity-Based Transition Programs for Athletes**

Difficult transitions and the accompanying health problems mentioned previously have not gone unnoticed by experts, and as such, preretirement planning efforts are promoted to and fostered by those who work with athletes during their sports seasons. Preretirement planning has been shown to be the most effective method for facilitating a successful transition for retiring athletes (Murphy, 1995), as this method works to prevent negative transition experiences before they manifest and can be implemented while organizations still have contact with the athlete. Having the athlete consider plans regarding continuing education, career changes, broadening their social circle, and maintaining healthy habits while they are still in sport and approaching retirement has been shown to help them prepare for the upcoming experience of transition (Murphy, 1995; Raabe et al., 2017). While not always be feasible, it is suggested that organizations work towards creating interventions for their retiring athletes to aid in pre-retirement planning, while still giving them the option of support should they need it once they retire. To facilitate this support, Sinclair and Orlick (1993) suggest staying in contact with
athletes through seminars on transition, providing resource centers for them to access, and where applicable, offering continued but limited monetary support to athletes once they retire.

In particular, intervention on behalf of MPCs is recommended to aid in athletes’ cognitive restructuring regarding sports retirement (Taylor & Ogilvie, 1994; Wylleman et al., 2004), as these individuals are equipped to help athletes develop new self- and social-identities, deal with the emotional distress that occurs after retirement, work on maintaining the athletes’ sense of self-worth, and utilize psychological skills training (PST) to cope with the stress of transition. Additionally, MPCs can utilize “teach for transfer” to show athletes how to utilize psychological techniques they may already be familiar with from sport (e.g., stress management, cognitive restructuring, PST) in overcoming challenges related to adopting a new career and lifestyle (Leventhal et al., 1983). Because an over-developed athlete identity can result in difficulty transitioning out of sport (Lally, 2007), MPCs who have the ability to prepare athletes for their transition out of sport focus much of their efforts on diminishing athlete identity by providing athletes with the space to express emotional distress, explore new avenues of life, and develop new self-identities. Further, formal pre-retirement interventions put in place to aid athletes with their transition out of sport also focus on developing other life skills, such as financial planning (Charter, 2017, September 27; Curran, 2015; Wilcoxson & Link, 2019) skill transference (Lavallee, 2005), and exploring future jobs and continuing education (Cooper et al., 2019; Curran, 2015).

Considerations for Transition Programs

In line with Wylleman et al. (2004), formal transition programs provide step-by-step procedures to aid athletes in transition by reducing distress related to the career transition at the psychological, physical, and social levels. As such, many current transition programs and studies
examining athlete transition out of sport draw from early research exploring this topic that provide therapeutic suggestions for intervention. For example, a model developed by Baillie (1992; 1993) suggests a two-part process where (a) pre-retirement interventions focus on the functional adjustments of athletes (e.g., new career options, reorienting attitudes that focus on opportunity instead of loss, recognizing feelings to desensitize the difficulty of transition), while (b) post-retirement interventions focus on affective concerns (e.g., dealing with grief, disorientation, loneliness, depression) and providing social support through individual or group counseling. This was echoed in a more recent systematic review by Park et al. (2013a), which synthesized literature on high school to professional athletes’ career transitions between 1968-2010. The authors suggest MPCs should provide both proactive (e.g., career planning, transference of skills) and reactive (e.g., coping with emotions, supporting identity reformation) programs to help athletes prepare for retirement and adjust to post-sport life. Taking into account the previous coach-athlete relationship, individualizing assistance based on reasons for sport discontinuation, and providing adequate education on the importance of pre-retirement planning and life skill development are also suggested methods (Park et al., 2013a). Further, research by Grove et al. (1997) in former professional athletes mentions that providing athletes with the opportunity to vent and express their feelings prior to and within retirement may aid in easing emotional distress. Additionally, utilizing account-making (i.e., constructing a story about a traumatic event to represent a person’s understanding of it in time, then refining and elaborating on it as he/she gains further perspective of the event (Harvey et al., 1990; Horowitz, 1993) for coping with a loss to sports may aid former athletes in gaining closure on their careers and confidence in evolving new self- and social-identities (Grove et al., 1998). Specifically for retiring college athletes, Stokowski et al. (2019) suggests that college athletics departments
provide (a) mentorship and practical learning opportunities (e.g., service learning, job shadowing, study abroad) to broaden identity and self-worth outside of sport while athletes are still active, (b) holistic policies to aid injured athletes physically and mentally through sudden, non-normative transitions, and (c) invite former athletes to remain active with their university, athletic department, and team at on-campus events after they retire. Overall, the plethora of research examining athlete transition processes and quality over the years has provided numerous methods for intervention develop. Based on these therapeutic suggestions, some formal transition programs have been conceptualized and implemented at the professional and college level, though none seem to have been put in place for former high school athletes. Fortunately, researchers agree that more interventions are needed across a variety of sports, levels of play, and countries (Dimoula et al., 2013; Park et al., 2013a; Stambulova et al., 2009).

**Current Transition Programs for Former Athletes**

**Former Professional Athletes**

In recent years, some professional organizations have implemented programs to aid their transitioning athletes, however the detailed explanation of said programs is mixed. In a qualitative study by Curan (2015) who analyzed the post-playing careers of Irish soccer players who played in English League Football between World War II and 2010, participants mentioned benefitting from the Professional Footballers Association (PFA), a sportsperson union for current and ex-professional soccer players. Current and former players join for a seasonal fee of £150 and can benefit from programming surrounding continuing education, coaching/management training, well-being support and counseling, financial assistance, physical rehabilitation and medical grants, legal advice, and become part of the pension scheme (Professional Footballers Association, n.d.). While specific program details are not provided in the study nor the PFA
website, the study reported that former athlete members benefitted through advice and monetary grants (up to £5000) offered to current and former players for education and vocational training to be used after they retired. However, reviews were mixed, with one participant explaining that he still struggled with job searching and injury complications even after receiving assistance from the PFA (Curran, 2015). Participants also mentioned a charity organization known as X-Pro, which provides physical, psychological, financial, and legal services to ex-professional soccer players (Curran, 2015), however reviews of this program were not provided in the study and a brief Google® search indicates that it may no longer be in existence. While this available information points to the benefit of transition programs implemented by professional organizations, few studies exist reviewing transition program methods or examining effectiveness in the former professional athlete realm.

A study by Lavallee (2005) is one of the few that describes a transition program for professional athletes with replicable precision. In this study, the author implemented and evaluated a life development intervention to help with career adjustment put in place with former professional athletes. Retired male professional soccer players (N=71) were divided into intervention (45.1%, ages 29.0±3.92 years, retired between 2000-2003) and control groups (54.9% ages 28.2±4.3 years, retired between 2002-2003). All participants completed a survey pre- and post-intervention assessing the quality of adjustment to sports career termination, perceptions of transition (‘situation’), the qualities they bring to transition (‘personal’), aid they have from others (‘support’), and how they tend to cope with transitions (‘coping’). The intervention took place approximately three weeks after participants’ point of retirement and continued for four months; controls did not receive any form of intervention. The intervention consisted of life development package based on a psychoeducational model (Danish et al., 1995;
Danish et al., 1993). Participants underwent at least three one-on-one counseling sessions with the author (3.2±1.4 sessions), where assessment of life events occurred in the first two sessions, and identification of skills from sport, transference of these skills to post-sport life through goal setting, and development of new life skills through feedback, support, and follow up took place in subsequent sessions. Data analyses included paired-sample t-tests to examine pre-post differences between the groups, and post-intervention treatment group and within group differences were analyzed via ANOVAs. Paired-samples t-tests revealed that the two groups did not differ from each other in terms of career adjustment difficulty (p=.21), while significant differences were found between groups in terms of situation (p<.01), self (p<.001), support (p<.01), and coping (p<.001), and also within the group (situation p<.001, self p<.001, support p<.01, coping p<.001). The author concluded that life skills development programming, even one that is implemented across a short amount of time, can markedly improve former professional athletes’ adjustments to transition (Lavallee, 2005).

In a case study by Park et al. (2012), researchers explored the development of an established career transition program put in place for former professional athletes and focused on how personnel in this program address the psychological factors former athletes’ career transitions. The program in question was the Irish Institute of Sport’s (IIS) retirement program, which was developed based on noted limitations to the IIS’s lifestyle program for current athletes focusing on education, career development, and life-skills coaching. Participants were five men (ages 38±8 years) who had been part of the internal and external advisory board for the retirement program. Three participants were individuals who currently worked for the IIS, while the other two were former athletes. Participants completed a semi-structured interview exploring their role in program development, the IIS’s psychological approaches to aiding athletes’ career transitions, and how personnel in this program address the psychological factors former athletes’ career transitions.
transitions, and potential benefits of the program. The thematic analysis explains the program as it was planned to be implemented over time in retiring athletes via a (a) pre-retirement program, (b) immediate retirement program, and (c) post-retirement program. Within the pre-retirement phase, implemented in current athletes over the age of 25 years, personnel’s goal is to develop athletes’ overall life skills through long-term career planning, increase their competence in non-sport activities via education and employment support, and identify potential risks in post-sport adjustment. Implemented in near retiring and recently retired athletes, in the immediate retirement phase, the aim is to develop athletes’ overall readiness to retire through career exit support, group workshops with other retiring athletes, and counseling to deal with emotional and psychological responses to transition. In the post-sport program, also known as the ‘athlete rewards program,’ retired athletes undergo similar methods in the immediate retirement phase, with additional activities provided by the IIS, such as a retirement awards ceremony and a mentorship training program with long-retired athletes. The goal of this phase is to provide support to recent and long-retired athletes as they make their transitions and inspire them to give back to their sports programs. While outcomes on the effectiveness of this program are unavailable, the authors allude that utilizing platforms such as group counseling and combining populations of retired and retiring athletes can foster a sense of empathy and relatedness among individuals in both groups, which can recreate a feeling of community and ease the sense of loss commonly seen in sports retirement (Park et al., 2012). This also further encourages athletes to broaden their social circle to gain support and adapt to new lifestyles.

*Former College Athletes*
While also limited, transition programs for retiring college athletes seem to be described with more replicable precision. However, these programs are recent developments; the two mentioned were implemented within the last seven years. As such, understanding of the long-term effects of these programs is limited. Hansen et al. (2019) implemented and evaluated the introduction of a collegiate student-athlete workshop based on Schlossberg’s Model (1981), involving education on the transition out of sport, coping strategies, discussions on processing loss, and finding additional support resources. Implemented in the spring of 2016, participants of the pilot study (N=8, no demographics provided) were current DI athletes in their final year of college or who were no longer eligible to play NCAA sport. The 2-hour long workshop period was separated into four parts. Participants first underwent 20 minutes of psychoeducation to understand the prevalence of maladjustment to the transition out of sport, causes for adjustment difficulties, and warning signs of maladjustment. Over the next hour, they then focused on developing strategies for developing healthy adjustment patterns through CBTs and reflective exercises including goal setting and highlighting participants’ multifaceted identities. The third section of the workshop involved 30 minutes of group reflection to process their loss of sport. The last 10 minutes were devoted to providing participants with information on additional resources and support services from the university’s counselling center and a collaborative effort between its athletics and psychology departments to aid in their transition. Participants’ feedback indicated that all but one individual found the workshop helpful and that all enjoyed being able to share their individual experiences and thoughts on transition. However, participants also indicated they would have liked to see more student-athletes involved and suggested that the researchers expand to multiple sessions with younger athletes in their junior year of college so as to allow more time for pre-retirement preparation. The researchers agreed with these suggestions
and recognized that, as the pilot did not have the capability to measure whether the workshop was beneficial in participants’ transitions, more specific feedback evaluations should be included in future directions (Hansen et al., 2019).

In response to difficulties experienced by athletes of minority backgrounds related to academic neglect, athletic commodification, and social stigma (Beamon, 2012; Beamon & Bell, 2011; Beamon, 2008; Benson, 2000; Cooper & Hawkins, 2012; Melendez, 2008; Oseguera, 2010), transition programs specific to certain subpopulations of athletes are warranted. In a qualitative study by (Cooper et al., 2019), researchers examined the impact of a holistic development program designed for African-American former male DI athletes pre- and post-graduation experiences. The program in question, the Collective Uplift (CU) program, is a semesterly mentor program for African-American DI athletes based on the core tenets of holistic development, cultural empowerment, community outreach, and positive campus experiences. Faculty mentors and student athletes meet for 10 weeks throughout the semester and have the opportunity to meet out of the athletes’ sport seasons as well. Further details on the program’s methodology regarding these meetings were not provided in the paper and could not be gleaned from their main website link, which automatically redirected to an Instagram® page when clicked (Instagram, 2019). Participants in this study (N=7) were African-American former DI football players at a historically Caucasian university in the Northeastern U.S. who were formerly members of CU and graduates of the DI institution. Participants completed two individual interviews (one before graduation and one after) focused on exploring their reasons for taking part in the program, how participation in the program affected participants’ psychological well-being, and how the program impacted career readiness in participants’ post-college experiences. A content data analysis coding procedure revealed that participants’
benefitted from the social support and inclusive environment provided by the program, in that the program helped them reorient their life focus and identity away from sport and to other aspects of life in preparation for transition. Further, participants also made suggestions for improving the program, such as expanding its outreach, emphasizing mental health, and improving life skills exposure and knowledge acquisition.

**Limitations of Current Transition Programs**

While few programs seem to be put in place to aid athletes in their transition, this topic is gaining more traction in the research world, and what literature is available shows the overall and potential benefit these programs can have for athletes in transition. However, limitations do exist. Most notably, there does not seem to be any program implemented to aid in retiring high school athletes’ transitions out of sport. Researchers have suggested screening and intervention procedures including physical activity promotion be put in place during the college admissions process to identify and aid incoming freshman who may experience distress from sport discontinuation (Lubker & Etzel, 2007). However, to date no efforts have been made or at least published regarding this form of intervention. Further, research also shows that many athletes are usually unwilling or perceive to be unable to make transitional considerations prior to retirement (D'Angelo et al., 2017; Petitpas & Champagne, 2000) and only a small portion of athletes usually take advantage of available transition resources (Gorely et al., 2001). Additionally, although promoting the practice of physical activity is recommended to MPCs to aid in athletes’ transitions (Park et al., 2013b), most formal programs exclude this factor altogether, or at least do not incorporate it formally into their curriculum. To date, only two programs exist that emphasize physical activity promotion to transitioning athletes (Charter, 2017; Wilcoxson & Link, 2019; Reifsteck & Brooks, 2018; Smith et al., 2018), both of which are implemented in the
college population. As such, there is a need to further these efforts in other former athlete populations, as well as refine methods currently in use to increase promotion in former athlete populations. Particularly, a lack of athlete interest could be remedied by diversification in the curriculum of these programs to include education on health behaviors and personnel who oversee said programs. As the implementation of health-related RCTs and management of chronic diseases are improved with the use of multidisciplinary teams (Hogg et al., 2009), the diversification of personnel to a treatment team when developing interventions can be useful and is encouraged. In light of the increasing number of physical, psychological, and emotional issues that stem from transition manifesting in former athletes in recent years, recommended coping techniques within previously mentioned established models (Taylor & Ogilvie, 1994; Wylleman et al., 2004), such as education and maintenance of physical activity and exercise habits (Park et al., 2013b), warrant the inclusion of new approaches and other professionals capable of aiding in transition with these populations.

**Current Physical Activity-Based Approaches to Athlete Transition**

To date, only two programs exist that focus specifically on aiding athletes transitioning out of sport through physical activity promotion. The first is the Boiler Life After SporT (BLAST) program implemented at Purdue University (Charter, 2017; Wilcoxson & Link, 2019). Developed by personnel from Purdue’s athletics and academic services departments, BLAST seems to involve college athletes in their last and second-to-last years of eligibility and focuses on four areas of wellness to help them in their transition out of sport: nutrition and fitness, professional development, financial literacy, and health and wellness (Charter, 2017; Wilcoxson & Link, 2019). The program includes workshops focused on budgeting finances, job applications, understanding nutrition, and includes attending job fairs and an exercise class not
associated with the university. No studies have been conducted reporting how the program was developed or examining its effectiveness on athletes’ transitions, but anecdotal data from an alumnus of the program indicates that former athletes find it beneficial for their adjustment as they transition out of sport and college. Further, in 2017 the program graduated only eight retiring athletes, but as of the following school year had at least 25 junior and senior athletes involved, indicating its potential beneficial effect on transitioning athletes and necessity for Purdue athletics.

Based on the aforementioned studies by Reifsteck et al. (2013; 2016), researchers developed the Moving On! program at the University of North Carolina, Greensboro. While diminishing athlete identity is posited to be necessary in improving the overall transition experience (Lally, 2007), a more beneficial approach may be to teach athletes to transfer athletic identity to exercise identity and promote the maintenance of physical activity post-sport. This is one of the goals of the Moving On! program (Reifsteck & Brooks, 2018; Smith et al., 2018), which was created for transitioning college athletes based on the concepts of SDT and identity theory. In particular, the researchers recognize that athletes lose their sense of relatedness when they lose their team in retirement, their sense of competence when they can no longer train and compete in the sport they have mastered, and have underdeveloped autonomy due to always being told, versus being educated on how, to exercise for training (Smith et al., 2018). Implemented in student-athletes in their last year of eligibility, over the course of four sessions the researchers strive to recreate the team atmosphere through group exercise, introduce new activities for current college athletes to master, and educate athletes to exercise in their own program in an attempt to prevent unhealthy declines in physical activity after they retire. At present, longitudinal outcomes on participants’ physical activity maintenance are not yet
available. However, in a recent qualitative study, former athletes who took part in the program highlight its usefulness and necessity at their time of retirement, as well as improvements that could be made to the program’s implementation, such as extending the program to include more content, utilizing social media to recruit future participants, adding nutrition-based content, and offering incentives such as program t-shirts (Brooks et al., 2019). Again, while longitudinal data is not yet available, some of these suggestions, particularly use of social media and the addition of nutrition-based education has since been added to the present curriculum of this program (Moving On!, 2019).

**Limitations of Current Physical Activity-Based Transition Programs**

While the BLAST and Moving On! programs are important first steps in incorporating health and physical activity promotion to intervene on the transition of former college athletes, more research is necessary to further this field. At present both programs are limited to utilizing athletes while they are still on campus only and, in line with other traditional transition programs put in place with college athletes, lack longevity. Support toward athletes ends when they graduate. While resources may be more limited in this regard compared to professional organizations, recent research suggests mutually beneficial strategies that can be taken up by university athletics departments to support retired athletes long-term (Stokowski et al., 2019). Additionally, these programs take place on college campuses and utilize many of the amenities available to college students (e.g., safe and walkable campus, free gym membership). While the programs introduce basic cognitive-behavioral strategies (e.g., goal-setting) to help athletes maintain aspects of health, such as diet and physical activity, it may not adequately address barriers former athletes cite when facing the prospect of staying active after leaving campus.
(e.g., paying gym fees, lack of appropriate resources; Ferrara et al., 2021a). Other potential limitations of these programs relate to their development as interventions.

Previous development of behavioral interventions has relied heavily on randomized control trials (RCTs) by researchers, as RCTs are considered the gold standard for testing causal relationships (Collins et al., 2010; Oakley et al., 2006). However, in recent years, researchers have argued that traditional methods of testing behavioral interventions are limited, primarily due to “an overreliance on randomized trials, the slow pace and high cost of such trials, and the lack of attention to individual differences” (Dallery & Raiff, 2014, p. 290). Further, if an intervention is translated too quickly to target populations or tested in randomized controlled trials (RCTs) and does not achieve statistical significance (i.e., $p<.05$), promising behavioral treatments tend to be abandoned rather than refined (Czajkowski et al., 2015), further withholding potential treatment options from those in need. As a result, researchers are calling for more optimized strategies of behavioral intervention development (Craig et al., 2008; Czajkowski et al., 2015; Dallery & Raiff, 2014). Models such as the Medical Research Council guidelines for developing and evaluating complex interventions (Craig et al., 2008) and the ORBIT Model (Czajkowski et al., 2015) are examples of established strategies that guide researchers in rigorously testing aspects of health-related interventions early on in development before dissemination at the clinical and community level. In particular, a focus on pre-efficacy phases of intervention development, where small-scale studies are used to test and define intervention components based on preliminary measures of causation, is necessary to assure optimization of behavioral intervention components (Dallery & Raiff, 2014) prior to effectiveness trials and RCTs (Czajkowski et al., 2015), and is recommended for the development of exercise and physical activity-promotional programs (Ferrara et al., 2019;
Gorzynski, 2013). For this reason, while reviews of the BLAST and Moving On! programs have been positive, the optimization of the programs’ components is limited due to a lack of pre-efficacy testing on part of the researchers and long-term results regarding past participants’ physical activity behavior and health.

**Summary of the Development of Physical Activity Interventions for Former Athletes**

Difficult transition experiences by athletes have not gone unnoticed by researchers, and as such, past research has provided a variety of therapeutic suggestions to create interventions for retired athlete populations at the professional (Baillie, 1993; Grove et al., 1997; Park et al., 2013a) and college level (Stokowski et al., 2019). While further efforts are necessary to develop transition programs for transitioning athletes in general, the majority of existing programs do not include health or physical activity promotion in curriculum, despite that fact that physical activity promotion is recommended to improve transition quality (Helms & Moiseichik, 2018; Lubker & Etzel, 2007). To date, only two programs exist that emphasize the maintenance of former college athlete health and physical activity (Charter, 2017; Reifsteck & Brooks, 2018; Smith et al., 2018; Wilcoxson & Link, 2019). While these programs are important first steps in modeling intervention parameters for this population, more empirical evidence on how to promote physical activity effectively in former athletes is warranted to further the field.

Additionally, regardless of program type, former high school athletes continue to be neglected in their transition out of sport, despite their susceptibility to negative transition experiences. As such, more pointed research to aid in intervention development for this population, specifically, is also necessary.
The Critical Need for Pre-Efficacy Research in Behavioral Intervention Development

The ORBIT Model

The long-term goal of the present research line is to develop behavioral interventions to assist in athlete transition through physical activity promotion. To accomplish this, the overarching framework guiding the intervention development process is the ORBIT Model, a set of guidelines designed to streamline behavioral intervention development through various phases of pre-efficacy and efficacy testing focusing on clinical, rather than statistical, significance (Czajkowski et al., 2015). Based on the developmental stages utilized for pharmaceutical testing, the ORBIT Model allows researchers to systematically define, refine, and test intervention components in small-scale studies prior to effectiveness trials in RCTs. The forward-and-backward movement of the model allows for more efficient utilization and decreased waste of important resources (i.e., personnel, equipment, time), and produces a research-backed end product that is more readily equipped to achieve statistical significance when put in place in the general population. The presented study is part of Phase I of the ORBIT Model, the goals of which include defining and refining intervention components and behavioral risk factor targets, elucidating the target population, and developing a hypothesized pathway by which a behavioral treatment may solve a clinical problem (Czajkowski et al., 2015). As such, this study focused on a prospective cohort of former high school athletes transitioning out of sport and into college and defining aspects of their exercise behavior and related factors (i.e., identity, fitness) so as to influence future directions of intervention development.

Utilizing a Prospective Cohort

The present study utilized a convenience sample comprised of former high school athletes entering college to (a) more accurately define behavioral changes to their exercise, and
(b) validate the methods of this study to be used for future directions of intervention development for other athletic populations. This population was chosen for several reasons, the first being the notable gaps in literature regarding this population’s physical activity behavior as they transition out of sport. While former high school athletes for the most part are a younger population, those who discontinue organized sports when they begin college may experience similar transitional effects to older, more well-studied athlete populations (Helms & Moiseichik, 2018; Lubker & Etzel, 2007; Lyons et al., 2018), as well as detrimental decreases to their physical activity levels. Researchers are suggesting physical activity intervention in this population (Helms & Moiseichik, 2018; Lubker & Etzel, 2007) to aid in their transition to college and prevent later health problems. Given the lack of definitive reporting regarding former high school athletes’ physical activity behavior, before such interventions can be conceptualized, more details regarding how and why behavior change occurs in this population is warranted. Further, in addition to providing adequate information to inform behavior change interventions for former high school athletes, utilizing this group as a prospective cohort may provide data useful for intervention development in other athlete populations. According to the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) Statement, “prospective” in this prospective cohort study was defined in terms of the timing of the data collection (Von Elm et al., 2014). By utilizing this more logistically feasible convenience sample to study perceived fitness, exercise behavior, identity changes, and experiences with exercise, preliminary proof-of-concept data was collected, which can be verified, refined, and serve as a reference in later studies completed with other transitioning athlete populations.
Understanding Exercise Behavior

While much of the research available explores and promotes physical activity behavior in former athletes at various levels of play, a focus to exercise-specific behavior may be warranted. While physical activity is any movement completed by the body that requires energy from the skeletal muscles (Caspersen et al., 1985), exercise is a subset of physical activity that is planned, structured movement conducted with the goal of maintaining or improving one or more components of physical fitness (Caspersen et al., 1985). When in sport, athletes improve performance through training—chronic exercise involving repeated, acute bouts, the completion of which results in physiological adaptations (Scheuer & Tipton, 1977). However, the success of how well former athletes maintain exercise behavior over other physical activities is currently unknown. Researchers interested in former athletes’ physical activity often interchange the terminology, sometimes utilizing exercise-specific measurements and referring to the results as indicative of physical activity behavior (Reifsteck et al., 2013; Reifsteck et al., 2016). Additionally, within these studies self-reported physical activity/exercise is reported via questionnaires, which has been criticized as being insufficient in obtaining accurate measurements due to participants’ inability to remember specifics of their behavior (i.e., time spent in habitual, incidental, or intermittent behavior; Sallis & Saelens, 2000). In other cases, researchers imply exploring physical activity behavior and inadvertently encapsulate, but do not disentangle, exercise-related behavior in their findings (Helms & Moiseichik, 2018). Regardless of method, these studies rarely report their findings according to the FITT-VP Principle that would indicate whether participants are achieving levels of activity that would elicit health benefits. As such, it is difficult to distinguish exercise behavior from general physical activity behavior in former athletes or whether former athletes maintain healthy levels of exercise,
specifically, after they retire. By focusing on measurements of exercise, as opposed to broad physical activity, more indicative trends in the behavior of former athletes may be shown and better define future directions of intervention development.

**Understanding How Exercise and Its Associated Factors Change.** Fluctuations to an individual’s physical, mental, and emotional state that occur day to day, week to week, and month to month have been shown to affect the performance of chronic health behavior (e.g., exercise) over time (Dunton, 2017). Similarly, relying on cross-sectional measurements of chronic health behavior performance and outcomes does not adequately assess behavior change and limits researchers understanding of natural behavioral fluctuations. In contrast, traditional health behavior models and theories usually pertain to isolated behaviors that occur rarely (e.g., annual doctor appointments, vaccinations) and do not adapt well to chronic behaviors that occur throughout a lifetime, such as practicing healthy levels of exercise (Rhodes & Dickau, 2012). As such, multiple, in-depth behavioral measurements that are proximal to one another may provide a more realistic understanding of how chronic health behaviors are performed by an individual in their day-to-day lives, and how behavior and associated factors fluctuate and affect one another over time (Dunton, 2017).

To date, all measures of exercise/physical activity and associated factors (e.g., identity, fitness) in athletes, current or former, are cross-sectional, with repeated measures interspersed by months to years. As such, it is not entirely clear how exercise behavior changes over the course of transition for retired athletes. To develop behavioral interventions for transitioning athletes, it is necessary to have a deeper understanding of how their exercise behavior and fitness change over time, as well as how certain contextual factors that affect their behavior also fluctuate to determine how best to intervene. In particular, current measurements of athletic and exercise
identity relate only to general physical activity and have been cross-sectional, thus causation to exercise is not clearly established. Because psychological factors are known to fluctuate over time (Shiffman et al., 2008) and posited to relate to physical activity behavior, understanding how identity changes in transition may be key in understanding how and why exercise behavior changes. By defining the temporal relationship between transitional changes to athlete-specific psychological factors and resulting exercise behavior, hypothesis-driven research to guide future intervention development for this population may be developed.

**Understanding Why Exercise and Its Associated Factors Change.** While there are several theories as to why physical activity and exercise behavior may decline or be maintained after athletes retire from sport, little concrete evidence exists defining what exactly causes behavioral changes. In former college athletes, various reasons are cited that contribute to prolonged inactivity following sports retirement, including but not limited to a lack of available resources (e.g., money, facilities), a lack of community to keep them accountable, and negative associations with certain types of activity stemming from experiences in sport (Ferrara et al., 2021a). With this said, more information is necessary to adequately understand why former high school athletes’ exercise changes over time post-sport to adequately understand how to intervene on this population. For this purpose, qualitative methods are an asset. Qualitative research seeks to understand phenomena through the interpretation of “human perception and understanding” (Stake, 2010, p. 11). By allowing individuals to explain their perceptions and experiences, researchers gain novel insight into their lived experience. In the case of the proposed study, qualitative methods are useful in allowing individuals who are proximal to their retirement and in the midst of transition to elaborate on why observed changes to exercise and its associated factors occur, and to understand their perceptions of what could improve or maintain their
behavior. Such findings would then influence the direction of intervention development and help refine intervention parameters in the future.

**Summary on the Need for Pre-Efficacy Research in Behavioral Intervention Development**

Due to the little research conducted examining physical activity intervention development in former high school athletes, it is important for certain parameters of this population’s behavior be better defined for a program to be conceptualized. Particularly, considering the lack of definition regarding physical activity behavior in former athletes in general, and the cross-sectional nature of much of the research in this field, examining more specific measurements of exercise, specifically, and how and why it and its associated factors (e.g., identity, fitness) change over time will provide more holistic picture of behavior than what has been shown in the past. Further, in line with the ORBIT Model (Czajkowski et al., 2015), by utilizing this more easily accessible population, future directions of intervention development can be more easily defined for this and other athlete populations. Therefore, the purpose of this study is to document and explain temporal changes in exercise behavior, fitness, and athletic identity in former high school athletes who are not participating in organized sport during their freshman year of college.
CHAPTER III: METHODOLOGY

Research Questions

The purpose of this mixed methods study was to document and explain temporal changes in perceived fitness, self-reported exercise behavior, and identity in former high school athletes who are not participating in organized sport during their freshman year of college. Per the mixed methods design (Creswell, 2014), three research questions were posed to further develop our understanding of former high school athletes’ experiences with exercise during the transition out of organized sport and into college. The first aim focused on quantitative methods, the second on qualitative methods, and the third on combined methods:

Question 1: How do former high school athletes’ perceptions of fitness, self-reported exercise behavior, and identity change over the course of their freshman year when not participating in organized sport at the college level? (Quantitative)

Question 2: What are participants’ experiences with exercise over their freshman year? (Qualitative)

Question 3: Based on participants’ experiences, why do observed changes to the measured factors occur in this population over the course of their freshman year? (Mixed Methods)

Methodology

Mixed Methods

The proposed study utilized a mixed methods design—a form of research that employs pragmatism by combining the use of quantitative and qualitative methods to offset weaknesses and increase strengths of both methodologies (Creswell, 2014; Johnson & Onwuegbuzie, 2004; Johnson et al., 2007). Based on the previously mentioned gaps in the literature, mixed methods, where quantitative and qualitative methods are utilized in conjunction with each other, was
warranted for exploring how and why perceptions of fitness, exercise behavior, and identity change over time in former high school athletes. While quantitative and qualitative methods are often thought to contradict, the strengths of both methods can offset the weaknesses in the other when combined and used properly (Creswell, 2014). For example, quantitative research can draw conclusions from large populations and can give reason to probable causes and effects between variables, however it is criticized as being “impersonal and dry” and gives a limited understanding to context. Depth can be added to quantitative results with the use of qualitative methods, which provide an understanding to individuals’ lived experiences (Creswell, 2014). In contrast, while qualitative methods provide detailed perspectives from individuals, it has limited generalizability and is criticized for being highly subjective. However, when supplemented with quantitative methods, qualitative results can potentially be validated and extrapolated to a larger population (Creswell, 2014).

Due to the handling of multiple forms of data (i.e., strands), mixed methods research can be challenging to conduct properly (Creswell, 2014). However, when successful, this form of research can provide a holistic picture of what data is revealing to researchers (Creswell, 2014; Johnson & Onwuegbuzie, 2004; Johnson et al., 2007). The use of both quantitative and qualitative methods is encouraged as a way of refining intervention parameters early on in development (Czajkowski et al., 2015). Because research in the topic of exercise behavior in transitioning athletes is still relatively unknown, and the concept of creating a behavioral intervention for this population is still in its infancy, mixed methods was a viable approach to gaining a holistic picture and understand former athletes’ behavior change.
Explanatory Sequential Design

The mixed methods design utilized for this study was an explanatory sequential design (Figure 1), where the quantitative data was given priority and collected first, and the qualitative data was collected afterward with a subsample of the study’s population and used to enhance the quantitative findings (Creswell, 2014). This design was chosen because, at present, the understanding of exercise and fitness in former athlete populations has been garnered from one-time, self-report data aggregated at the group level (Reifsteck et al., 2013; Reifsteck et al., 2016; Simon & Docherty, 2017), leaving gaps in the literature regarding inter- and intraindividual changes to these variables over time in transition. As such, longitudinal, quantitative measurements of exercise behavior and perceived fitness can be used to address these gaps, and thus represents the priority of this study. Additionally, as key modulators to the transition experience (Lally, 2007; Park et al., 2013b) and potentially to exercise behavior (Reifsteck et al., 2013), taking multiple measurements of athletic and exercise identity over time could also provide insight into why exercise behavior changes occurred. However, while the quantitative methods have the advantage of collecting and analyzing data efficiently, it provides a limited understanding of important contextual, psychological, perceptual, and behavioral factors that influence decision-making processes and interpretations of outcomes (Creswell, 2014). As such, the use of qualitative methods to explore former athletes experiences with exercise and perceptions of why these factors change over time will be useful in supplementing the quantitative results and filling gaps in the literature; while many qualitative studies have researched various aspects of athlete retirement (Lavallee & Robinson, 2007; Park et al., 2013b; Raabe et al., 2017; Torregrosa et al., 2015), none have explored athletes experiences regarding exercise in transition. By idiographically analyzing changes to quantitatively measured variables
(i.e., exercise behavior, perceived fitness, athletic and exercise identity) and utilizing these changes to inform qualitative questions used to explore participants’ experiences with exercise during the study, the methods could specify how and why observed changes occurred. This provides a more direct understanding of behavioral changes in transition and helps to better define future directions of intervention development.

**Study Overview**

The study length for each participant was 22 weeks, with a subsample of participants who took part in the qualitative methods having an additional 2-week commitment, bringing their overall participation in the study to 24 weeks. Per the explanatory sequential design, the quantitative portion of the study occurred first over the 22-week timespan. Quantitative measures included electronic surveys sent to participants’ email accounts, which measured self-reported perceived fitness, exercise behavior, and athletic and exercise identity over time. During their week 1 meeting, which took place over Zoom (San Jose, CA) or by phone, participants were screened for eligibility, electronically signed the informed consent form, and received their first survey via email. Surveys were delivered electronically every three weeks over the 22-week timespan, culminating in eight surveys for each individual to complete while enrolled. Participants were allowed to miss up to three surveys before being dismissed from the study. Additionally, participants were further compensated with $50 Amazon gift cards if they completed at least seven surveys. Those who agreed to take part in the qualitative portion of the procedures during their screening session met with the primary investigator (PI) within one week of their last survey being completed (week 23) to participate in a semi-structured interview. Participants were presented with their survey data collected in the first 22 weeks and asked to detail their perceptions of the results, experiences with exercise over the course of the study, and to explain
why observed changes occurred. Once interviews were completed and participants approved their individual transcriptions following their interview (week 24), transcripts were thematically analyzed.

Population

Recruitment

Upon receiving approval from the Institutional Review Board (IRB), recruitment took place over six weeks between August and September of 2020 at a southeastern university in the U.S. as students were beginning their fall semester of the school year. Recruitment methods included emails sent through the university Kinesiology department freshman listserv, petitioning in level 100 classes containing freshman only or a freshman majority, and snowball sampling (Appendix I). During the recruitment period, 149 professors teaching various First Year Studies (FYS 101) and Honors First Year Seminar (UNH 101) classes containing between 15 and 50 students were emailed to ask permission for the PI to visit and recruit in their classes. Of these, 30 agreed to allow the PI to visit their class, either via Zoom or in person, and pass on the recruitment flyers to their students, with another 15 professors agreeing to pass on the study flyers only in place of an in-class visit.

Inclusion criteria for this study included individuals who:

1. Graduated high school and were entering their freshman year of college in the same calendar year (i.e., had not taken a gap year between high school and college)
2. Played high school sports all four years and devoted at least 20 hours per week to sport (complications due to COVID-19 were not counted as exclusionary)
3. Were not playing at the college varsity or club level in their freshman year of college
Figure 1. Data collection, analysis, and integration per the explanatory sequential design. Uppercase denotes prioritized data strand; lowercase denotes secondary data strand.
4. Were physically able to complete regular exercise and physical activity (i.e., not disabled due to injury or disease or currently undergoing rehabilitation for an injury)

5. Were at least 18 years of age

6. Owned at least one device with video and internet capabilities that could access email

Anyone who had taken a gap year between finishing high school and starting college, had played a high school sports less than four years, or were physically limited by disease, disability, or injury were excluded from the study. If individuals stated they were planning to or currently taking part in intramural sports, this did not count as exclusionary criterion. Further, if participants’ senior seasons had been cancelled or cut short due to the COVID-19 pandemic, this was also not counted as an exclusionary criterion.

Interested individuals contacted the PI using her email information provided in recruitment material. These individuals then underwent the screening process with the PI over Zoom or by phone to determine eligibility for the study (Appendix II). Including information pertaining to the above inclusion criteria, additional information gathered during the screening session included basic contact and demographic information (e.g., sex, age) and relevant information regarding individuals’ sports background (e.g., type of sport played in high school, how long they played, reasons for retiring). Eligible individuals were then emailed an online link containing the informed consent form in the form of an electronic survey (Appendix III). The researcher read the informed consent form verbatim to the participant as they followed along in the online link, answered any questions they had, and prompted them to electronically sign the form at the end of the online survey. Further, if individuals were interested, they checked a box at the end of the informed consent indicating their willingness to take part in the qualitative interview after the survey period. Whether they checked this box or not did not influence their
enrollment in the survey procedures or eligibility of the compensatory gift card. Screening procedures lasted approximately one hour for each individual. After this, participants were sent their first survey via email. After the recruitment period, a total of 41 individuals were enrolled in the study.

**Data Collection Procedures**

All procedures involving interaction with the participants on behalf of the PI took place over Zoom or by phone to maintain social distancing parameters during the COVID-19 pandemic.

**Survey Formatting and Instrumentation**

Participants were asked to complete eight electronic surveys that were emailed to them over the course of the study. These surveys were disseminated via QuestionPro (Austin, TX) and designed to assess immediate post-sport exercise behavior following retirement from high school sport (survey 1 only), and changes to perceived fitness, self-reported exercise behavior, athletic identity, and exercise identity (surveys 1-8; Appendix IV). Survey links were engineered to be clicked only once so participants could not complete the survey twice and change their answers. Additionally, survey questions could not be skipped by participants; they had to provide an answer to each question before being allowed to move forward. Participants received surveys every three weeks and had 72 hours upon reception of each email to complete the survey before the link expired to allow adequate time for their responses. If it was shown in the QuestionPro portal that a participant had not completed their survey within the first 48 hours, a second email was sent as a reminder for participants to complete the survey before the link expired. If participants failed to fill out a survey, they were emailed and instructed to complete future surveys. They were also reminded in this email that to remain in the study, at least five surveys
had to be completed, and that to receive the compensatory $50 Amazon gift card, they needed to complete at least seven surveys. Individuals who did not complete at least five of the surveys were excluded from the study and their data was removed from the final analysis. Results from these surveys were then used to supplement the interview that took place after week 22.

**Gauging Immediate Post-Sport Exercise Behavior (Survey 1 Only)**

At the beginning of the first survey of the study, participants were presented with a series of open-ended questions and asked to indicate:

1. How many months had passed since their last competition in high school
2. If they had participated in an organized sports club or group following retirement from high school sport
3. How often they exercised per week and what they did for exercise in the timeframe between retirement and starting their freshman year of college
4. How they intended to exercise over the coming school year

These questions were only asked during the first survey to provide a baseline for researchers’ understanding of participants’ exercise behavior. Information regarding their plans to maintain exercise during their freshman year was also used in the later qualitative interview. The questions that followed were identical across the rest of the surveys in the study.

**Perceived Fitness Changes and Satisfaction (Surveys 1-8)**

Survey 1 continued with the same items that the rest of the surveys began with: a series of questions assessing participants’ perceived changes in aspects of fitness. Ideally, actual changes in fitness would have been measured via in-person testing, however due to the COVID-19 pandemic, this was deemed too risky as social distancing would have been difficult to maintain. As such, survey items were used to assess participants’ perceived changes in fitness so
as to subjectively understand changes across physical fitness components and overall satisfaction.

**Bodyweight.** As a way of assessing anthropometric changes over time, the survey questions began by asking participants to report their height in inches and weight in pounds. Further, to gain a better understanding as to what areas of the body were changing to affect individuals’ weight within the restrictions of the COVID-19 pandemic, participants then indicated via a multiple-choice question whether their weight had increased, decreased, or stayed the same since their last survey, then explained in detail why any observed changes had occurred via an open-ended question. Example responses were provided to show what a detailed response entailed (i.e., “I have lost 5 lbs because I have been biking regularly”; “I have gained 10 lbs because I have been weightlifting and my muscles have grown”).

**Fitness Change Perceptions and Satisfaction.** Using adapted methods from Flanagan and Perry, 2018 and Gestsdottir et al., 2016, a series of Likert scale questions and an open-ended response were utilized to assess participants’ perceived changes to, and satisfaction with, their fitness. Prior to each Likert scale statement, definitions from the ACSM for each of the following aspects of fitness were provided for participants: muscular strength, muscular endurance, agility, aerobic fitness, and flexibility. Based on their personal perceptions, participants were then instructed to rate their perception of how good each of these aspects of fitness was on a 5-point Likert scale ranging from 1 (poor) to 5 (excellent). After completing their ratings, they were then asked to think about their overall fitness and rate their satisfaction with it on a similar Likert scale (1=not at all satisfied; 5=completely satisfied), and to explain their answer in detail via an open-ended response.
**Self-Reported Exercise Behavior**

The next set of questions gauged participants’ exercise behavior and were premised with a definition of what exercise is (i.e., “structured, musculoskeletal movement that requires energy and is performed with the goal of improving some aspect of fitness”) and examples of what exercise was not, (e.g., lawn mowing, walking to class) to ensure participants provided appropriate responses. This section included questions gauging the general amounts of time in the preceding seven days they had spent completing light, moderate, and strenuous activity using the Godin Leisure-Time Exercise Questionnaire. Further, to offset weaknesses of this questionnaire, additional questions asking participants’ to indicate the specific exercises they had completed in the previous seven days and how much time they had devoted to those specific exercises were presented. Finally, participants indicated any barriers they faced in completing exercise and explained their overall satisfaction with their exercise behavior.

**Godin Leisure-Time Exercise Questionnaire.** The Godin Leisure-Time Exercise Questionnaire measures exercise levels based on self-reported frequency of light, moderate, and strenuous activity completed in at least 15-minute bouts per week (Shephard, 1997). The questionnaire then approximates the metabolic equivalent (MET) values of these bouts via the following equations:

- \( \text{# strenuous bouts/week} \times 3 = \text{METs completed from mild activity} \)
- \( \text{# moderate bouts/week} \times 5 = \text{METs completed from moderate activity} \)
- \( \text{# mild bouts/week} \times 14 = \text{METs completed from strenuous activity} \)

These MET values at each intensity are then added together to calculate a leisure-time activity score, categorizing individuals as sedentary (<14), moderately active (14-23), or active (>23).
Time Spent in Specific Exercise Modes. Because the Godin Leisure-Time Exercise Questionnaire does not gauge specifically the type or time spent in activity, participants were then asked to report this information about the specific types of activities they engaged in generally for exercise. Individuals were presented with a list of 13 common exercise modes (e.g., running, cycling, weightlifting), as well as an “other” option with space to indicate unlisted activities, and asked to select all of the activities they had taken part in in the last seven days. For each exercise mode that was chosen, individuals were then asked to indicate how many times they had completed the activity and for how long (minutes) they had engaged in each bout of activity.

Perceived Exercise Barriers and Satisfaction with Exercise Behavior. Participants were then asked to report the degree to which different barriers commonly reported barriers against being regularly active affected their behavior using an established questionnaire (Allison, 1999). This questionnaire lists 16 commonly reported barriers to being regularly active (i.e., time devoted to schoolwork, cost, lack of energy) and asks participant's to rate each factor’s importance on a Likert scale from 1 (not at all) to 5 (a great deal). Further, a final question asking participants to think about their overall exercise behavior and rate their overall satisfaction with it using a similar Likert scale (1=not at all satisfied; 5=completely satisfied) was presented, after which they were asked to explain their answer in an open-ended response.

Changes to Athletic and Exercise Identity

The last set of questions involved two sets of Likert scale statements that gauged participants’ identities in terms of athletics and exercise.

Athletic Identity Measurement Scale (AIMS). The AIMS has been shown to be a valid, reliable, and consistent method of measuring athletic identity in former athletes (Brewer et al.,
For this study, the abridged 7-item AIMS scale (Brewer & Cornelius, 2001) was used over the 10-item original version (Brewer et al., 1993), as it has been shown to be valid, with a better expressed factor structure that more appropriately estimates athletic identity (Li & Andersen, 2008; Proios, 2012; Visek et al., 2008). This version of the AIMS consists of seven presented statements meant to gauge respondents’ perceptions of sport in their lives (e.g., “I consider myself an athlete”, “I have many goals related to sport”). Participants rate each statement on a 7-point Likert scale (1=strongly disagree, 7=strongly agree) and their numeric responses are then summed, with a higher score indicating more salient athletic identity within the person.

**Exercise Identity Scale (EIS).** The EIS has been shown to be a valid and reliable method of measuring exercise identity in individuals (Anderson & Cychosz, 1994; Cardinal & Cardinal, 1997). The EIS is a 9-item scale which present statements that gauge respondents’ perceptions of exercise in their lives (i.e., “I consider myself an exerciser”, “I need to exercise to feel good about myself”). Participants then rate their agreement with each statement on a 7-point Likert scale (1=strongly disagree, 7=strongly agree) and their numeric responses are summed, with a higher score indicating more salient exercise identity within a person.

**Data Integration I - Building**

Data integration refers to how the qualitative and quantitative results are brought together in a mixed methods study, the method(s) of which are related to the type of mixed methods design used (Creswell, 2014). This study utilized two points of data integration, the first of which occurred between the quantitative data analysis and the qualitative data collection (Figure 1). This first level of integration involved utilizing results from the quantitative data collection to build, or influence, questions in the interview guide. Perceived fitness, self-reported exercise...
behavior, and identity changes from survey responses were graphed and then profiles based on these results were created for each participant who took part in the optional interview to show how measured variables fluctuated over time. Generation of profiles occurred within a week of each participants’ final surveys and were presented and explained to them to aid in the exploration of their experiences with exercise over the survey period.

**Individual Interviews**

Because the quantitative results were used to influence the qualitative methods, the qualitative portion operated under a constructivist paradigm. The constructivist approach focuses on what is unique to an individual and how multiple realities “derived from community consensus [determines] what is real” (Denzin & Lincoln, 2011, p. 116); specifically, what is useful and has meaning (Lather, 2012; Lather & Smithies, 1997). Based on constructivism, the purposes of the qualitative methods were to (a) explore participants’ experiences with exercise, and (b) use their experiences and perceptions to construct the reality that influenced resultant changes to their exercise behavior over time in transition. Ultimately, within the mixed methodology of this study, this allows the prioritized data strand (quantitative) to be augmented by the secondary strand (qualitative; Creswell, 2014). Further, based on the exploratory nature of this study, basing its qualitative methods in a theoretical framework would have been premature.

**Developing the Interview Guide**

The semi-structured interview guide (Appendix V) was developed and refined through a series of pilot interviews. The two-part interview guide contained open-ended questions. Part one focused on building rapport with participants, allowing them to acclimate to the interview environment, and immersing them in their experiences from the survey period so as to prepare them to answer questions in part two. Based on data collected in week 1 surveys, participants
were asked to describe how well they had fulfilled their original plans for staying active in their freshman year and what they would have done differently in hindsight to improve their exercise behavior.

The second part of the interview focused on exploring participants’ perceptions of their results and was split into four sub-sections examining changes that occurred to (a) perceptions of fitness, (b) exercise behavior, (c) identity, and (d) how the COVID-19 pandemic affected these variables. Within sub-sections of the interview, the PI presented participants’ survey results as a profile of graphs depicting changes to variables over time via Zoom’s screenshare capability. Participants were asked to elaborate on their thoughts regarding the results, expand on why observed changes occurred, and explain whether anything could have improved their results and how they may have been different without the influence of COVID-19. Utilizing probes, follow up questions, and reiterating participants’ open-ended responses from surveys, the PI gained more in-depth information on participants’ experiences with exercise maintenance from over the study. Finally, at the end of the interview, participants were asked if they had any additional thoughts to add that may have been missed in the interview.

**Pilot interviews.** The interview guide was finalized prior to beginning the qualitative data collection through multiple pilot interviews conducted with individuals of similar backgrounds to the target population. Based on preliminary patterns in data observed in the (at the time) ongoing quantitative data collection, as well as brief conversations with the individuals who completed the pilot interviews, the PI created a mock profile of data that was used in the pilot interviews to make the interview process as realistic as possible. The PI practiced the interview protocol with three different individuals, from which minor changes were made to the protocol regarding the wording of questions and explanation of profiles. Further, pilot interviews
were video-recorded and reviewed by the PI following their completion to test Zoom’s transcription function, and to allow the PI to engage in reflexivity of her conduct in interviews so as to prevent the use of leading questions in actual data collections. In doing so, she identified that she held assumptions in how participants’ exercise behavior and related factors would change over the course of the study, much of which she believed would be driven by school-related time commitments and difficulties related to maintaining self-discipline toward healthy behaviors in participants’ transition to college.

**Recruitment for Interviews**

Following the completion of their final survey, those who agreed to take part in the interview at the end of the screening procedures from the beginning of the study were asked if they were still interested in participating and scheduled accordingly; even if participants had indicated their interest at the beginning of the study, they were free to withdraw from the interview without penalty. Additionally, those who had originally declined to be in the interview were emailed thanking them for their participation and had the opportunity re-presented to them in case they reconsidered. Those who declined to be interviewed or did not respond to these emails were excluded from the qualitative data collection, while those who agreed were scheduled for a Zoom interview with the PI within 1 week of their final survey’s completion. Per the IRB-approved protocol, the PI read a second informed consent form (Appendix VI) specific to the interview protocol to participants prior to beginning the interview. After having any questions they had answered, participants provided verbal consent and gave permission to have the PI sign for them on a physical copy of the form. Additionally, at the end of the consent process, participants were asked to give a pseudonym (or allowed the PI to assign one for them) by which their interview was identified, so as to protect their information and retain
confidentiality. All interviews lasted approximately one hour, were audio and video-recorded using Zoom, and transcribed via Zoom’s transcription function. Interviews continued until saturation was reached (i.e., when no new information is gleaned from interviews; Fusch & Ness, 2015).

**Quantitative and Qualitative Data Cleaning**

Following the completion of all surveys by participants, responses were consolidated by survey and cleaned in SPSS. The cleaning process involved (a) excluding participants from the dataset who had not completed at least five surveys, (b) converting text responses to numerical entries (e.g., replacing “four” with “4”), (c) averaging numerical ranges (e.g., replacing “2-4” with “3”), and (d) filtering out non-exercise responses from closed- (e.g., completing 40–60-minute bouts of running in the last 7 days) and open-ended responses (e.g., “digging a grave (this is not sarcasm)”). Further, by the end of the survey period, six of the original 41 individuals enrolled were excluded from the study for not completing at least five surveys, and at least six others had missing data at various points throughout their surveys after data cleaning and due to software malfunctions with QuestionPro.

For data collected in interviews, because transcripts were generated automatically by software and not by a human being, they were prone to typographical errors and mistakes throughout. As such, transcripts were reviewed by the PI and corrected based on audio and visually recorded data, then sent to participants for member-checking to ensure that their experiences were adequately captured (Merriam & Tisdell, 2015) and to remove information participants wished to keep confidential (Smith & McGannon, 2018). Participants were asked to review their transcripts and relay any edits back to the PI within one week of reception before the thematic analysis occurred.
Data Analysis

Quantitative Analyses

Statistical Analysis

Following data cleaning, descriptive statistics were conducted on participants’ demographics and sports history. To quantitatively assess change over time, separate, uncorrected hierarchical mixed models analyses with an autoregressive covariance structure were utilized to assess bodyweight, perceived changes to aspects of fitness, intensities of exercise, minutes of aerobic exercise completed in the last seven days, total bouts of muscle strengthening exercise completed in the last seven days, and identity scores from the AIMS and EIS. The mixed models analysis was chosen to understand overall trends in measured variables because it would allow the modeling of variability between timepoints despite missing data across the surveys. A within factor of survey group (i.e., survey number) was utilized and significance was set at $P < .05$. All analyses were conducted using Statistical Package for the Social Sciences (SPSS; IBM Corporation, Armonk, NY) across the quantitatively measured aspects of perceived fitness, self-reported exercise behavior, and identity.

Idiographic Analysis

In addition to the statistical analysis, the quantitative data underwent idiographic analyses to explore the variability in participants’ survey responses over time. The idiographic method of analysis was warranted to establish if preliminary patterns of change within individuals could be discerned and expanded upon in future studies with larger populations. Idiographic analysis has been shown to be a successful method in establishing personal behavioral profiles for individuals through patterning of intraindividual behavior change and stability (Shoda et al., 1994) and is recommended for tracking interindividual idiosyncrasies across participants in psychological
research, rather than “averaging them out” and diluting data for the sake of establishing
generality (Nesselroade et al., 2007). Because this study was exploratory, the idiographic
analysis process was decided upon as data was collected, graphed, and visually analyzed. First,
for each variable, all participants’ data was graphed over time with group means and standard
deviations or medians and interquartile ranges overlayed, depending on normality. Through the
initial visual analysis, it was observed that individuals could not neatly be categorized as
presenting with increasing, decreasing, or stable data for most variables. Rather, within-person
data for most variables demonstrated instability of varying degrees (i.e., increases and decreases
over time). To quantitatively document the overall degree of temporal consistency or
inconsistency across participants, intraclass correlation coefficients (ICCs) were calculated for
each examined variable. For the present study, consistency based on ICCs were classified based
on the criteria by Koo and Li (2016) for each factor, such that an ICC <.50 equated to poor
consistency, .50-.74 equated to fair consistency, .75-.90 equated to good consistency, and .90 or
higher was classified as excellent consistency.

**Qualitative Analysis**

Following the approval of interview transcriptions from participants, the qualitative
analysis proceeded according to the thematic analysis method dictated by Braun and Clark
(2006). The PI who conducted the interviews also conducted the analysis by familiarizing herself
with participants’ responses through thorough read-throughs of each participant’s transcription,
generating initial codes describing participants’ responses from key words and phrases, and
categorizing codes into common themes (Braun & Clarke, 2006). From here the final phases of
thematization involved refining and defining these themes to represent participants’ experiences
(Braun & Clarke, 2006). For this process, transcriptions were sent to another member of the
research team (CW) who also read them thoroughly to familiarize herself with participants’ responses. The second analyzer, CW, was an undergraduate research assistant majoring in Kinesiology and a former Division II athlete (track/cross country) trained by the PI in the methods of thematic analysis. She was chosen for her comprehension of the qualitative methods used in this study, and for her first-hand familiarity with sports transition. Both the PI and secondary analyzer independently categorized participants’ responses into the constructed themes and reconvened to determine interobserver agreement (IOA) by calculating the proportion of measures agreed upon between the two. Initial IOA should reach at least 80% (Horner et al., 2005). If agreement was found to be less than 80%, the PI and secondary analyzer would have met to determine within which themes the majority of discrepancies occurred and if they could resolve the disagreement. If necessary, data would have been recategorized to reflect the analysis team’s understanding of participants’ data, after which the team members would have reconvened to determine the new IOA. In actuality, an initial IOA of 83.0% was found. As such, additional discussions were held to come to 100% agreement, during which minimal adjustments to themes were made for clarity. The use of a tie-breaker (i.e., the PI’s major professor) was deemed unnecessary for this process.

Data Integration II – Explaining

The data analysis then proceeded with the second level of integration, which involved utilizing themes constructed in the qualitative portion of the study to explain the quantitative results (Figure 1; Creswell, 2014). Results from the qualitative analysis were relayed back to participants’ profiles and graphs depicting the overall sample populations’ data to ascertain if certain themes related to particular changes in perceived fitness, exercise behavior, or identity. By finding commonalities across participants’ data, a more in-depth understanding to the
transition experience could be gained regarding how exercise behavior is affected by transition, and vice versa. For example, by utilizing this technique of integration we could define more acutely if certain contextual factors influence mental and behavioral changes during transition in former athletes, how they affect certain trajectories of behavior, and what factors may be affected by transition more than others. From these results, how these changes in behavior are indicative of transition quality and parameters on how to intervene on this population may be determined, such as when to intervene, determining who is more susceptible to exercise/fitness declines, and differences between subpopulations (e.g., gender, sport type, season of retirement).

**Position Statement**

As a former high school athlete who did not compete at the college varsity level and who experienced a difficult transition after discontinuing sport after both high school and the college club level, I feel a certain amount of empathy toward the sample population. I predicted maintaining impartiality in my relationships with participants and/or controlling my own bias would be challenging, particularly during the individual interviews. I also predicted that, because of my past experiences with maintaining exercise in college and training as a Clinical Exercise Physiologist, it would be difficult to avoid “counseling” participants, rather than allowing them to convey their own thoughts, feelings, and perceptions. In order to control these biases, several methods to improve trustworthiness were put into place.

**Validity, Reliability, and Trustworthiness**

In order to ensure the validity and reliability of data collected in this study, several safeguards were put in place. For the quantitative data, the survey utilized validated instruments to measure aspects of exercise behavior and identity. Additionally, in order to retain the quality and assure the completeness of data collected over time, participants were held to a standard of
needing to complete at least five of the surveys for their data to move on to analysis, with periodic emails sent reminding participants to fill out the surveys.

To promote trustworthiness of the qualitative data, safeguards were put in place to aid the PI in controlling her biases. The semi-structured interview went through several phases of pilot interviews before being finalized. To supplement the lack of actual data for these procedures, mock quantitative data was created based on preliminary patterns in observed survey data and pilot interviewees actual experiences with exercise maintenance. The pilot interviews were completed with individuals of similar but exclusionary backgrounds to the sample population (i.e., two former college athletes within a year of their retirement, one former high school athlete at a different institution). This aided in refining interview questions to be appropriately applicable to participants and allowed the PI to practice her conduct in interviews before the actual data collections. Additionally, pilot interviews were audio and video-recorded in a similar manner to the actual interviews and were reviewed to assure that all aspects of the interview were fulfilled and conducted properly. This also allowed the PI to engage in reflexivity of her conduct in interviews so as to avoid implementing leading questions with participants and to ascertain any assumptions and biases she held. Further, after interviews were complete, entire transcripts were thoroughly reviewed and corrected based on the audio and video recordings of the interviews and coded by hand to ensure a deep understanding of the participants’ data. Finally, member-checking to assure transcriptions were accurate to what participants conveyed in interviews added another layer of reliability, as did the inclusion of a second analyzer from outside the data collection process, who was utilized to further corroborate qualitative themes.
Risks to Participants and Associated Protections

Ethical considerations were a priority of the study. Prior to all data collections, participants were briefed on all procedures and associated risks, with the informed consent read to them word-for-word. Participants either signed off electronically to consent to be in the study and/or provided verbal consent and allowed the PI to sign for them on a hard copy form. Several modes of data collection were utilized in this study, including hard (i.e., paper) copies of participants’ data, electronic responses to surveys, and recorded audio and visual data. To protect participants’ confidentiality, hard copied data associated with the qualitative data collections (e.g., PI’s notes) were stored in a locked filing cabinet in the PI’s office that only she had access to. These records will be kept on file for three years before being destroyed. Participants were also assigned an identification number at their baseline meeting, which was associated with their quantitatively collected data to retain anonymity. Participants who also took part in the interview at the end of the study were assigned a second identification number and pseudonym to ensure their quantitative data could not be connected with their quantitative results by outside parties. Only the PI had access to the key connecting participants’ identification numbers and actual names, which was stored on her personally owned, password protected computer.

Electronic Surveys

Minimal risk was expected with the electronic surveys. Electronic data from surveys was kept confidential within the online survey portal, and once exported to outside analysis software (e.g., Microsoft Excel, SPSS), was kept on a password protected computer belonging to the PI and backed up on an external hard drive that was locked in her private residence to assure no other individuals would be able to access it.
Individual Interviews

Interviews took place via Zoom, with the PI in either her private residence or office space on campus. Both areas were private with minimal risk of being interrupted and contained adequate power sources for her computer and recording devices that were used to facilitate the interview. A second informed consent orienting the participant to the purpose of the interview and the risks associated was signed at the beginning of the session. The greatest risk associated with these interviews was the possibility of a breach in confidentiality. To mitigate this risk, participants were given the option to pick a pseudonym to go by in cases when their information was referred to in data analyses and future presentations or publications, or had one assigned to them by the PI. Individual interviews were conducted and recorded using Zoom on the PI’s password protected computer. Further, the transcription application Temi® (San Francisco, CA) was also utilized on the PI’s personal cell phone as a back-up recorder in case Zoom failed during the interview; the application’s generated transcripts and audio recordings were not utilized in data processing. Audio and video-recorded data, as well as automatically generated text transcriptions of interviews, were stored within the PI’s password protected Zoom account that only she had access to. Within this account, the PI reviewed interview recordings to correct transcripts before saving them as Word® (Microsoft; Redmond, WA) documents to her password protected computer. Only the PI had access to participants’ interview recordings and transcriptions during this process. Once qualitative analyses were complete, recordings were securely deleted from the Zoom account.

To retain accuracy of data, participants were asked to member check their transcription one week after the PI had finished reviewing and correcting them. A deidentified transcription using participants’ interview identification numbers, so as not to connect their real name with
their chosen pseudonym or identification number used for the survey data collection, was emailed to them via a secure email courier (UT Vault). We intended to only collect information from participants that was considered necessary for achieving the aims of this study. As such, the risk of broaching sensitive topics in the interview was minimal. However, if at any point a participant felt uncomfortable with any topics covered, they were informed they could opt out of the interview at any time and any collected data would be destroyed to retain their privacy.

**Summary**

The aim of this chapter was to outline and explain the proposed procedures for this study. Justification for the mixed methods design, a description of the study’s participants, and procedures for recruitment, data collection, and analysis explain the specifics for the study’s conduction. Temporal changes in perceived fitness, exercise behavior, athletic and exercise identity were measured via electronic surveys to create individualized participant profiles. Following the quantitative methods, a constructivist approach was utilized in the qualitative interviews to build upon the quantitative results and explore participants’ experiences with exercise over the study period, as well as provide an in-depth understanding as to why observed changes to measured variables occurred in the sample population. According to the mixed methods approach, after this process was complete themes found across the participants’ responses were then cross-referenced with idiographs of the sample populations’ data to explain observed changes in the quantitative data.
CHAPTER IV: RESULTS

Per this study’s mixed methods design, Chapter IV will overview the quantitative and qualitative results separately. The second integration, where the results are interpreted together, will occur in the discussion section of this dissertation, Chapter V.

Participant Demographics

During recruitment, 52 freshmen students contacted the PI inquiring about the study, 41 of which underwent the screening process. All 41 were found eligible to participate and initially enrolled. Of these, 85% (n=35, 28 women, 7 men) met study completion requirements (i.e., returned at least five finished surveys within the identified timeframe). From this sample, 91% (n=32) of participants completed all eight surveys while the remaining 9% (n=3) completed seven surveys. Participants had collectively competed in 17 different sports in high school, 77% (n=27) of which played at least two sports, and 97% (n=34) competed at the varsity level (3±1 years). Further, 43% (n=15) indicated their final sport seasons were cut short due to the COVID-19 pandemic, with the remaining 57% (n=20) finishing their senior seasons under normal circumstances (e.g., championship games, graduation). Table 1 shows additional characteristics.

Of the 35 participants who completed the study, 86% (n=31) consented to taking part in the follow up interview. Following the completion of their final survey, 14 individuals (10 women, 4 men) completed the interview before saturation was reached. Of these, 86% (n=12) completed all eight surveys. Those who completed the interview reported playing 14 different sports in high school, 64% (n=9) played at least two sports, and 93% (n=13) competed at the varsity level (3±1 years). Additionally, 35% (n=5) of participants indicated their final seasons of sport were cut short due to the COVID-19 pandemic, with the remaining 65% (n=9) finishing their senior season under normal circumstances. Further characteristics are shown in Table 2.
Table 1. Demographics of all participants.

<table>
<thead>
<tr>
<th></th>
<th>Men (n=7)</th>
<th>Women (n=28)</th>
<th>Total (N=35)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Mean ± SD)</td>
<td>(Mean ± SD)</td>
<td>(Mean ± SD)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>18 ± 1</td>
<td>18 ± 0</td>
<td>18 ± 0</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>4 (57.1)</td>
<td>21 (75.0)</td>
<td>25 (71.4)</td>
</tr>
<tr>
<td>African-American</td>
<td>1 (14.2)</td>
<td>3 (10.8)</td>
<td>4 (11.4)</td>
</tr>
<tr>
<td>Asian</td>
<td>--</td>
<td>2 (7.1)</td>
<td>2 (5.8)</td>
</tr>
<tr>
<td>Multi-Racial</td>
<td>2 (28.7)</td>
<td>2 (7.1)</td>
<td>4 (11.4)</td>
</tr>
<tr>
<td>Sports</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Badminton</td>
<td>--</td>
<td>1 (3.5)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Baseball</td>
<td>3 (42.9)</td>
<td>--</td>
<td>3 (8.6)</td>
</tr>
<tr>
<td>Basketball</td>
<td>1 (14.2)</td>
<td>9 (32.1)</td>
<td>10 (28.6)</td>
</tr>
<tr>
<td>Cheerleading</td>
<td>--</td>
<td>5 (17.9)</td>
<td>5 (14.3)</td>
</tr>
<tr>
<td>Cross Country</td>
<td>4 (57.1)</td>
<td>4 (14.3)</td>
<td>8 (22.9)</td>
</tr>
<tr>
<td>Dance</td>
<td>--</td>
<td>2 (7.1)</td>
<td>2 (5.8)</td>
</tr>
<tr>
<td>Field Hockey</td>
<td>--</td>
<td>1 (3.5)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Football</td>
<td>2 (28.7)</td>
<td>--</td>
<td>2 (5.8)</td>
</tr>
<tr>
<td>Gymnastics</td>
<td>--</td>
<td>1 (3.5)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>--</td>
<td>4 (14.3)</td>
<td>4 (11.4)</td>
</tr>
<tr>
<td>Soccer</td>
<td>2 (28.7)</td>
<td>5 (17.9)</td>
<td>7 (20.0)</td>
</tr>
<tr>
<td>Softball</td>
<td>--</td>
<td>7 (28.0)</td>
<td>7 (20.0)</td>
</tr>
<tr>
<td>Swimming</td>
<td>1 (14.2)</td>
<td>4 (14.3)</td>
<td>5 (14.3)</td>
</tr>
<tr>
<td>Tennis</td>
<td>--</td>
<td>4 (14.3)</td>
<td>4 (11.4)</td>
</tr>
<tr>
<td>Track &amp; Field</td>
<td>4 (57.1)</td>
<td>6 (21.4)</td>
<td>10 (28.6)</td>
</tr>
<tr>
<td>Volleyball</td>
<td>--</td>
<td>5 (17.9)</td>
<td>5 (14.3)</td>
</tr>
<tr>
<td>Wrestling</td>
<td>1 (14.2)</td>
<td>--</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Number of Sports Played in High School</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>1 (14.2)</td>
<td>7 (25.0)</td>
<td>8 (22.9)</td>
</tr>
<tr>
<td>Two</td>
<td>3 (42.9)</td>
<td>13 (46.5)</td>
<td>15 (42.9)</td>
</tr>
<tr>
<td>Three</td>
<td>1 (14.2)</td>
<td>7 (25.0)</td>
<td>9 (25.6)</td>
</tr>
<tr>
<td>Four</td>
<td>2 (28.7)</td>
<td>1 (3.5)</td>
<td>3 (8.6)</td>
</tr>
<tr>
<td>Played at the High School Varsity Level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>--</td>
<td>1 (3.6)</td>
<td>1 (2.9)</td>
</tr>
<tr>
<td>Yes</td>
<td>7 (100.0)</td>
<td>27 (96.4)</td>
<td>34 (97.1)</td>
</tr>
<tr>
<td>Years Playing Varsity (Mean ± SD)</td>
<td>3 ± 1</td>
<td>4 ± 1</td>
<td>3 ± 1</td>
</tr>
<tr>
<td>Time Since Retirement from High School Sport</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Months (M±SD)</td>
<td>7 ±2</td>
<td>7 ± 2</td>
<td>7 ± 2</td>
</tr>
<tr>
<td>Played Organized Sport Post-High School*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6 (85.7)</td>
<td>25 (89.3)</td>
<td>31 (88.6)</td>
</tr>
<tr>
<td>Yes</td>
<td>1 (14.3)</td>
<td>3 (10.7)</td>
<td>4 (11.4)</td>
</tr>
</tbody>
</table>

*Played sport through a recreational league or club after high school but ceased play before entering college.
Table 2. Demographics of interview participants.

<table>
<thead>
<tr>
<th></th>
<th>Men (n=4)</th>
<th>Women (n=10)</th>
<th>Total (N=14)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Mean ± SD)</td>
<td>(Mean ± SD)</td>
<td>(Mean ± SD)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td>19 ± 1</td>
<td>18 ± 0</td>
<td>18 ± 0</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>3 (75.0)</td>
<td>9 (90.0)</td>
<td>12 (85.8)</td>
</tr>
<tr>
<td>African-American</td>
<td>--</td>
<td>1 (10.0)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Multi-Racial</td>
<td>1 (25.0)</td>
<td>--</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td><strong>Sports</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseball</td>
<td>2 (50.0)</td>
<td>--</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Basketball</td>
<td>1 (25.0)</td>
<td>2 (20.0)</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>Cheerleading</td>
<td>--</td>
<td>2 (20.0)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Cross Country</td>
<td>1 (25.0)</td>
<td>--</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Dance</td>
<td>--</td>
<td>2 (20.0)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Football</td>
<td>2 (50.0)</td>
<td>--</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Lacrosse</td>
<td>--</td>
<td>2 (20.0)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Soccer</td>
<td>1 (25.0)</td>
<td>2 (20.0)</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>Softball</td>
<td>--</td>
<td>1 (10.0)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Swimming</td>
<td>--</td>
<td>1 (10.0)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Tennis</td>
<td>--</td>
<td>2 (20.0)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td>Track &amp; Field</td>
<td>1 (25.0)</td>
<td>2 (20.0)</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>Volleyball</td>
<td>--</td>
<td>3 (30.0)</td>
<td>3 (21.4)</td>
</tr>
<tr>
<td>Wrestling</td>
<td>1 (25.0)</td>
<td>--</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td><strong>Number of Sports Played in High School</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>1 (25.0)</td>
<td>4 (40.0)</td>
<td>5 (35.7)</td>
</tr>
<tr>
<td>Two</td>
<td>2 (50.0)</td>
<td>4 (40.0)</td>
<td>6 (42.9)</td>
</tr>
<tr>
<td>Three</td>
<td>--</td>
<td>1 (10.0)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Four</td>
<td>1 (25.0)</td>
<td>1 (10.0)</td>
<td>2 (14.3)</td>
</tr>
<tr>
<td><strong>Played at the High School Varsity Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>--</td>
<td>1 (10.0)</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Yes</td>
<td>4 (100.0)</td>
<td>9 (90.0)</td>
<td>13 (92.9)</td>
</tr>
<tr>
<td><strong>Time Since Retirement from High School</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Months (M±SD)</td>
<td>7 ± 2</td>
<td>7 ± 2</td>
<td>7 ± 2</td>
</tr>
<tr>
<td><strong>Played Organized Sport Post-High School</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3 (75.0)</td>
<td>7 (70.0)</td>
<td>10 (71.4)</td>
</tr>
<tr>
<td>Yes</td>
<td>1 (25.0)</td>
<td>3 (30.0)</td>
<td>4 (28.6)</td>
</tr>
</tbody>
</table>

*Played sport through a recreational league or club after high school but ceased play before entering college.
Survey Results

Overview

For context, Table 3 shows the date ranges from when the first to last participant completed each survey over the duration of the study. Quantitative results are presented using nomothetic and idiographic approaches. Group-level change over time is presented using multilevel modeling statistics and figure panels demonstrating measures of central tendency (Figures 2-9 and 11-12). Each of these figures also demonstrates idiographic changes over time, with individual results separated by a median split based on within-person standard deviations of each metric for ease of visualization.

Perceived Fitness

Bodyweight

Figure 2 depicts changes over time for self-reported bodyweight in pounds. No significant changes to bodyweight were found over time ($F(1,7)=.529, p=.812$). The idiographic analysis revealed that, while interindividual differences were observed across participants’ graphed data (Figure 2B-C), the majority of participants did not seem to vary much in their self-reported weight over the course of the study.

Global Fitness

Figure 3 depicts aggregated changes over time across the combined scores of muscular strength, muscular endurance, agility, aerobic fitness, and flexibility, termed ‘global fitness’. Based on group averages, participants consistently rated their fitness as “good”, maintaining a score around “3” in their responses. No significant differences were found in participants’ ratings over time ($F(1,7)=1.434, p=.193$), however between and within-person variability was observed (Figure 3B-C).
Table 3. Ranges of survey completion dates from the first to last participant.

<table>
<thead>
<tr>
<th>Survey</th>
<th>Date Ranges (2020-2021)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey 1</td>
<td>August 28-October 1</td>
</tr>
<tr>
<td>Survey 2</td>
<td>September 20-October 22</td>
</tr>
<tr>
<td>Survey 3</td>
<td>October 10-November 13</td>
</tr>
<tr>
<td>Survey 4</td>
<td>November 1-December 4</td>
</tr>
<tr>
<td>Survey 5</td>
<td>November 22-January 8</td>
</tr>
<tr>
<td>Survey 6</td>
<td>December 11-January 15</td>
</tr>
<tr>
<td>Survey 7</td>
<td>January 1-February 5</td>
</tr>
<tr>
<td>Survey 8</td>
<td>January 22-February 26</td>
</tr>
</tbody>
</table>
Figure 2. Changes in self-reported bodyweight over time (A), with median split from low (B) to high (C) standard deviation.
Figure 3. Changes in global fitness (i.e., aggregation of perceived muscular strength, muscular endurance, agility, aerobic fitness, and flexibility) over time (A), with median split from low (B) to high (C) standard deviation.
Exercise Behavior

**Godin Leisure-Time Exercise Scores and Exercise Intensities**

Figure 4 depicts results from the Godin Leisure-Time Exercise Questionnaire regarding overall activity scores. Based on average scores of the questionnaire, this sample was considered ‘active’ (score >24 units) across all eight surveys, with participants’ average scores ranging between 37.1-53.3 units over the course of the study. No significant changes were found regarding bouts per week of strenuous ($F(1,7)=1.596, p=.139$), moderate ($F(1,7)=0.511, p=.825$), or light intensity ($F(1,7)=0.444, p=.873$) exercise (Figures 5-7, respectively). Further, between- and within-person variability was observed idiographically for both activity scores and intensities of exercise.

**Aerobic Exercise**

Figure 8 depicts changes over time for self-reported aerobic exercise (minutes per week). Over the course of the study, 62.9% of participants reported completing at least one bout of aerobic exercise for all eight surveys with 8.6% reporting not completing aerobic exercise for at least half of the surveys. Median values of aerobic exercise (Figure 8A) remained between 100-170 (IQR 135-232.5) minutes/week over the course of the study. A statistically significant increase in behavior was observed over time ($F(1,7)=3.209, p<.01$). Upon further analyses to determine the location of this effect, it was determined that results from the original model were driven by an extreme increase in aerobic exercise in the small number of male participants between surveys 1 and 2 (data not shown). As this study was not powered to detect sub-group effects, the statistical significance should be interpreted with caution, especially considering the substantial inter- and intraindividual variability observed in participants’ data over time (Figure 8B-C).
**Muscle Strengthening Exercise**

Figure 9 depicts changes over time for self-reported muscular strengthening exercise (bouts per week). Overall, 48.6% of participants reported completing muscle strengthening exercise for all eight surveys, with at least 20.1% of participants reporting no muscle strengthening exercise for at least half of the survey period; one individual reported no muscle strengthening exercise for the entire study. Median values of muscle strengthening exercise (Figure 9A) remained between 2-5 (IQR 4-7) bouts/week. No significant changes in behavior occurred over time ($F(1,7)=1.406, p=.205$). Substantial inter- and intraindividual variability was observed (Figure 9B-C).

**Barriers to Exercise**

Participants’ average scores regarding their perceived importance of various barriers toward their exercise behavior over time are depicted in Figure 10, with listed barriers from the survey grouped by factors relating to time, self-discipline, health, social support, and “other” for ease of visualization (Figure 10A-E). Based on group averages, participants’ most prominent barrier to exercise was ‘time devoted to schoolwork’ (Figure 10A), which maintained the highest scores compared to the other listed barriers across for 50% of the surveys, and was the only barrier to be rated between 4 and 5 on the scale (i.e., very to extremely important). In contrast, a ‘lack of family support’ and a ‘lack of friend support’ were rated by the group as the least important barriers to exercise (Figure 10D), maintaining scores between 1-2, respectively, on the scale (i.e., not at all to slightly important) for all eight surveys.
Figure 4. Changes in participants’ activity scores over time according to the Godin Leisure-Time Exercise Questionnaire (A), with median split from low (B) to high (C) standard deviation.
Figure 5. Changes in strenuous intensity exercise over time (A), with median split from low (B) to high (C) standard deviation.
Figure 6. Changes in moderate intensity exercise over time (A), with median split from low (B) to high (C) standard deviation.
Figure 7. Changes in light intensity exercise over time (A), with median split from low (B) to high (C) standard deviation.
Figure 8. Changes in aerobic exercise over time (A), with median split from low (B) to high (C) standard deviation. Asterisk (*) indicates significant change over time ($p<.01$).
Figure 9. Changes in muscle strengthening exercise over time (A), with median split from low (B) to high (C) standard deviation.
Figure 10. Changes over time to participants’ perceived barriers to exercise regarding time (A), self-discipline (B), health (C), social support (D), and other external factors (E).
Identity

Athlete Identity

Changes to athlete identity are shown in Figure 11. Average athlete identity scores (Figure 11A) remained between a range of 27.0-30.6 on the AIMS over the course of the study. The AIMS does not provide classifications for salience of athlete identity, however this range of scores remains centered on the median of the scale (overall scale range: 7-49, median: 28), indicating the population could be classified as exhibiting “moderate” salience of athlete identity over the course of the study. No significant differences were found in scores over time \( (F(1,7)=1.690, p=.113) \). Further, variability was noted in the idiographic analysis, both between and within individuals (Figure 11B-C).

Exercise Identity

Changes to exercise identity are shown in Figure 12. Average exercise identity scores (Figure 12A) remained between 44.1-48.0 on the EIS over the course of the survey period. The EIS also does not provide a classification system regarding the salience of exercise identity. This range of scores remains just below the 75th percentile of the scale (overall scale range: 9-63, median: 36, 75th percentile: 49.5), thus participants could be said to have exhibited “moderately strong” salience of exercise identity over the course of the study. No significant differences were found in EIS scores over time \( (F(1,7)=0.621, p=.738) \). Additionally, while interindividual variability was noted between participants, intraindividual variability was less so, indicating participants scores did not vary much over time (Figure 12B-C).
Figure 11. Changes in athlete identity over time (A), with median split from low (B) to high (C) standard deviation.
Figure 12. Changes in exercise identity over time (A), with median split from low (B) to high (C) standard deviation.
Measures of Within-Person Consistency

Departing from group means, which indicated relatively stable trends in data across the course of the study, idiographic analyses revealed that individual data patterns were more variable and fluctuated over time. As such, ICCs were calculated for each variable to quantify the degree of consistency within the sample as a whole. Table 4 shows ICC values for each variable assessed in the surveys. Overall, only three variables—bodyweight, athlete identity, and exercise identity—exhibited “good” to “excellent” within-person consistency over time. In contrast, global fitness, self-reported vigorous, moderate, and light intensity exercise, as well as self-reported aerobic and muscle strengthening exercise exhibited “poor” to “fair” consistency, indicating higher degrees of within-person variability. Additionally, while the individual tendencies for strength of perceived barriers to exercise of participants was not shown graphically, the ICCs similarly suggest within-person, temporal fluctuation for some barriers. For example, ‘time devoted to schoolwork’ was the highest rated barrier over time and also exhibited the lowest within-person consistency compared to other barriers. In comparison, the barrier exhibiting the highest level of within-person consistency was participants’ perception of exercise being ‘not fun’ (“good” consistency), with average scores rated between 2-3 across the survey period. Lower ICCs suggest that, while the nomothetic statistical results did not show significant change over time to participants’ measured factors, intraindividual changes were still present and could be indicative of meaningful behavioral tendencies in participants. These findings warrant further exploration to understand why participants’ observed fluctuations occurred, further justifying the use of qualitative and mixed methods in this research.
Table 4. Examination of within-person consistency based on intraclass correlation coefficients (ICCs) from surveys 1-8; factors appear in the order they were presented in on the surveys.

<table>
<thead>
<tr>
<th>Measured Factors</th>
<th>ICC</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived Fitness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bodyweight</td>
<td>.987</td>
<td>.968-.989</td>
</tr>
<tr>
<td>Global Fitness</td>
<td>.682</td>
<td>.554-.805</td>
</tr>
<tr>
<td><strong>Exercise Behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Godin Activity Score</td>
<td>.496</td>
<td>.363-.646</td>
</tr>
<tr>
<td>Godin Strenuous Bouts per Week</td>
<td>.496</td>
<td>.349-.665</td>
</tr>
<tr>
<td>Godin Moderate Bouts per Week</td>
<td>.381</td>
<td>.241-.562</td>
</tr>
<tr>
<td>Godin Light Bouts per Week</td>
<td>.592</td>
<td>.438-.754</td>
</tr>
<tr>
<td>Aerobic Exercise</td>
<td>.418</td>
<td>.283-.584</td>
</tr>
<tr>
<td>Muscle Strengthening Exercise</td>
<td>.409</td>
<td>.274-.576</td>
</tr>
<tr>
<td><strong>Perceived Importance of Exercise Barriers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>.544</td>
<td>.400-.701</td>
</tr>
<tr>
<td>Discomfort</td>
<td>.654</td>
<td>.521-.785</td>
</tr>
<tr>
<td>Illness</td>
<td>.477</td>
<td>.332-.645</td>
</tr>
<tr>
<td>Injury</td>
<td>.628</td>
<td>.492-.767</td>
</tr>
<tr>
<td>Lack of Energy</td>
<td>.512</td>
<td>.368-.675</td>
</tr>
<tr>
<td>Lack of Family Support</td>
<td>.434</td>
<td>.291-.607</td>
</tr>
<tr>
<td>Lack of Friend Support</td>
<td>.349</td>
<td>.214-.528</td>
</tr>
<tr>
<td>Lack of Self-Discipline</td>
<td>.581</td>
<td>.440-.731</td>
</tr>
<tr>
<td>Mood</td>
<td>.574</td>
<td>.432-.726</td>
</tr>
<tr>
<td>Not Fun</td>
<td>.745</td>
<td>.631-.848</td>
</tr>
<tr>
<td>Self-Conscious</td>
<td>.459</td>
<td>.316-.630</td>
</tr>
<tr>
<td>Stress</td>
<td>.449</td>
<td>.306-.621</td>
</tr>
<tr>
<td>Time – Family Activities</td>
<td>.271</td>
<td>.148-.447</td>
</tr>
<tr>
<td>Time – Part-Time Work</td>
<td>.559</td>
<td>.416-.714</td>
</tr>
<tr>
<td>Time – Schoolwork</td>
<td>.268</td>
<td>.146-.444</td>
</tr>
<tr>
<td>Time – Other Interests</td>
<td>.485</td>
<td>.341-.652</td>
</tr>
<tr>
<td><strong>Identity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Athlete Identity</td>
<td>.788</td>
<td>.686-.877</td>
</tr>
<tr>
<td>Exercise Identity</td>
<td>.898</td>
<td>.840-944</td>
</tr>
</tbody>
</table>
Interview Results

After completion of the thematic analysis, five themes were constructed (Table 5). The first two themes relate to participants’ experiences as they transitioned to college in relation to exercise: (a) adapting to transition and (b) from “athlete” to “athletic exerciser.” The last three themes discuss factors that both helped and hindered participants’ exercise over the course of the study: (a) motivational determinants to exercise, (b) person-specific precondition, and (c) environment. Direct quotes from participants’ interviews are utilized in the descriptions of each subtheme, with underlining used to denote participants’ emphasis. All quotes have been deidentified using participants’ chosen pseudonyms.

**Theme 1: Adapting to Transition**

Participants discussed their adaptation experiences that related to the transition to college, which also affected their exercise behavior. This theme contained two subthemes: (a) out of sport, into college, and (b) developing self-discipline.

**Subtheme 1: Out of Sport, Into College**

Participants mentioned difficulties they faced making the transition to college while also dealing with the challenge of learning how to exercise outside of organized sport. Many experienced the "culture shock" of college resulting from having so much freedom and a less strict class schedule. This affected both daily life and exercise behavior, as shown by James:

not only fixing like my workout routine…the first semester, I had an awful daily routine. I didn't really have a good sleep schedule, I would wake up super late in the day, get my schoolwork done, and then, by that time I would not have really anything else to do, it would be super late, go back to sleep, and do the same thing.

Alicia described her struggles with finding a new role and how this impacted her adjustment to college and learning how to exercise on her own:
overall the transition…from high school to college that really just takes a toll…finding an
identity in college because, I've always been known like as an athlete but now I don't
really have that label because I'm not…that's a really big change and that affects a lot of
it, especially with my exercise behavior.

Others explained distractions of friends and extracurriculars would sometimes keep them from
responsibilities related to school as well as exercise: “once I started meeting people, they would
ask me to go to lunch…go eat dinner…go somewhere at night…anything pertaining to like a
social activity…that kind of started to get…more in the way as the semester went on” (Sarah).
Additionally, unexpected realizations relating to a loss of gains and detraining after retiring from
organized sport was a secondary shock participants experienced, as expressed by Nicole:

the first day I went to the gym I got on…the stair steps…I went with my boyfriend and
we're like, "okay we'll do 10 minutes," and I was like two minutes in and I was like, "can
we do four minutes?"…I really realized that [my fitness] was not nearly as great as I
thought it was.

As a result, participants’ exercise fluctuated as they grappled with setting too high of
expectations for themselves regarding the intensity of their workouts and alternatively lowering
the bar and settling for easier or more convenient workouts. This is exemplified by Amelia:

I had really high hopes of what I wanted to do at the beginning of the semester…then the
stress of like college hit and I realized that it was a little bit harder to uphold a lot of that.
I did go to the gym quite a bit, and then…at one point sort of just opted instead…to just
walking, whether that be around campus or downtown because…it was easier for me to
just, at the spur of a moment, leave my dorm than to walk all the way across campus, get
on a machine, do something like that.

Overall, how well participants adjusted to college affected various aspects of life, including their
exercise behavior.
Subtheme 2: Developing Self-Discipline

As a result of transitional challenges they faced, participants discussed that they had to learn new forms of self-discipline to pay adequate attention to all factors of college life (e.g., schoolwork, social life), including exercise. In particular, participants explained how difficult it was to get back into a habit of exercising regularly upon realizing how much their fitness and exercise had declined since retiring. Andrea discussed how she wished she had formed and maintained an exercise routine earlier on:

[getting] into a habit a lot sooner…once you get out of a habit…[and] not work out for a certain amount of time, it's really hard to get back into the swing of things…what's that like Newton's Law? It's like, once in motion you're always in motion…that kind of thing… it's easier to just, stay on top of it once you've been doing it for a while.

Rodney explained needing to learn how to hold himself accountable, set his own goals, and self-motivate in the absence of a team and coaches to guide him:

with basketball, I was always working towards something…if I had a goal to reach that someone else would help push me towards it would have been easier…it just took me a while of doing a lot less to make goals for myself and push myself on my own.

While participants explained their struggles in developing self-discipline to exercise outside of mandatory sports training, they also discussed a number of strategies they used in creating their consistent routine, including various ways they learned how to manage their time, create a consistent routine, and overcome barriers to fit exercise into their schedules. Such methods included setting alarms and reminders on smartphones, bringing workout clothes to class, and planning ahead and scheduling exercise around classes and the on-campus gym’s modified COVID-19 schedule. Nicole exhibited one of the more creative ways in making sure she did not skip early morning workouts:
I cannot sleep with lights on and...without a box fan...I have my light on a timer and I have my box fan on a smart plug so that whatever time I need to wake up my fan goes off and my lights come on, and just doing that has helped me so much to just be able to get out of bed, and to not keep laying there and be like, "oh it's fine."

**Theme 2 – From “Athlete” to “Athletic Exerciser”**

Participants explained the perception shifts that occurred with no longer participating in organized sport and learning to focus on exercise for maintaining fitness. This theme was comprised of four subthemes: (a) identity contemplation, (b) incorporating old and new in exercise behavior, (c) utilizing athleticism to guide/assess exercise behavior, and (d) “positive feedback loop.”

**Subtheme 1: Identity Contemplation**

At some point during their freshman year, participants made the realization that they were no longer "athletes" in the traditional sense—they were no longer on a team or training for competition, and likely would never be part of an organized sports team again. As such, participants stated that they no longer identified with being an athlete nearly as strongly as they had while still playing high school sport, with many describing the process of consciously disengaging with athletic aspirations as they made this realization, as explained by Elizabeth:

last semester I was looking to join the rowing team...they put...height requirements

...And I was like, "well I'm not even close," so [I] didn't try out...all last semester, I was like, "...I'm just going [to] holdout till next year...I will be an athlete,"...this semester...I ended up just deciding, "...as much as I want to compete again, I'll just do intramurals and don't need to be a part of the university, like competitive team."...that realization definitely hit...like, "I'm just not really an athlete anymore" (laughs)
At the same time, participants started to recognize their exercise ability away from sport: “just being able to go to the gym [I] was like, "oh yeah I can exercise, like I am good at doing this" (Alicia). Participants still felt they could identify as athletes through participation in intramural sports, but also through personal perceptions of athleticism enhanced through their practice of exercise. Further, despite not feeling as fit or exercising as much as they once were when they were still participating in sports, participants were adamant in identifying as exercisers and were confident that because exercise had and always would be a part of their lives, they would eventually achieve goals related to exercise and fitness. These concepts are exemplified by Rodney:

I feel like I am athletic but, not an athlete anymore, since I don't really identify with playing anything like I did in high school and middle school…but exercise has always been part of my life. I want it to always be a part of my life…even in those times when I wasn't exercising at the level that I wanted to, I still considered myself an exerciser…I didn't want to…take that out of who I thought I was just because I wasn't in a good routine…I knew I would get back into it eventually…I hope it stays that way forever.

Overall, as their point of retirement drifted further into the past, participants’ identifications of being “athletes” seemed to decrease. Meanwhile, their athletic backgrounds aided in increasing or maintaining their perceptions of being “exercisers,” even if they were not exercising regularly at the time.

**Subtheme 2: Incorporating Old and New in Exercise Behavior**

Participants discussed their various experiences in developing exercise routines over their freshman year and how their athletic backgrounds influenced their activity choices. Many desired to stay active in sport to a degree and retain their athlete identity and attempted to do so through intramurals: “doing intramurals and like being able to play volleyball just like really
I think, because I was able to continue like what I did in high school, obviously” (Alicia). Others retained passion for their sport by taking part in recreational activities that related back to training: “once a week I would go to a dance practice thing…I was taking these Zoom dance classes…[which] made me rekindle that passion…I was working more on the technical aspect of dance instead of just working out to feel good” (Andrea). However, participants also varied their exercise routines through new experiences. Some took exercise classes to expand the types of exercises they felt comfortable completing: “this semester, I was in a weightlifting class…that's definitely made me more comfortable with like using the bar at the gym” (Elizabeth). Others explored new places to exercise and tried working out with people to avoid boredom and stay engaged, as shown by Sarah:

I went to the track about twice…I ended up actually finding some other spots to go for a run or for a walk so that I didn't have to…see the same things because I get bored if I do that…I tried to find, like other people that would want to like walk or run and we would run…around campus or by the river or something like that instead.

Others incorporated entirely new types of exercises into their routine. Andrea further supplemented her exercise with “YouTube workouts, I'd never really done those before, but I found that I really liked them, especially like just doing them in my room was easy and efficient.” By combining old training practices or continuing recreational participation in sports with new exercise experiences, participants created varied and exercise regimens that helped keep them engaged with exercise over time.

Subtheme 3: Utilizing Athleticism to Guide/Assess Exercise Behavior

Because of their sports backgrounds, participants utilized their past experiences to guide and assess their exercise behavior and fitness progress. Besides providing a basis of exercises they were familiar with in college, many recognized their sports training could be an advantage
in developing their self-discipline to exercise: “Self-discipline…whenever I first started exercising at the beginning of my high school career, I just had to instill that into me. I guess I just…learned self-discipline and how to keep at it daily” (Henry). Participants also utilized their training backgrounds to guide their exercise behavior through a combination of quantifiable fitness measures and subjective feelings, as explained by James:

   I would…base [exercise progression] off of how well I was able to go from workout to workout without taking like a break or being winded or how many reps I was able to do per workout, instead of doing like 3 or 4 doing like 8 or 10…not necessarily maxing out, but how much weight I was able to do, how much heavy weight I was able to do for less reps…we would do a bunch of stuff at the turf so I'd focus on how much I was getting winded…how much I was able to run at top speed…how well I was able to, just do some drills and go at top speed and still have my balance and still be able to move effectively

Inevitably, participants’ compared their current fitness to their past athleticism. As a result, they struggled with not feeling as fit as they once were and reported difficulty in setting goals without the limitations of sport, as further exemplified by Henry:

   I would never walk in cross country, I would do the whole thing in one go. But I guess running now…because there's also no finish line, it's just me going as long as I feel like…I'll be like two miles in and think to myself, "wow I really want to stop," but I would also remember…I could do like four and a half miles and not think about it too much…the absence of a finish line, a goal…that may be a factor.

Some explained having an ever-present feeling of needing to improve their ability that resulted from past sports experiences, as shown by Emily:

   I still have my high school coach's voice in the back of my mind that's like, "go run," or, "you should be making this certain amount of time."…I thought about him a lot actually …"he'd be so mad at me right now."
As such, satisfaction with behavior and fitness could vary as a result of this athlete mentality, as participants could get frustrated with not seeing gains as quickly as they would have liked to or feeling as though their fitness was fluctuating. However, they also explained that feelings of dissatisfaction were also enablers for their exercise, as constantly striving for a goal was something that influenced their behavior. This paradox is exemplified by Gwen:

I feel like I'm constantly changing in weight, which I know is normal and healthy, but it's like hard for me to see the scales going up and down all the time…if my weight had not [increased]…I may have been like a little bit more satisfied…Probably not completely satisfied because I do enjoy exercising…seeing progress, seeing results…that enables me to keep going and keep trying to reach some of my goals

Overall, participants’ athletic backgrounds functioned as an enabling factor in guiding their exercise behavior, as they had a knowledge base to draw from and past feelings of fitness to work toward as they developed their exercise regimens. However, participants also had to actively not become discouraged as they dealt with harmonizing expectations based on their past athleticism with their current fitness level and lack of sports goals.

**Subtheme 4: “Positive Feedback Loop”**

Participants explained that, after adjusting to their freshman year and making a conscious decision to start exercising again after a period of inactivity, exercise became more efficacious and triggered “a positive feedback loop-kind of thing” (Andrea) that affected lifestyle choices and identity. Benefits of exercise (e.g., stress relief, improved fitness) set off a chain reaction in participants, who became motivated to live healthier lifestyles. This included continuing exercise and also improving habits relating to diet, hydration, and sleep schedules. This is exhibited by James, “within the first two or three days of working out my mood completely flipped. I had all
the energy in the world, I wanted to work out twice a day, I couldn't wait to work out again,” and also by Amelia:

    BMI, I have also been tracking that…on my phone and it has gone increasingly downward…a lot of it has been that I'm working out more and I'm trying to eat better …after working out…I think, "okay, what's the best option for me health-wise because I just worked out, no sense in taking two steps back eating [unhealthy] food. I want to eat something that's going to help me continue to grow and to like, be healthier."

Additionally, per participants contemplation of identity (Theme 2, Subtheme 1), the act of exercising continually affected their perceptions of being athletes and exercisers over time. Participants acknowledged that the two forms of identity were separate but similarly were affected by their exercise practices, and in turn, their identity influenced their future behavior. This concept is exemplified by Kenny Powers:

    I play [recreational] sports, like every week. So like I feel like I'm an athlete in that perspective…I haven't really ‘been low’ on like exercise hours at all during the semester and I haven't really been too extremely high…so I definitely feel like an exerciser …because I identified myself as say an athlete or an exerciser, I felt that I had to maintain that higher…workload of exercise…that would…motivate me to keep working out…the higher identity is just like motivation to keep doing it.

In summary, participants indicated that their exercise behavior affected feelings of fitness and identity. Changes to these factors then influenced them to make healthier life choices, including continuing to exercise, which facilitated the cycle to continue.

**Theme 3 – Motivational Determinants to Exercise**

Participants drew motivation to exercise from various internal and external sources. This theme contained three subthemes: (a) social support, (b) enjoyment, and (c) surveys.
**Subtheme 1: Social Support**

All participants stated that they could exercise by themselves, however having others to workout with could be a motivating factor: “my roommate exercises with me daily…that's been a motivator for me. Although I think, even if [he didn’t] exercise with me, I still would have brought myself to do it” (Henry). Social support could stem from friends or family, and was preferred for various reasons, such as aiding with accountability and the continual progression of exercise goals. Having even one person to exercise with could provide an avenue for self-reflection and introduce new forms of exercise, as Deborah described:

if you're working out with someone else, then you both have to go, like one of you can't pull out, so it's like you're literally obligated. And then…like meeting back up at the end and just being like, "oh that was a good workout, like what did you do?"…I guess if you had a partner, they could like push you to go even harder, push you to try something new.

Particularly for female participants, having another person with them at the gym or knowing where they were when they went to exercise added a sense of safety, as explained by Nicole:

if the weight racks are nothing but like grown men or even guys my age…I'll maybe do arms because I'm not just going to sit and squat and bend over, and all this other stuff in front of these 30-year-old men in a pair of leggings…that's not a confidence thing, that's a constantly-scared-of-being-kidnapped thing…*(laughs)*…I'll still work out and feel fine, but I might switch what I had planned on doing originally and if I know that my boyfriend or my friend is going then I'm not as worried about it

Participants also explained that they longed for a community that wouldn’t just encourage them to exercise, but also help them perpetuate an overall healthy lifestyle, as expressed by Rose:

I didn't think of it as like I need them to be like, "oh you're doing a great job!" I don't need that but more of like, when I see other people that I'm living with and surround myself with working out and having that lifestyle than I kind of follow in that path.
**Subtheme 2: Enjoyment**

Enjoyment was a motivator for participants to exercise. While exercise was sometimes difficult to begin, participants explained that once they started working out and established a consistent routine, they found exercise to be fun and fulfilling, which motivated them to maintain the behavior, as expressed by Elizabeth:

> I got into a really good rhythm and would find myself…really excited about my next workout, really proud of myself when I got done with it…I oftentimes on freer days would plan my day around getting to exercise as opposed to fitting exercise into the rest of my day…I was like, "I'm really just enjoying working out, I think this is wonderful, I feel good about myself," and am like actually getting joy out of it

Participants also discussed how certain forms of exercise were more enjoyable than others and how they sometimes avoided exercise modes or intensities that were not fun or caused excessive discomfort, as noted by Deborah:

> during basketball I used to sweat a lot…I did not want to sweat a lot when I worked out….I didn't want to like push myself too much, so I usually stuck to like light or moderate exercise…I was forced to work out with my mom one time, so she killed me…I just wanted to stick with lighter, moderate exercise because I did not want to sweat that much

Even if exercise itself was not enjoyable in-the-moment, the post-exercise benefits (e.g., stress relief, feelings of accomplishment) were, and served as adequate motivation: “coming out of a workout, my mood, my stress levels are decreased, I'm like, very motivated. Like that's something that definitely drives it as well, and…like all those feelings are kind of like what keeps me motivated” (Gwen).
Subtheme 3: Surveys

Participants discussed how the surveys used to track their perceptions of fitness, exercise behavior, and identity over the course of the study were motivators for their exercise behavior. By self-reflecting on their behavior every three weeks, resulting satisfaction/dissatisfaction with their responses motivated participants to adjust or maintain their behavior accordingly to improve over time. This is shown by both Alicia, “honestly, doing the surveys like helped me stay active. They just held me accountable…I would like self-reflect and [think], "Oh, I need to actually do some more stuff," ” and also by Emily, “the actual surveys helped me (laughs)…keep track of myself…like okay, "you're not doing so well in this so maybe you should get better, or you're not doing so well in this and maybe you should get better." ”

Theme 4 – Person-Specific Pre-Condition

How participants felt internally—whether physical or mental—affect their physical and perceived abilities to complete exercise. This theme contained four subthemes: (a) stress, (b) health/fitness/body image, (c) injury/illness, and (d) mood/affect.

Subtheme 1: Stress

Stress often stemmed from factors such as schoolwork, time devoted to extracurriculars, and part-time jobs. Participants explained that at times they were overwhelmed by these responsibilities to the point that they skipped exercising or settled for easier forms of physical activity, as Amelia explained:

The stress of school had like really overwhelmed me my first semester…while I didn't get to [exercise] I did try and make sure I was making up for it somehow - using the stairs a lot, doing things that I know are sort of like getting my body moving….stress and worrying really kept me from doing a lot of things last semester…I started out with like
really high hopes for myself and then, as it became more realistic of what I was going to be capable of doing around like my school schedule, I think I adjusted to that.

In contrast, many used stress level as an indication of needing to go exercise to obtain stress relief: “there's a punching bag downstairs in the [dorm] gym, so I would just like punch that and…I felt so amazing, it's therapeutic. But usually working out helps with my stress” (Deborah). As such, stress could act as either an enabler or an inhibitor of exercise.

**Subtheme 2: Health/Fitness/Body Image**

Participants could be motivated and discouraged to exercise by factors relating to their perceived fitness, health, and body image. Most participants desired to live active, healthy lifestyles: “I always try to exercise and be athletic…I'd like to keep exercising for as long as I can… even after college I plan to stay exercising and do things that, require physical ability” (James). Participants were very self-aware and focused on achieving an overall healthy lifestyle that included exercise. They did so through subjective feelings of fitness, recognizing unhealthy habits, and self-reflecting on these factors, as explained by Rose:

> I've also learned over the past couple years [dealing] with body image, that it's not like what you look like, it's how you feel…it's more of a mental thing…like reflection…a self-awareness-realization kind of thing…that is what tells me…I need to make a change

However, they would sometimes feel dismayed at their decreased fitness after retiring from sport. As a result, factors relating to self-consciousness was something participants had to overcome in order to exercise regularly. This could stem from feelings of intimidation and inexperience at the gym, as shown by Amelia:

> it's an intimidation kind of thing too…you go to the gym and there's all these people that really know what they're doing… I just don't want to draw attention to myself and have people be like, "what the heck is she doing?"…[in feeling] self-conscious, I was just like,
"suck it up." (we both laugh) I was like, "just power through it."...everyone's always been like really helpful and really nice at the gym, so that's made me...be less worried about it.

Participants also explained needing to persevere through issues with body image and feeling the need to look thin or muscular, as expressed by Elizabeth: “I was struggling...with my relationship with exercise, where I was like...“it's more like something I need to be doing to look a certain way,” as opposed to, “I really want to be just because I like being active.”” Participants were very self-aware of their exercise habits, with many of them focusing on becoming internally motivated rather than being driven to exercise due to external factors.

**Subtheme 3: Injury/Illness**

Participants sometimes became sick and had injuries, or lingering effects of injuries, from past sports that limited their ability to do certain types of exercise. This is shown by Gwen, “I was sick for about three weeks at the end of last semester, and then...three more weeks going into the winter break...I tried to exercise like once during that time period and it made me feel worse,” and also by Kenny Powers, “my knees...they've hurt me for like four years, and so...I've never like worked out my legs just because...it would just hurt to work them out.” However, past experiences with injuries were also a motivating factor to exercise. In most cases, participants took a rehabilitative approach with their exercise and modified their workouts to rest and improve physical ability affected by injury while still maintaining or improving fitness. This is showcased by Elizabeth, “[injury is] a motivator for the kind of workout that I do...I was having problems with my hip...while I was running...I stopped running...changed my workouts where I was doing less lower body, so I could let that heal,” and also by Rodney:

I tore my meniscus last March in my last game of my senior year...I didn't have surgery until the end of May. And then I was in physical therapy up until three days before I
came back to school…I felt like I made an excuse for the whole semester…coming to school I didn't do anything to help myself… I needed to stop making this an excuse to not do anything, and start taking it kind of how we were doing physical therapy, just do what I can do…it started to feel better when I was up on it more and exercising it not too hard, and then just progressively getting harder and harder, and now I'm running a lot, it feels good, I haven't had really any problems with it.

Understandably, illness and injury could be physically debilitating, whether for the short- or long-term. However, participants understood that they would eventually recover and that their ability could return, even if it meant modifying exercise or resting and being inactive for a time.

**Subtheme 4: Mood/Affect**

Participants consistently referenced how their ‘mood’ prior to exercise often affected their decision to exercise and its quality. However, based on their descriptions, participants’ seemed to imply that pre-exercise ‘affect’, the subconscious foundation of emotion and mood states (Russell, 1980), was the antecedent for their behavior. Affect is determined by valence (positive or negative) and activation states (e.g., feeling awake, having/lacking energy, ability to focus), as shown by Andrea, “I'm like a very, high-energy person…so when I did work out I just felt so much better [because] I expended all this energy that I felt had just been like building up inside, so that helped,” and also by Gwen, “I need to exercise, so that I can focus on my classes.” As such, pre-exercise affect was either an encouraging motivator for participants to exercise, or a discouraging factor that they either had to compromise with to complete exercise, or that would completely derail the behavior altogether. Either positive or negative affect could be motivating to exercise. For example, participants would take advantage of positive pre-exercise affect to push themselves in a workout, or alternatively, they would use working out to improve negative pre-exercise affect. This is exemplified by Elizabeth:
If I'm in a bad mood or can feel myself crashing I need to go get a good workout in so
that's always a motivator, but especially if I'm in a really good mood and have a ton of
ergy, I want to go work out

Further, affect could also precede exercise quality. Positive affect would sometimes preclude a
good workout, whereas participants would sometimes have to work through periods of negative
affect to get exercise into their day, as shown by Sarah:

I definitely do better if I'm like in the mood to work out or go for a run or whatever it
might be. I still will if I'm not in a great mood but…I feel better about the workout if I am
in a good mood previously

Sometimes, participants would not try to compromise when exhibiting negative affect—if they
didn’t feel like exercising, they would skip their workout because there was nothing obligating
them to. This is explained by James:

My mood, kind of goes along with self-discipline. I didn't really have anything to get me
to want to work out, so I didn't. I wasn't really in the mood to work out, I was never really
kind of excited to go do anything…I just didn't have the discipline to get up and go
workout or fix my sleep schedule or anything like that.

**Theme 5 – Environment**

Participants explained how uncontrollable aspects of their external environment affected
their ability to exercise. This theme contained three subthemes: (a) winter break/being at home,
(b) weather, and (c) the COVID-19 pandemic.

**Subtheme 1: Winter Break/Being at Home**

For some being home over winter break or for other factors (e.g., illness, semester at
home) affected their exercise behavior. Being at home could provide a chance to relax and be
lazy, and many participants experienced decreases in their exercise behavior during this time:
“Yeah! I didn't do anything over break… I was like, ”well I know I'm not going to discipline myself over break to [exercise] so I'll just wait ‘til after break” (laughs)” (Rodney). For others, being at home meant they could exercise more conveniently because they were away from the distractions of college, had better access to appropriate resources, and could draw social support from their family and friends in the area. This is exemplified by Rose, “we literally have a gym in my garage…when I went home over break…I was working out more and eating a lot healthier than I do here, just because of…access in my own home,” and by Emily:

my family's very active…I think having those people to pull me out…and like get me to
do things definitely helped…And the availability…we have a treadmill in our basement,
we have a pull up bar…it's all like close and accessible, I have a soccer field five minutes
from my house…that really helped in terms of me exercising when I was home.

In particular, winter break was a turning point for some in terms of exercise behavior; after acclimating to their first semester, it was time to "get back into the swing of things" and start being healthier, as explained by James:

once I got home, I was able to kind of reset…My friends were there, so I was able to go
work out with them again, start our kind of routine again, and get back in the flow of
things. And then coming back this semester I'm just staying in the routine of that, waking
up early, eating as much as I can, and then working out…four or five times a week.

Subtheme 2: Weather

Several participants discussed their preference for exercising outside, which could be limited by the weather. Nicer weather made working out more conducive, as many used the opportunity to get people to do group activities outdoors, “when it…got nice and warm, got a big group outside to play like football and just other activities…but I knew when there was going to be like good days that's when I knew I would plan out and exercise” (Kenny Powers). In
contrast, rainy or cold weather made exercising more difficult, forcing participants to adjust accordingly or skip exercise altogether, as exemplified by Gwen:

running in the cold is really hard for your lungs when you're not acclimated to it, so I would run outside with a mask on sometimes, because that would keep like the warm air going into my lungs… it's hard when it rains when it rains I have to decide if I want to run in the rain, or just not exercise at all.

Subtheme 3: The COVID-19 Pandemic

The COVID-19 pandemic was discussed as something that decreased and/or increased exercise in participants. In particular, wearing a mask while exercising was a largely unappealing factor for participants who were partial to exercising indoors: “I was gonna take a futsal [indoor soccer] class…then my sister pointed out…"hey you realize you're gonna have to wear a mask while you play soccer," and I was like, "good point, not going to take that class" (laughs)” (Emily). Other safety restrictions, such as limited occupancy and hours of the campus and dorm gyms, and general fear of being in close proximity to people while working out, were other barriers participants mentioned, as shown by Deborah:

working out here [at school] like you never know when the [gym] is just going to close, and then I also like noticed that there was a gym downstairs, so then that helped a bit, but it only can have like four people, so…it just like affects your timing and like how long you work out

However, many also explained that the pandemic solidified their exercise behavior and was a catalyst for some to start exercising regularly. Gwen discussed this when describing how the initial quarantine incited her to start running regularly at home and when she moved to college:

I was in the house, and I wasn't doing anything, and I really had nothing to do, I…kind of, self-motivated myself to start exercising. So I would run outside a lot and I had
planned on…doing the same thing when I got to school and, when I got here I started running a lot.

Rose explained how exercise during quarantine was utilized to create a sense of normalcy during a time of uncertainty and how her perceptions of certain forms of exercise (i.e., running) changed as a result:

I was a goalie in soccer so running was not my favorite thing…quarantine was a unique experience because there was literally nothing to do, at all. So, running became like that outlet like, just to get energy out, and you know feel like I did something…when everything was absolutely locked down…that's when I think it was a very important part of my life because that's all I could do…I absolutely hated running, so the fact that I turned that into something that I enjoyed and like was good for me was definitely important

Andrea described how COVID-19 changed her plans for college and exercise, forcing her to become adaptable with school and her workouts by sampling new forms of exercise. In doing so, she increased her self-discipline and confidence with working out regularly:

as time went on…I figured out more ways to do like COVID-safe activities…it definitely like increased my self-discipline… I auditioned for a school…that had a dance major…literally right before the pandemic…[and] they were like, "we can't take you because there's like a pandemic,"…it kind of crushed my dreams…if the pandemic wasn't a thing I would be so much more active, but also I don't like thinking about that because I mean that's not what happened…I like that I increased my self-discipline and…have those experiences under my belt…I just think it makes me stronger

Overall, participants exhibited a resilience through their experiences with the COVID-19 pandemic. While the pandemic did lower their exercise for a time, all adapted and worked
around the restrictions in some way to maintain their behavior, with some expressing
gratefulness for the experience for improving their health and fitness.
Table 5. Qualitative themes constructed from interviews.

<table>
<thead>
<tr>
<th>Themes and Subthemes</th>
<th>Representative Quotes (Participants’ Pseudonym)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theme 1: Adapting to Transition</strong></td>
<td></td>
</tr>
<tr>
<td>Subtheme 1: Out of Sport, Into College</td>
<td>“I just think it was more of like...not disappointment, but like I always told myself, I was going to keep [exercise] up in college and then I just didn’t” (Rose)</td>
</tr>
<tr>
<td></td>
<td>“I'm not super satisfied with my fitness, but I feel like that's me comparing how fit I was in high school to how I am now.” (Emily)</td>
</tr>
<tr>
<td>Subtheme 2: Developing Self-Discipline</td>
<td>“I'm taking my workout clothes with me to class because I'm going to be over by the gym.” (Amelia)</td>
</tr>
<tr>
<td></td>
<td>“I just kind of made it work like, 12:00 to 1:00 was usually a good time, and if I didn't go then, then I usually went like at night, like 6:00 or 7:00.” (Deborah)</td>
</tr>
<tr>
<td><strong>Theme 2: From &quot;Athlete&quot; to &quot;Athletic Exerciser&quot;</strong></td>
<td></td>
</tr>
<tr>
<td>Subtheme 1: Identity Contemplation</td>
<td>“I [could] feel [my athlete identity] like slowly going down as I realized, &quot;oh I can’t really play soccer this year.&quot;” (Emily)</td>
</tr>
<tr>
<td></td>
<td>“it's easier for me to be like, &quot;oh yeah I exercise all the time,&quot; than for me to be like, &quot;oh yeah I'm an athlete,&quot; especially not being like currently in a sport it's a lot easier to identify myself as an exerciser than an athlete.” (Nicole)</td>
</tr>
<tr>
<td>Subtheme 2: Incorporating Old and New in Exercise Behavior</td>
<td>“if I'm not doing something that I know works, I don't really like doing it because I don't want to do something that is not really helpful or beneficial” (James)</td>
</tr>
<tr>
<td></td>
<td>“I got [gymnastics rings] over the course of Christmas break and I've also been using that a lot too...it's like a pull up bar except a lot more free, in my opinion.” (Henry)</td>
</tr>
<tr>
<td>Subtheme 3: Utilizing Athleticism to Guide/Assess Exercise Behavior</td>
<td>“I can feel my metabolism slowing down...since I'm not doing strenuous activity, five, six times a week for basketball for hours a day...i felt it slowing down, I felt worse, I felt more insecure about myself.” (Rodney)</td>
</tr>
<tr>
<td></td>
<td>“[I’m] definitely [a] believer in just listening to your body...I definitely just pay attention to what my body's telling me...[I] don’t go if I'm not feeling good, and go more if I'm really feeling it.” (Kenny Powers)</td>
</tr>
</tbody>
</table>
Table 5 (continued)

<table>
<thead>
<tr>
<th>Themes and Subthemes</th>
<th>Representative Quotes (Participants’ Pseudonym)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtheme 4: &quot;Positive Feedback Loop&quot;</td>
<td>“The behavior [drives] the identity, but my behavior wouldn't have increased without my identity...it's like the chicken or the egg.” (Nicole)</td>
</tr>
<tr>
<td></td>
<td>“just making the initial decision to wake up early one day, eat, go workout that evening and get a good workout in, I think that was probably the biggest thing, because it flipped a switch” (James)</td>
</tr>
<tr>
<td>Theme 3: Motivational Determinants to Exercise</td>
<td></td>
</tr>
<tr>
<td>Subtheme 1: Social Support</td>
<td>“I have really good like family support and friend support...they all are very supportive...they always just hype me up...it makes me want to work harder” (Andrea)</td>
</tr>
<tr>
<td></td>
<td>“right in the beginning of the year I went for a run, I was like- I made sure that, like my roommate had my location stuff because it was like getting dark out.” (Rose)</td>
</tr>
<tr>
<td>Subtheme 2: Enjoyment</td>
<td>“I've never been the kid who leaves school, just goes home, does homework, and that's it. I knew that I wanted to still be active and still do things like that, because I get enjoyment from it.” (Amelia)</td>
</tr>
<tr>
<td></td>
<td>“I completely enjoy working out, I love how I feel after.” (Alicia)</td>
</tr>
<tr>
<td>Subtheme 3: Surveys</td>
<td>“when I was doing them [the surveys] I was trying to think back to the previous one that I did, and kind of compare myself to that... it was definitely like a reflection tool that I could use...it definitely made me like think about how I was doing and how I felt that I was doing compared to the past.” (Kenny Powers)</td>
</tr>
<tr>
<td></td>
<td>“I just felt like I was exercising for this survey” (Deborah)</td>
</tr>
<tr>
<td>Theme 4: Within-Person Pre-Condition</td>
<td></td>
</tr>
<tr>
<td>Subtheme 1: Stress</td>
<td>“I know that if I'm really stressed, I especially need to work out” (Elizabeth)</td>
</tr>
<tr>
<td></td>
<td>“I enjoy working out...I knew I would feel better afterwards...it just gave me a time to like clear my mind and just, forget everything else, and just like focus on that for a little bit.” (Alicia)</td>
</tr>
</tbody>
</table>
Table 5 (continued)

<table>
<thead>
<tr>
<th>Themes and Subthemes</th>
<th>Representative Quotes (Participants’ Pseudonym)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subtheme 2: Health/Fitness/Body Image</strong></td>
<td>“I was self-conscious of my lifting at the beginning of the semester… I wasn’t able to lift as much weight, so I think that was something that made me self-conscious… because I’ve always had body image issues.” (Gwen)</td>
</tr>
<tr>
<td></td>
<td>“the more that I realized how important it was to me to live [in a healthy] way is when I would have better exercise behavior.” (Rodney)</td>
</tr>
<tr>
<td><strong>Subtheme 3: Injury/Illness</strong></td>
<td>“Injury, I had a fracture in my spine last year… sometimes that kind of, affects certain things” (Sarah)</td>
</tr>
<tr>
<td></td>
<td>“I did have [COVID-19] at the end of the semester [when] we went home… So my plan was, “as soon as I get over this, I’m going to start working out again.” So that kind of helped me reset.” (James)</td>
</tr>
<tr>
<td><strong>Subtheme 4: Mood/Affect</strong></td>
<td>“if I’m going at like 8:00 pm on a Tuesday, I’m going to be more tired than I would at like 8:00 am on Wednesday… so some days I would have like a more negative reflection on the workout based on how tired I was.” (Elizabeth)</td>
</tr>
<tr>
<td></td>
<td>“And then mood, just like not wanting to go like, (laughs) just wanting to take a break from everything and like rest… being exhausted, not wanting to like go workout obviously just because I’m so hung up on school and just, I’m tired. (laughs)” (Alicia)</td>
</tr>
<tr>
<td><strong>Theme 5: Environment</strong></td>
<td><strong>Subtheme 1: Winter Break/Being at Home</strong></td>
</tr>
<tr>
<td></td>
<td>“when I went home over break… I was working out more and eating a lot healthier than I do [at school]” (Rose)</td>
</tr>
<tr>
<td><strong>Subtheme 2: Weather</strong></td>
<td>“I used to exercise at night and as it got closer to December, the colder it got and just going out to the track and running seemed very painful, so I resorted to other leg workouts in the dorm.” (Henry)</td>
</tr>
<tr>
<td></td>
<td>“when it got really cold. It was either a, &quot;oh you know what, it's like 50 degrees, it's perfect for running!&quot; I feel like I'd go then, but when it got colder I feel like I didn't. Or I tried to stay in like at home and get on the treadmill.” (Emily)</td>
</tr>
</tbody>
</table>
Table 5 (continued)

<table>
<thead>
<tr>
<th>Themes and Subthemes</th>
<th>Representative Quotes (Participants’ Pseudonym)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtheme 3: COVID-19 Pandemic</td>
<td>“I couldn't bring myself to exercise with a mask on.” (Henry)</td>
</tr>
<tr>
<td></td>
<td>“over quarantine...I started exercising every day and like losing a bunch of weight” (Gwen)</td>
</tr>
</tbody>
</table>
CHAPTER V: DISCUSSION

The purpose of this study was to document temporal changes to perceived fitness and exercise behavior, as well as athlete and exercise identity in former high school athletes during their freshman year of college. Additionally, we sought to understand this population’s general experiences relating to exercise participation during this time period, and explain why observed changes in quantitatively measured variables occurred through participants’ lived experiences. To our knowledge, this is the first study to utilize mixed methods in to gain an in-depth understanding into former athletes’ (high school or otherwise) exercise behavior. The quantitative results demonstrated that, at the group level, participants’ overall perceptions of fitness, self-reported exercise, and identity did not significantly change over the course of the study. However, by examining the data from an idiographic perspective, participants were shown to vary considerably over time regarding these factors, indicating that the average values are not necessarily representative of data at the individual level. The observed variability of participants’ quantitatively measured factors also implies the necessity of our qualitative methods to better understand why participants’ behavior and associated factors fluctuated over time. Specifically, participants’ discussed how their adaptations to the transition out of sport and into college, backgrounds in sports, and factors related to their motivation, pre-exercise states, and uncontrollable aspects of their external environment affected their perceived fitness, exercise behavior, and identity over time. Further, the qualitative themes provide preliminary insight into how these factors interrelated and affected one another over the course of the study.
Integration II – Interpretations of Mixed Data

Variation of Exercise Over Time

From the nomothetic perspective, participants’ measured factors did not change over the course of the study. Based on scores pertaining to the Godin Leisure-Time Exercise Questionnaire, participants as a group were considered active. This was further reinforced, as the population reported completing an average of 139.8 minutes of aerobic exercise and 4 bouts of muscle strengthening exercise per week. Additionally, former high school athletes rated their perceived fitness as “good” for the entirety of the study, and generally their identities remained stable for both athlete identity (“moderate” salience) and exerciser identity (“moderately strong” salience). These results further imply the favorability of group-level results. However, from the idiographic perspective, substantial variability was noted for most measured factors, which was reinforced by poor to fair within-person consistency for variables relating to fitness and exercise. Particularly, variation in aerobic and muscle strengthening behavior indicated that participants could range from being well below or above the calculated averages. For example, the participant with the lowest standard deviation for aerobic exercise (ID 030; SD=20.6 minutes, range 0-50) reported completing no aerobic activity for five surveys, while the individual with the highest level of standard deviation (ID 004; SD=193.1 minutes, range 0-480) reported completing 0 minutes/week only once during the study period and volumes of aerobic exercise above the group average for five of the eight surveys. Similarly, the individual who exhibited the lowest standard deviation for muscle strengthening exercise (also ID 030; SD=0, range 0-1) reported completing no resistance exercise for seven surveys, while ID 033 (SD=4, range 0-12) reported no muscle strengthening exercise for the first four surveys but increased in volume to above group-average levels by the end of the study.
Participants’ self-reported exercise results appear to reflect physical activity and behavioral patterns found in general college freshmen. In a study by Randall et al. (2007), large ranges of variability were shown in a cohort of freshmen women (n=137) whose vigorous activity (pre: median=600, IQR 1400; post: median=480, IQR 1440; \( p = .24 \)) and walking (pre: median=2639, IQR 2196; post: median=2079, IQR 2627; \( p < .05 \)) appeared to decrease from fall to spring semester, while moderate activity did not change (pre: median=240, IQR 720, post: median=240, IQR 600; \( p = .91 \)). Further, a cross-sectional study by Wilson et al. (2020), in which self-reported physical activity was assessed in general college freshman during their first year, showed large margins of variation regarding freshmen (N=514) who indicated completing less (52.1%, 144.0±155.8 minutes/week), more (32.3%, 175.5±178.5 minutes/week), and the same (15.6%, 151.7±165.2 minutes/week) amounts of activity than they did in high school (study purpose states interest in general physical activity, but methods imply the focus was on exercise-specific behavior). Taken at the group level, the findings of the current study may be interpreted such that former high school athletes are similarly (and sufficiently) active as the general freshmen population, potentially requiring no behavioral intervention. However, the substantial variability noted through the idiographic analysis supports the notion that accounting for inter- and intra-individual variability of persons, in addition to nomothetic approaches, is necessary to understand exercise and physical activity as complex health behaviors, and may better support the creation of person-specific health behavior interventions (Dunton, 2017; Dunton & Atienza, 2009).

**Potential Explanations for Exercise Variation**

The qualitative methods revealed a number of factors that affected participants’ exercise behavior similar to those found in the general population and college students, such as weather
(Stutts, 2002), illness and injuries (Deliens et al., 2015; Stutts, 2002), and difficulty in establishing self-discipline (Deliens et al., 2015). The majority of these factors can be categorized as impacting participants at the society, community, relationship, and individual levels, reflective of the Social-Ecological Model (SEM; Sallis et al., 1998). The SEM depicts the complex interplay of how variables at each of these levels of society influence the adoption and maintenance of health behaviors in individuals, including physical activity and exercise. As such, the following sections of the discussion are organized in line with the SEM.

At the Society and Community Levels

The SEM dictates that at the societal level, public policy at the local, state, and national level, as well as perpetuated social and cultural norms, influences individuals’ adoption maintenance of health behavior, while at the community level, behavior is influenced by organizations, institutions, and social networks in a defined area (Sallis et al., 1998). In this study, these levels coincided with one another closely as participants adapted to the transition from one life stage (i.e., living at home, attending grade school, participating in organized sport) to a new one (i.e., college, discontinuation of organized sport) and renegotiated aspects of their external environment and social networks. As such, primary societal and community level factors that affected participants’ exercise included time devoted to the responsibilities of college, as well as the nationally and institutionally-dictated regulations regarding the COVID-19 pandemic.

Time Devoted to Schoolwork. One particular factor that affected exercise over the survey period was ‘time devoted to schoolwork.’ Academic pressure has been found as a moderating factor for sedentary and physical activity behavior in college students (Deliens et al., 2015). Specifically, in a qualitative study by Deliens et al. (2015) involving students at all levels
of college, participants mentioned that exam periods in the semester were periods of time when they were least active. When cross-referenced with Table 3, Figure 10 distinctly depicts how schoolwork as a barrier was rated highest during midterms, finals, and the start of the spring semester, and lowest at the beginning of the fall semester and over winter break when schoolwork was not as intense for students (“I moved into school two weeks before [the beginning of the study]…classes weren't really as intense as they were towards the middle…that's why I had time to do [exercise].” [Rose]). However, the observation that exercise behavior did not follow a single distinct pattern may be because participants coped with this barrier differently. For example, schoolwork was often cited in interviews as a determinant for stress levels and incidental affective states. Interestingly, for some individuals, it was an antecedent to exercise for stress relief or improve affect, but for others, these signals resulted in them abstaining from exercising altogether (Theme 4 – ‘Stress’). Similarly, while being at home over winter break improved some participants’ behavior due to better accessibility and increased social support, others’ behavior declined, as the chance to be home was seen as an excuse to relax physically and mentally (Theme 5 – ‘Winter Break/Being at Home’). The duality of this barrier is further shown in Figures 4-9, where certain individuals’ patterns in exercise data mirror the perceived importance of schoolwork as a barrier in Figure 10.

**COVID-19.** The COVID-19 pandemic was another factor that affected participants’ behavior at the societal and community level. Internationally, decreases in physical activity and increases in sedentarism have been reported as a result of restrictions put in place due to the pandemic (Fearnbach et al., 2021; Stockwell et al., 2021; Wilke et al., 2021). Cross-sectional data from 14 different countries (sampled April-May 2020) indicated that self-reported moderate-to-vigorous physical activity decreased by 41.0% since the beginning of the pandemic,
while vigorous physical activity declined by 42.2% (Wilke et al., 2021). Further, physical activity guideline compliance as dictated by the World Health Organization decreased from 80.9% (95% CI 80.3-81.7) to 62.5% (95% CI 61.6-63.3) in this time (Wilke et al., 2021). With this said, Fearnbach et al. (2021) showed that over time, increases in physical activity could occur in the midst of the pandemic as individuals adapted through purchases of at-home exercise equipment and the use of virtual platforms to perform physical activity. Similarly, both nationally (Centers for Disease Control and Prevention, 2021) and institutionally-dictated regulations regarding social distancing, mask-wearing, and limited occupancy and hours of gym facilities affected exercise before and after participants began college, respectively. However, while initial lockdowns caused self-reported declines in exercise, in time participants adapted to these restrictions, citing that COVID-19 provided both barriers that needed to be overcome to remain active and an environment that improved and solidified their exercise behavior (Theme 5 – ‘COVID-19 Pandemic’). Further, participants indicated utilizing their athleticism and past sports background to modify and guide their exercise behavior during the transition to college (Theme 2 – ‘Utilizing Athleticism to Guide/Assess Exercise Behavior’). Thus, past athleticism may have been a primer for participants in maintaining exercise in the climate of the pandemic while also moving through their transition. Similar findings were found in a longitudinal smartphone-tracking study by McCarthy et al. (2021), in which participants minutes of physical activity per week were recorded multiple times throughout the three months before and after the onset of the pandemic. A protective effect was shown in individuals who were classified as ‘active’ (defined in the study as completing >150 minutes/week of physical activity) prior to the beginning of the pandemic compared to those who were ‘fairly’ active (completing 30-149 minutes/week) or ‘sedentary’ (completing 0-29 minutes/week). While all in this study
experienced a decrease in physical activity, those who were active prior to the pandemic exhibited a median of approximately 100 minutes more activity per week during the pandemic than those who were fairly active or sedentary, who exhibited no activity at all (McCarthy et al., 2021). Further research is necessary to understand whether this protective effect exists under “non-pandemic” times, however these findings indicate a potential mechanism for researchers to utilize as they work to promote exercise in transitioning athletes.

**At the Relationship Level**

At the relationship level of SEM, a person’s interpersonal relationships with family, friends, and coworkers affects behavior (Sallis et al., 1998).

**Needing Exercise-Specific Social Support.** Based on the survey data, a lack of support from friends and family were rated as the least important barriers throughout the study. However, the qualitative data provided further clarification of participants’ interpretation of this barrier. Participants explained that they felt they still had social support to be active in exercise that transferred from when they were in sports, usually in the form of encouraging words from family and friends, and as such rated these barriers as unimportant in the survey. However, after leaving the lifestyle of organized sport and the support of a team, many participants were now exercising by themselves, and as a result tried to find others to create an exercise-based social support system. Having a friend or group in college is shown to aid in former high school athletes adjustment in transition (Lyons et al., 2018). The present findings indicate such support also improves former athletes engagement in exercise, as exercising with even just one other person pushed participants to reach goals and held them accountable (“I have a friend downstairs that would always be like, "I'm running today, go with me."…I found a consistent running buddy” [Emily]). In contrast, while participants indicated they had friends in college, a lack of such
exercise-specific social support prolonged difficulties in trying to exercise regularly (“if I was surrounded with more of those people like I was in high school, like all of my friends were athletes and my teammates, I think that would have pushed me a little bit more” [Rose]).

Social relationships are primers to motivation (Deci & Ryan, 2012) and self-efficacy (Bandura, 2010) for athletics and exercise. Positive interpersonal bonds create an environment that can satisfy one’s basic psychological needs (i.e., relatedness, autonomy, competence; Deci & Ryan, 2012). In sports, the satisfaction of the psychological needs helps athletes embody a team’s values, goals, and behaviors (Raabe et al., 2016). Further, interactions outside of training impact athletes’ sense of relatedness within the team, and teammates who provide recognition, support, peer coaching, and a friendly, competitive environment can enhance individuals’ competence and motivation to train (Raabe et al., 2016). Additionally, according to self-efficacy theory (Bandura, 2010), individuals’ self-efficacy beliefs for a behavior is increased through vicarious experiences provided by social models. In other words, completing a behavior with others similar to oneself increases an individual’s belief that they also possess the abilities to succeed in the behavior. The present findings indicate that exercise-specific social supports may be a necessary component of future behavioral interventions to promote exercise in this population. Examining how such interpersonal relationships can be formed within a programmatic setting should be considered in future studies.

**Social Comparisons Affecting Perceptions of Fitness and Behavior.** Social support also affected participants’ exercise by changing their perceptions of fitness, the nuances of which could not be interpreted using the survey results alone. Despite participants’ ratings ranging the entire scale, average scores stayed solidly in the middle, indicating their perceptions of muscle strength, muscle endurance, agility, aerobic fitness, and flexibility remained “good” for the entire
study. However, in interviews participants expressed dissatisfaction with their fitness, in part, by recognizing their loss of fitness gains after retirement (Theme 1 – ‘Out of Sport, Into College’), but also based on comparisons with their available social supports that could either encourage or discourage them from exercise (Theme 3 – ‘Social Support’). Several participants who were able to find others to exercise with compared their fitness and ability with these individuals. For some, this improved perceptions of their own fitness, as they were motivated to compete with others they were working out with and utilized much of their athletic ability in doing so (“other people in there were a lot more flexible and could do a lot more things than I could…So I was like, “man if only I worked out more, I think I would be able to do that” ” [Andrea]). Previous research has indicated that healthy competition between teammates on a sports team can encourage athletes to improve their skills (Raabe et al., 2016). For others, these comparisons worsened their perceptions of fitness, as they felt their body image or physical ability was not to the same standard of those around them (“being exposed to a lot more guys who just seem, naturally bigger than me…thinking back, I can remember feeling small around certain other guys who weren't really that much different in age.” [Henry]). Such comparisons that incite feelings of intimidation and negative views of body image in exercise settings (e.g., gyms) are common in the general population (Coulter, 2020; Pridgeon & Grogan, 2012). Taken together, others in participants’ social circles and exercising environment could improve or worsen behavior over time, which may help explain the observed variability in the sample population.

**At the Individual Level**

Several factors affecting exercise in former high school athletes stemmed from the individual level of the SEM, which states that psychological and biological factors, as well as developmental history, affect behavior (Sallis et al., 1998).
Self-Regulation Derived from Sports Backgrounds. Participants were motivated to achieve holistically healthy lifestyles, understood how exercise could achieve healthy benefits, and exhibited a level of intrinsic and self-determined extrinsic motivation for exercise, specifically (Theme 3 – ‘Enjoyment’; “I knew that I wanted to still be active and still do things like that, because I get enjoyment from it.” [Amelia]). However, as a result of the various barriers to exercise participants faced in their transition to college, they indicated needing to develop self-discipline to meet their exercise goals (Theme 1 – ‘Developing Self-Discipline’) and utilized their sports backgrounds to do so through self-regulation (Theme 2 – ‘Utilizing Athleticism to Guide/Assess Exercise Behavior’). Temporal Self-Regulation Theory (TST; Hall & Fong, 2007) posits that an individual’s intention to engage with health behaviors and long-term performance of a behavior is moderated by their behavioral pre-potency (i.e., how often an individual has performed the behavior in the past and the presence of cues to action in their environment) and their self-regulatory capacity (i.e., state or trait factors that influence an individual’s ability to regulate their behavior). While sports training seemingly provided individuals with a certain level of behavioral pre-potency, their sports backgrounds from high school may have also provided them with adequate levels of self-regulatory ability to overcome barriers and engage in exercise during their freshman year. For example, self-regulation manifested through participants being very interoceptively in-tune with their feelings of fitness (Theme 1 – ‘Out of Sport, Into College’), recognizing and being motivated to work towards the health benefits of exercise (Theme 4 – all subthemes), and utilizing their acquired physical skills from sport to guide their behavior and establish self-discipline (Theme 2 – ‘Incorporating Old and New in Exercise Behavior’). Further, as participants’ confronted various barriers to their behavior (e.g., weather, illness, schoolwork), exercise was sometimes not possible to complete.
due to physical inability or other responsibilities causing fitness goals to be secondary. This is also reflective of TST, as the influence of the moderating factors within the model increase or decrease depending on how immediate or not immediate acquiring behavioral contingencies become (Hall & Fong, 2007), hence why observed fluctuations may have occurred in participants’ behavior over time.

**Within-Person Pre-Condition.** Participants’ perceptions of their mental and physical precondition also affected their exercise behavior over time and incited their ability to self-regulate. While exercise psychologists have often conceptualized exercise and physical activity as means of improving well-being and mental health, it is reasonable to consider that physical and psychological states are also precursors to subsequent exercise behavior. In the context of sport-specific training, the strategy of autoregulation was developed to account for athlete’s changing circumstances regarding training- and non-training-related stressors, thereby allowing degrees of flexibility in daily training choices so as to maximize training quality (Greig et al., 2020). As such, strength and conditioning coaches routinely monitor athletes’ mental and physical states using a variety of metrics (e.g., injury, hydration, and mental and physical fatigue; Kraemer & Fleck, 2007). Further, researchers interested in developing person-adaptive exercise programming based on autoregulatory concepts have provided preliminary evidence of this directional relationship, such that negative emotional states, low energy, and physical discomfort undermine perceptions of readiness-to-exercise (Strohacker & Zakrajsek, 2016; Strohacker et al., 2019) and contribute to ratings of exercise-related affective responses (Beaumont et al., 2021, Strohacker et al., 2017). In turn, affective changes in responses to a stimulus like exercise then inform future judgements and decisions regarding the behavior (Brand & Ekkekakis, 2018). In addition to being interoceptively aware of their fitness, participants also took certain internal
cues (Theme 4 – ‘Stress’, ‘Mood/Affect’) as indications of needing to exercise. Some participants exhibited a degree of self-awareness in utilizing their pre-exercise states to modify their workouts or take rest days accordingly (“[I’m] definitely [a] believer in just listening to your body…I definitely just pay attention to what my body's telling me…[I] don't go if I'm not feeling good, and go more if I'm really feeling it.” [Kenny Powers]), or at times used their “athlete mentality” to persevere and overcome these obstacles (“if I was stressed or anything…being on a team, that didn't really matter…you had to go do stuff anyway…I just kind of have that mindset…I'm going to [exercise] anyways because that's just how I've been taught” [Sarah]). The ability to recognize and interpret body signals to appropriately guide behavioral decisions that promote physical and mental well-being is as an important component of physical activity-related health competence (PAHCO; Pfeifer et al., 2013; Schmid et al., 2020).

**Physical Activity-Related Health Competence.** Physical activity-related health competence (Sudeck & Pfeifer, 2016) refers to the integration of individual competencies to promote healthy physically active lifestyles, and combines “health literacy” (i.e., knowledge, motivation, and competency to access, understand, appraise, and apply information when making decisions regarding health and well-being) and “physical literacy” (i.e., knowledge, motivation, physical competence, confidence, and understanding to value and take responsibility for engaging in physical activity for life; Haible et al., 2020). The PAHCO model is composed of three forms of competence: (a) movement competence, or how well basic motor skill and physical ability can meet the requirements of physical activity on a regular basis; (b) control competence, or how well an individual can balance physical activity loads to generate health gains, minimize injury, and facilitate positive affective reactions; and (c) physical activity-specific self-regulation competence, involving an individual’s motivations, volitional ability, and
will in integrating regular, health-enhancing physical activity into everyday life (Sudeck & Pfeifer, 2016). Research indicates that individuals who exhibit higher levels of these three competencies, reported completing more habitual exercise than those with lower competence (Schmid et al., 2020; Sudeck & Pfeifer, 2016). Further, those who exhibit higher physical activity self-regulation, specifically, exhibit the highest levels of physical activity (Schmid et al., 2020), and positive affective well-being due to habitual physical activity (Sudeck et al., 2018). In the present study, it is reasonable to consider that participants’ sports backgrounds influenced their development of PAHCO, however the degree of development may not be equal and a potential cause for the observed inter-individual variability among participants. While many readily turned to exercise to obtain stress relief or improve mood, others indicated lower capacities of self-regulation, stating that being in a more positive pre-exercise state was necessary for quality exercise and implying that they would rather skip working out if not feeling optimally ready (“[My] mood definitely affected [exercise] because I mean, I have to be in a good mood to actually do anything.” [Emily]). Further, depending on how soon individuals chose to engage in exercise after retirement, loss of fitness gains may have lowered their competence, as present fitness no longer matched preconceived health and physical literacy, causing them to struggle in making progress toward fitness goals that they set at too high of a standard (Theme 1 – Out of Sport, Into College; “I always tried to increase the work I’m putting in. But…at the end of it, I still don't feel much more improved…I still get fatigued as easily, no matter how much I increase [Henry]). This indicates that while sports backgrounds may present advantages to former athletes in maintaining exercise, it also presents new difficulties unique to this population that researchers should be aware of. These findings also suggest that developing
former athletes’ PAHCO early on in their retirement may be a viable mechanism for promoting exercise maintenance post-sport.

**Identity/Exercise Positive Feedback Loop.** Athlete and exercise identity remained one of the least variable factors among participants in this study. Research studying the general transition experiences of athletes shows that the salience of athlete identity is an antecedent to transition quality and suggest its diminishment to improve transition experiences (Lally, 2007). As such, researchers examining and promoting physical activity behavior in these populations have utilized a similar model, with a focus on understanding how athlete identity affects exercise behavior post-sport (Reifsteck et al., 2013; Reifsteck et al., 2016). This research implies that both athlete and exercise identity are antecedents for physical activity in former athletes, as non-athletes do not exhibit as high a degree of salience (Reifsteck et al., 2013), and that salience of exercise identity correlates with identified regulation for the practice of physical activity in the former college athlete population (Reifsteck et al., 2016). In contrast, while this relationship has not been solidified in former high school athletes, past transition research in this population implies that the practice of physical activity may affect and be caused by the salience of athlete identity (Helms & Moiseichik, 2018), and that physical activity engagement is utilized for identity renegotiation in college (Lyons et al., 2018).

Similar to the results of Lyons et al. (2018), some participants in the present study did mention competing in intramural sports and exercise out of a desire for control and finding a new athletic role in college after sports retirement, as shown by Amelia:

…my deep desire to like hold on to some part of myself…[exercise] was like something I could control…like, "I'm capable of doing this, it's the one thing that I am fully in control of right now that I can do something about."
However, the qualitative findings in Theme 2 indicate a potentially more complex, cyclical relationship. Nearly all participants explained that exercise was completed because they wished to be active and healthy, more so than to remain competitive and active in sport. As a result, exercise completion or non-completion caused fluctuations in both athlete and exercise identity. How the two forms of identity related to each other over time is outside the scope of this study, yet participants further indicated that fluctuations in both influenced one another and the continuation of exercise, allowing the process to continue. This cycle is reminiscent of self-efficacy theory (Bandura, 2010), specifically in building self-efficacy for exercise through mastery experiences. Successes in behavior grows one’s personal efficacy, while the sustained effort necessary to overcome setbacks and failures strengthens their perseverance and belief that they can succeed (Bandura, 2010). As the number of these successful experiences with a behavior increases, so does one’s self-efficacy. The “positive feedback loop” between exercise behavior and identity conceptualized in this study is a slight departure from past transition research implying that identity is an antecedent to exercise only, and indicates that the development of exercise behavior in transition may warrant a different approach than what has been utilized in programs focusing on developing new identities, careers, and lifestyles for former athletes. This is particularly important for researchers utilizing exercise and physical activity promotion to aid athletes in their transition. With this said, this “positive feedback loop” relationship is based solely on the qualitative aspect of the present study and requires further quantitative exploration for validation.

Survey Effect on Exercise Behavior. An unexpected factor that aided in participants’ self-regulation of exercise was their reactivity to the surveys used to collect data (Theme 3 – ‘Surveys’). In particular, information uncovered in interviews suggests that completing the
surveys served as a form of self-monitoring. Based in cognitive behavioral therapy, self-monitoring involves methods of record keeping on a specified behavior as a method for enacting behavior change (Michie et al., 2011). This technique has been used successfully by researchers to enact beneficial changes across a variety of health behaviors, including inciting weight loss (Burke et al., 2011), medication use (Heneghan et al., 2012; Lancaster et al., 2018), and chronic disease monitoring (Clar et al., 2010). Further, self-monitoring is shown to be promising in reducing sedentary behavior and increasing physical activity in adults (Gardner et al., 2016; Gleeson-Kreig, 2006) through both physical (e.g., self-reporting behavior through exercise diaries, recording regular fitness measurements) and electronic (e.g., utilizing technological devices such as fitness trackers, pedometers, and accelerometers) means (Compernolle et al., 2019). While the surveys in this study were only intended to document behaviors and perceptions, multiple participants explained that answering them regularly aided in self-regulating their behavior by allowing self-reflection of past exercise, directing future modifications to behavior, and providing a sense of satisfaction and competence, as demonstrated by Elizabeth:

> whenever I got the surveys…I was…proud to be able to say like, "oh, I have done a good bit in the last seven days,"…the fact that I could reflect…and think of all the times I'd worked out in the last seven days…[I] was just really proud that I'd been consistently going and the changes I'd seen either physically or…mentally

The discovery of this reactivity further speaks to the importance of implementing mixed methods approaches, as this concern likely would not have emerged through quantitative data collection alone. Because reactivity can bias and confound research results, researchers interested in implementing longitudinal research to track behavior in former athletes should work towards implementing safeguards to minimize reactivity and capture unbiased data, such as randomizing
when surveys are sent to participants as a way of varying their response rate (Warner, 1965). However, a positive interpretation of this finding is that electronic-health interventions and strategies offer promise for modifying behavior in former high-school athletes. Research indicates that utilizing social media and electronic forms of communication to aid in maintaining healthy behaviors after retirement from sport is warranted in the former college athlete population (Brooks et al., 2019; Ferrara et al., 2021b). These propositions are reflective of the increased use of electronic health methods to provide remote healthcare (Caligtan & Dykes, 2011) and promote physical activity (Buchholz et al., 2013; Consolvo et al.; Fanning et al., 2012; Head et al., 2013; King et al., 2013) in the general population.

**Limitations**

This study is not without limitations. The majority of the sample consisted of non-Hispanic, Caucasian women, and as such, our results are not generalizable to more diverse groups based on sex or race. Additionally, participants were sampled from one, medium-size, public university in the southeastern U.S. with a majority Caucasian population, therefore these results may also not apply to former high school athlete freshmen at smaller/larger institutions, private colleges, or historically Black universities in other regions or countries. Further, due to the exploratory nature of this research, exclusionary criteria were not put in place to limit participation based on specific criteria, such as the length of individuals’ retirement (i.e., whether individuals had retired in the fall, winter, or spring from high school sport). Thus, differences related to factors such as the seasonality of sports play, length of retirement, and different sport types may have gone undetected in this study. Future studies may consider examining how these factors may affect former athletes’ exercise following retirement and if they cause differences in the transitional experience among subpopulations. Also, selection bias may have occurred during
recruitment for this study, as individuals who may have already been struggling with exercise maintenance prior to college may have elected not to partake in the study. Future iterations should be completed with larger populations that that are more racially diverse, include more men, and be conducted utilizing former high school athlete freshmen at other various institutions during non-pandemic times to understand if and how the transition to college affects these populations. Further, this study took place in a small timeframe (6 months) during the COVID-19 pandemic (2020-2021 academic year). As such, the results may not be representative of former high school athletes’ “typical” changes to perceived fitness, exercise, and identity during the entirety of their freshmen year. Restrictions due to the COVID-19 pandemic also limited our research ability for this study. Specifically, exercise testing to measure changes in fitness over time was replaced with assessing perceptions of fitness through surveys so as to maintain social distancing parameters, limiting our understanding of true fitness changes in this population over time. Future, post-pandemic research should be conducted for longer periods of time and seek to understand (a) whether the current findings are accurate to the former high school transition experience, or (b) establish a true baseline understanding of behavior in this population, and exercise testing should be included in future protocols to gain a true understanding of how fitness changes over time. Also, while video chat interviews and recordings were a useful compromise in light of COVID-19, in-person interviewing, where the researcher and participant can interact more naturally with one another, may yield richer data and should also be considered where available.

Inherent issues within survey research may have artificially inflated findings related to exercise behavior in this study. A major finding of this study was that the surveys used to track their behavior over time influenced their responses and incited them to complete exercise when
they may not have otherwise, potentially unintentionally influencing self-reported exercise data. Additionally, while participants were instructed in surveys to report exercise, specifically, many reported on their walking behavior, which may have encompassed non-exercise behavior (e.g., transportation to class). Despite data cleaning methods utilized, not all reports of walking could be excluded from the analysis as non-exercise, therefore aerobic exercise levels may be overestimated. Further, the use of surveys in research presents the opportunity for bias and inaccuracy on behalf of participants. In this study, participants may have misrepresented their behavior to avoid seeming overly inactive during the study, also inflating exercise data. However we believe this risk to be small considering the number of individuals who reported low or no exercise over the survey period. Regardless, more precise methods assessing exercise behavior should be utilized in the future, such as using fitness trackers, having participants keep an exercise log, or having them complete brief, periodic interviews with researchers to report exercise behavior. While survey biasing cannot be eliminated entirely, steps can be taken to minimize these risks. Specifically, as was done in this study, future mixed methods studies emulating this protocol should save revealing participants’ quantitative results to the end of the data collection period so as not to influence participants’ interview responses. Finally, survey items assessing perceptions of fitness and exercise barriers were adapted from past studies that utilized 5-point Likert scale statements, which are inherently flawed. Respondents to Likert scales generally avoid the extreme ends of the scales, opting instead to answer in the middle and causing a smaller scale to shrink by 1-2 points, decreasing sensitivity and reliability (Bandura, 2006). As such, these ratings may not be accurately representative of participants’ true perceptions, which were elucidated in the qualitative results. The use of larger Likert scale
ranges for appropriate survey items should be considered to improve the sensitivity and reliability of such measures.

**Contributions From and To Mixed Methods**

Utilizing mixed methods in this study provided unique perspectives both in exploring aspects of athletes’ transitions out of sport and also to the general field of mixed methods. Combining quantitative and qualitative methods in this study proved to be advantageous and necessary. The quantitative survey data revealed both interindividual and intraindividual variability in former high school athletes’ perceived fitness, exercise behavior, and identity previously unknown prior to this study beyond group level findings. Such results support the notion of creating an intervention for this population to aid in their exercise transition post-sport. Further, the qualitative interview data explained the intricacies for why such changes occurred and revealed certain causes for the observed variability that would not have been identified based on the use of quantitative methods alone (i.e., intricacies of perceived social supports on exercise behavior, the effect of the surveys on participants’ exercise behavior, the identity/exercise positive feedback loop). As such, the integration of these results will aid in enhancing intervention development beyond what could have been accomplished if either method was utilized alone.

This study also provides a new contribution to the field of mixed methods research. Anecdotally, mixed methods has been rarely used in the field of Kinesiology. Based on the richness of the data collected in the present study, further utilization of this methodology in exercise behavioral research may be warranted to create more robust interventions and programs for promoting exercise in various populations. Further, to our knowledge, the interactive methods of integration implemented in this study (i.e., allowing participants to view their
quantitative data and influence their responses in the qualitative data collection) have never been used before and are a departure from traditional means of integration in sequential mixed methods research, where the results from one data strand are used to influence the other’s (Creswell, 2014) without input from participants. We believe this unique method of participant-driven integration directly enhanced the incorporation of quantitative and qualitative data together in this study more so than if other traditional integrative methods had been utilized. As such, we believe this study provides a unique contribution to mixed methods literature. Further, utilizing similar, participant-driven, integrative techniques in mixed methods studies may prove useful and be a consideration to practitioners of this methodology in other fields.

**Summary of Major Findings and Future Directions**

Overall, findings from this study provided information that will direct future phases of intervention development to aid former high school athletes maintain exercise through their transition out of sport. In particular, practical considerations for future intervention programming were made known, such as providing exercise-specific social support and developing former athletes’ practical self-discipline skills for exercise so as to avoid behavioral lapses, particularly in regard to schoolwork and winter break. Additionally, former athletes’ sports backgrounds were shown to positively influence their ability to self-regulate their exercise behavior through their familiarity with exercise concepts, subjective feelings of fitness, and internalized importance of maintaining their health. However, detraining was also shown to potentially detract from their experiences and make exercise difficult. This provides a new insight unique to transitioning athletes that researchers should be aware of when developing appropriate behavioral transition programs for this population, as well as avenues to potentially utilize in future studies to promote exercise maintenance. Future pre-efficacy studies examining these
factors, as well as electronic means of promoting self-monitoring of behavior and ways of developing athletes’ PAHCO post-sport, should be considered for future intervention development. Additionally, in-depth insight was provided regarding athletes’ changing identities over time as they transitioned out of sport and into college, and preliminary evidence shows how these changes may affect/be affected by exercise behavior. As such, confirmation or refutation of the “positive feedback loop” relationship between identity and exercise found in this study is warranted. Specifically, as the preliminary proof-of-concept data gathered in this study indicates that these methods were viable in understanding former high school athletes exercise behavior and its associated factors, the utilization of quantitative, qualitative, and mixed methods research is encouraged to achieve this aim and the other potential research directions mentioned. Finally, as mentioned, the repetition of this or use of similar methods in other former athlete populations at the college and professional level, as well as in subpopulations of athletes regarding sex, race, sport type/season, and retirement length, is encouraged to further solidify researchers’ understanding of exercise in athletes’ transitions out of sport and how this relationship may differ from what is posited in traditional transition research.

Conclusions

This study provided insight into the temporal changes to perceived fitness, exercise behavior, and identity in former high school athletes as they transitioned to college, their experiences with exercise over this transition, and reasons for why observed changes occurred. At the population level, quantitatively measured variables did not exhibit noticeable changes over time, yet at the individual level, participants exhibited substantial variability across most variables. Such findings indicate importance in taking into account inter- and intra-individual changes developing and promoting health behaviors, such as exercise and physical activity.
Further, qualitative data indicated that participants’ adaptations to the transition to college and identity renegotiation during this time affected their initial exercise behavior. Meanwhile, factors relating to their motivations to exercise, personal pre-condition, and external environment were modifiers of their behavior and caused observed fluctuations in the quantitative variables. Furthermore, the qualitative findings provided preliminary insight into the how perceived fitness, exercise, and identity interrelated with one another over time. Implications of this research include continuing to expand researchers’ understanding of exercise behavior in transitioning athletes by examining these same variables in other athlete populations and with more diverse samples. Further, future studies are encouraged to continue exploration of the relationship between identity and exercise in transitioning athletes, and the continued promotion of exercise in these populations to improve the quality of their retirement experiences and maintenance of their long-term health.
References


Burnsed, B. (2013). NCAA mental health task force holds first meeting.


Gorczynski, P. (2013, 2013/01/01). The use of single-case experimental research to examine physical activity, exercise, and physical fitness interventions: A review. *Journal of*
https://doi.org/10.1080/10413200.2012.664606


https://doi.org/10.1123/ssj.2.2.101


https://doi.org/10.1080/10413209708406481


Martin, E. (2017). Here’s how much more expensive it is for you to go to college than it was for your parents. *CNBC Make It*.


during the COVID-19 pandemic lockdown: A systematic review. *BMJ Open Sport & Exercise Medicine, 7*(1), e000960.


https://doi.org/10.1177/216507990205001106


USA Triathlon. (2021). https://www.teamusa.org/USA-Triathlon/USAT-for-Me/Athlete-Resources/Youth


Wilcoxson, A., Link, L. Life after sport: Your role in preparing athletes to transition well. (2019, March). Symposium conducted at the Great Lakes Athletic Trainers Association 51st Annual Meeting & Symposium, Wheeling, IL, USA.


https://www.youthpolicy.org/factsheets/country/united-states/

Appendix I: Flyer Used in Recruitment Efforts

College Freshmen Research
Participants Needed!

Individuals are eligible if they
- Graduated high school and are starting college in 2020
- Played a high school sport all 4 years of high school and devoted at least 20 hours/week to training in-season
- Are not playing a college varsity or club sport, and have no plans to try out for either
- Own a device that can access email and has video capabilities

Study Purpose
Understand changes to exercise behavior and identity over the course of 6 months

Earn a $50 Amazon Gift Card by...

...report your exercise behavior and changes in identity through a series of electronic surveys.

...discuss your experiences with exercise in a voluntary post-study interview.

| Time Commitment, Location, and Contact Information |
|----------------|-----------------|
| Surveys: 8 Total 10 minutes each | All data collections will take place online via participants’ email, with optional interviews conducted via Zoom. |
| Interview: 1 Hour |

To determine your eligibility for this study or if you have any questions, please contact Paula Ferrara at pferrar1@vols.utk.edu by September 30, 2020.

IRB NUMBER: UTK IRB-20-05944-XP
IRB APPROVAL DATE: 08/13/2020
Appendix II: Screening Forms

Phone Screen: Former Athlete Study

Hello, this is ____________ from the Applied Exercise Physiology Laboratory at the University of Tennessee, Knoxville. I am contacting you because you have expressed interest regarding our study on exercise in former high school athletes. The purpose of the study is to record and determine why changes to exercise behavior, fitness, and changes to psychological factors affecting both occur over the course of your Freshman year of college. The study involves your completion of periodic electronic surveys and an optional follow up interview that would take place over the course of 26 weeks (6.5 months). The surveys will be sent to you via email every 3 weeks and will consist of questions assessing changes to self-reported exercise and psychological factors expected to affect exercise behavior. There are 8 surveys in total, and if all are completed you will earn a $50 Amazon gift card. However, if you do not complete at least 5 surveys you will be expelled from this study in order to retain the accuracy of our data. Further, an optional follow up interview would occur a week after your final fitness test and serve to provide researchers with a more in-depth understanding as to why observed changes to previously measured factors occurred based on your experiences with exercise over the course of the study. All procedures are optional to you and you can opt out of the study at any time without consequence. If found eligible after this phone screening, we will go over the informed consent form and more information regarding the study’s procedures will be provided to you for you to decide whether you would like to participate.
If you are interested in this study and have some time (about 10 minutes), I have some questions to ask you to determine your eligibility. If you are found eligible the informed consent document will take another 10 minutes to go over. Go to Screening Form.
SCREENING FORM

| First Name:____________________ | Last Name: ______________________ |
| Email address:__________________________ |
| Best phone number to be reached at:_______________ |

OK to say we’re calling from the UT Exercise Physiology Lab if leaving a voicemail?

- No
- Yes

How did you hear about our research study?

- Email
- Flyers
- Class
- Word-of-mouth
- Social Media
- Other: _________________

ELIGIBILITY

| Eligible: | Yes | No | Screened by:__________________________ |
| If No, Reason: | | | |

| | Date:__________ |

If you have time, I will go over the informed consent with you, which will take about 10 minutes. Afterward you will have the opportunity to ask any questions and decide whether or not you want to participate. If you don’t have time now, we can schedule another time to go over the informed consent.

If rescheduled, next time to call: _________________
1) How old are you? Age:_______

2) What is your gender? _______ Gender:_______

3) What race do you identify with? (Can have multiple) Race:_______
   □ Hispanic       □ Non-Hispanic

4) In what year did graduate from high school athletics? Year Graduated:
   a) ≥ 2020
   b) < 2020 (INELIGIBLE)

**If retired from sport before Fall 2019:** I am sorry, but we are recruiting individuals who graduated high school and are beginning college in the same calendar year. Since you graduated before the allotted time, you are not eligible for this study. Thank you very much for your time.

5) What sport or sports did you play in high school? Sport(s):

6) How long did you play this/these sport(s) in high school? # Years:

**If they did not play all four years of high school:** I am sorry, but we are recruiting individuals who played all four years of high school. Since you did not, you are not eligible for this study. Thank you very much for your time.

   a) So to clarify, you did play through your senior year of high school?
      i. Yes – Why did you retire from your sport? Reason for Retiring:
      ii. No (INELIGIBLE)

**If they did not play through senior year:** I am sorry, but we are recruiting individuals who played through their senior year. Since you did not, you are not eligible for this study. Thank you very much for your time.

7) How many hours per week did you spend training? Number of Hours:
   a) ≥20 hours
   b) <20 hours (INELIGIBLE)

**If they devoted less than 20 hours per week to training:** I am sorry, but we are recruiting individuals who devoted at least 20 hours per week to training in high school. Since you did not, you are not eligible for this study. Thank you very much for your time.

8) Did you play at the varsity level in high school? # Years:
   a) Yes – how many years?
   b) No
9) Are you continuing to participate in varsity athletics in your Freshman year at UTK?
   a) No
   b) Yes (INELIGIBLE)

If continuing varsity sport in college: I am sorry, but we are recruiting individuals who are not playing at the varsity level in college. Since you are, you are not eligible for this study. Thank you very much for your time.

10) Do you have access to a smartphone, laptop computer, or other device with internet and email capabilities?
   □ Yes
   □ No (INELIGIBLE)

If NO to Q10: I am sorry, but due to the fact that you do not have access to a device that can access email, you are not eligible for this study. Thank you very much for your time.

11) Are you able to read English?
   □ No (INELIGIBLE)

If NO to Q11: I am sorry, but because you report being unable to read English, you are not eligible for this study. Thank you very much for your time.

12) Did you incur any injuries while playing sport in high school?
   □ Yes
   □ No
   Type of Injury:
   Reason for Injury:
   Year Occurred:

13) Do you know of any reason why you should NOT do exercise or physical activity?
   □ No
   □ Yes, please specify____________________ (MAY BE INELIGIBLE)

If yes to Q13: I am sorry, but because you have indicated having an injury/disease/disability that will prevent you from completing regular exercise, you are not eligible for this study. Thank you very much for your time!

IF ELIGIBLE: Congratulations! I am happy to inform you that you meet the eligibility criteria for this study.

**********************Back to Screening Form**********************
Appendix III: Baseline Informed Consent

Former High School Athletes' Exercise - Informed Consent

Consent for Research Participation

Research Study Title:
Idiographic Exploration of Temporal Changes in Exercise Behavior, Fitness, and Identity in Former High School Athletes Entering College (Part I)

Researcher(s):
Paula-Marie M. Ferrara, University of Tennessee, Knoxville
Kelley Strohacker, University of Tennessee, Knoxville

Why am I being asked to be in this research study?

We are asking you to be in this research study because you were a high school athlete, who is no longer participating in organized sport during your Freshman year of college, and who meets the following additional criteria:
1. Graduated high school and are entering their freshman year of college in the same calendar year
2. Played a high school sport for all four years and devoted at least 20 hours per week to training in-season
3. Not playing a college varsity or club sport in their freshman year
4. Do not have plans to try out for a varsity or club sport during their freshman year
5. At least 18 years of age
6. Own at least one device with internet and video capabilities that can access email, the Internet, and Zoom
7. Physically able to engage in exercise regularly (i.e., not permanently unable to be active due to previous injury or disease)

What is this research study about?

The purpose of the research study is record and explain changes observed in exercise behavior, perceived fitness, and identity in former high school athletes during their first year of college when not participating in varsity or club sport.
How long will I be in the research study?

This study has two parts: (1) the primary research study and (2) a post-study interview.

Every participant will complete the first part (primary research study), which will take place over the course of 24 weeks. During this time, you will also be asked to complete 8 online surveys that will be sent to your email account every 3 weeks, starting on week 1. These surveys will take approximately 20-30 minutes to complete and you will be given 72 hours to complete them before their links expire.

Only some participants will complete the second part (post-study interview). This interview will take place in the two weeks following the primary research study and involve Zoom interview with a researcher for approximately 1 hour to discuss your experiences over the course of the study. You will be able to express your interest in participating in this part today, on this form. We will also check in with you at the end of the primary research study in case you change your mind over time.
What will happen if I say “Yes, I want to be in this research study”?

To recap, if you agree to be in this study, we will ask you to complete 8 online surveys and volunteers will have the opportunity to take part in an in-person interview at the end of these procedures.

**Online Surveys:** Emails will be sent to you containing active links that, when clicked, will open the study surveys in your preferred internet browser. These surveys are designed to document changes to your self-reported exercise behavior, athletic identity, and exercise identity over the course of the study, and can be completed on a phone, computer, or tablet. Survey questions will consist of open-ended questions where you indicate the frequency, intensity, time, and type of exercises you have completed in the last 7 days, as well as questions that allow you to rate different aspects of athlete and exercise identity on 0-6 scales.

**Interview (optional):** Based on your results from the previously described procedures, we will create profiles for you depicting your changes to your perceived fitness, exercise behavior, and identity over time. These results will be presented and explained to you during the interview. Questions during this interview will involve gauging your perceptions of your profiled results and exploring your experiences with exercise over the course of the study. Interviews will be audio and/or video recorded for transcription purposes. You will receive a typed copy of what was said in the interview so that you can review it to assure what was transcribed accurately describes your experiences.

If you think that you want to participate in the interview, you will be able to indicate that today, later in this form. However, before you are interviewed, you will need to undergo separate consenting procedures (like what we are doing today). A separate informed consent detailing the procedures, risks, and rights you have regarding these interviews will be presented to you when/if you are contacted to participate. **If you are interested in participating in the interview, please check the box at the bottom of this form.** Please note, checking this box is not binding – you may change your mind later about participating in the interview. Furthermore, we will only be interviewing a sub-portion of our study population; you may or may not be selected to complete an interview. The lead researcher will notify you of this at the end of the study.
What happens if I say “No, I do not want to be in this research study”?

Being in this study is up to you. You can say no now or leave the study later. Either way, your decision won’t affect your grades, your relationship with your instructors, or standing with the University of Tennessee or your institution.

What happens if I say “Yes” but change my mind later?

Even if you decide to be in the study now, you can change your mind and stop at any time. If you decide to stop before the study is completed, please inform the lead researcher of the study. She will stop recurring surveys from being sent to your email address. Any information collected from you will be excluded from our data analysis.

Are there any possible risks to me?

It is possible that someone could find out you were in this study or see your study information, but we believe this risk is small because of the procedures we use to protect your information. These procedures are described later in this form.

Regarding the individual interview, the risk of broaching sensitive topics is minimal, however if at any point you feel uncomfortable with any topics covered, you may opt out of the interview at any time and any collected data will be destroyed to retain your privacy.

Are there any benefits to being in this research study?

We do not expect you to benefit from being in this study. Your participation may help us to learn more about how exercise, perceived fitness, and identity change in former high school athletes when not participating in organized sport in college. We hope the knowledge gained from this study will benefit others in the future.
Who can see or use the information collected for this research study?

Several modes of data collection will be utilized in this study, including paper copies of participants’ data, electronic responses to surveys, and recorded audio/video data. Only members of the research team will have access to deidentified data; only the lead researcher will know whose identification numbers/pseudonyms associate with participants’ actual names. Such information will be kept on her password protected computer. We will protect the confidentiality of your information in the additional following ways.

Participants will be assigned an identification number after their survey screening is complete, which will be associated with their collected data to retain anonymity. Electronic data from surveys will be kept confidential within the online survey portal, and once exported to outside analysis software (e.g., Microsoft Excel), will be kept on a password protected computer belonging to the PI and backed up on an external hard drive.

For interviews, you will be asked to pick a pseudonym to go by when your data is referred to in data analyses and future presentations or publications. Further, your privacy will be respected; you will not be approached in a public location by members of the research team regarding the research study. Individual interviews will be conducted and recorded on Zoom by the lead researcher and also transcribed via Zoom’s transcription function. Audio/video-recorded data and generated transcriptions will be downloaded from Zoom to the lead researcher’s password protected computer that only she has access to. Because transcriptions are generated automatically by Zoom’s software and not by a human being, it is prone to typos and mistakes throughout. As such, transcriptions will be reviewed and corrected for accuracy by the lead researcher based on your interview recordings before being sent to you for member checking. Once approved, deidentified transcripts will only be shared between members of the research team.

If information from this study is published or presented at scientific meetings, your name and other personal information will not be used. We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information or what information came from you. Although it is unlikely, there are times when others may need to see the information we collect about you. These include:

- People at the University of Tennessee, Knoxville who oversee research to make sure it is conducted properly.
- Government agencies (such as the Office for Human Research Protections in the U.S. Department of Health and Human Services), and others responsible for watching over the safety, effectiveness, and conduct of the research.
• If a law or court requires us to share the information, we would have to follow that law or final court ruling.

**What will happen to my information after this study is over?**

We will not keep your information to use for future research outside of our lab. Your name and other information that can directly identify you will be kept secure and stored separately from your research data collected as part of the study. We will not share your research data with other researchers.

**Will I be paid for this study?**

While to retain your participation in the study, you must complete only 5 of the 8 surveys, if you successfully complete at least 7 surveys you will be rewarded with an Amazon gift card valued at $50. This gift card will be emailed to you at the end of the study via the contact information we have on hand for you. Failing to complete at least 7 surveys will result in forfeiture of this reward.

**What else do I need to know?**

We may need to stop your participation in the study without your consent if you do not comply with the minimum requirements for participation. This includes completing at least 5 of the 8 online surveys. Reminders will be sent by the lead researcher to help you remember to accomplish these tasks. Once 5 surveys are missed, you will be removed from the study.

If the study is stopped for any reason, you will be notified of its cessation and informed on next steps regarding your future participation and data collected. If we learn about any new information that may change your mind about being in the study, we will tell you. If that happens, you may be asked to sign a new consent form. Your research data may be used to create products or to deliver services, including some that may be sold or make money for others. If this happens, there are no plans to provide financial payment to you or your family.
Who can answer my questions about this research study?

If you have questions or concerns about this study, or have experienced a research related problem or injury, contact the researchers, Paula Ferrara (pferrara@vols.utk.edu) or Kelley Strohacker (kstrohac@utk.edu).

For questions or concerns about your rights or to speak with someone other than the research team about the study, please contact:

Institutional Review Board
The University of Tennessee, Knoxville
1534 White Avenue
Blount Hall, Room 408
Knoxville, TN 37996-1529
Phone: 865-974-7697
Email: utkirb@utk.edu

• STATEMENT OF CONSENT

I have read this form and the research study has been explained to me. I have been given the chance to ask questions and my questions have been answered. If I have more questions, I have been told who to contact. By completing this document, I am agreeing to be in this study. I will receive a copy of this document for my records.

☐ I wish to participate in this study and do not have any questions.

☐ I DO NOT wish to participate in this study.

Thank you for your consideration of our study! Please answer this final question and provide your contact information and today’s date below. This information will only be used for this study’s purposes.
It was mentioned previously that some participants may be contacted to complete an individual interview with a member of the research team at the end of the study. Please indicate whether you would like to volunteer to be contacted in the future for this follow-up interview.

By checking this box, I agree to being contacted in the future to return for a follow-up interview that will take place after the study’s completion. I understand that checking this box is not binding; if considered for an interview, I can change my mind at any time and opt out of participating.

I DO NOT wish to be contacted in the future regarding a follow-up interview.

Contact Information

Name (First and Last)

Email Address

Today’s Date

Month    Day    Year

Thank you! You will receive your first survey within the next 24 hours. Please contact Paula Ferrara at pferrar1@vols.utk.edu if you have any questions.
Appendix IV: Electronic Survey

Former High School Athletes Exercise - Survey 1

- Please enter your name (First and Last).

  Name (First and Last)

- Please enter your email address.

  Email Address

- What is today's date?

  Month  Day  Year

The following questions will ask about your exercise level since retiring and your anticipated exercise level during your Freshman year.

- How many months have passed since your last competition or practice as a high school athlete?

  months

- In the time following high school athletics, did you partake in any other organized sports group, for example a club team, summer league, etc.?  

  ○ Yes  
  ○ No

- What organized sports group(s) did you take part in after retiring from high school sport?

  IRB NUMBER: UTK IRB-20-05044-XP  
  IRB APPROVAL DATE: 08/13/2020

Former High School Athletes Exercise - Survey 1 TEST
• Think about the time since you retired from sport. In general, how often (number of times per week) did you exercise during this timeframe?
  ○ 0
  ○ 1
  ○ 2
  ○ 3
  ○ 4
  ○ 5
  ○ 6
  ○ 7

• In the time since you retired from high school sport, please describe your exercise behavior using as much detail as possible. For example:
  • "I have been going for 30-minute runs 3 times a week for the last 2 weeks"
  • "I have been lifting weights at least 2 times per week for the last month"

• How many days per week do you intend to exercise during your Freshman year?
  ○ 0
  ○ 1
  ○ 2
  ○ 3
  ○ 4
  ○ 5
  ○ 6
  ○ 7
• Please describe how you intend to exercise during this coming school year with as much detail as possible.
  • "I plan to take regular exercise classes at the on-campus gym twice a week"
  • "I am going to join an intramural sports team"

These next questions will gauge changes to different aspects of your fitness based on your perceptions.

• What is your current height?

• What is your current weight?

• Since retiring from sport, has your weight increased, decreased, or stayed the same?
  ○ Increased
  ○ Decreased
  ○ Stayed the same

• Please explain why you believe your weight has $\{piping\text{ }text\}$ using as much detail as possible. For example:
  • "I have lost 5 lbs because I have been biking regularly"
  • "I have gained 10 lbs because I have been weightlifting and my muscles have grown"
**Muscular strength** is defined as the ability of a muscle to exert force.

Since retiring from sport, how good is your muscular strength?

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Muscular endurance** is defined as the ability of muscle to continue to perform without fatigue.

Since retiring from sport, how good is your muscular endurance?

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Agility** is defined as the ability to change the position of the body in space with speed and accuracy.

Since retiring from sport, how good is your agility?

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Aerobic fitness** is defined as the body’s ability to transport and utilize oxygen during sustained exercise.

Since retiring from sport, how good is your aerobic fitness?

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Flexibility** is defined as the range of motion available at a joint.

Since retiring from sport, how good is your flexibility?

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Think about your overall perceived fitness level.**

<table>
<thead>
<tr>
<th>Not at all satisfied</th>
<th>Slightly satisfied</th>
<th>Neutral</th>
<th>Very satisfied</th>
<th>Extremely satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

IRB NUMBER: UTK IRB-20-05944.XP
IRB APPROVAL DATE: 08/13/2020

Former High School Athletes Exercise - Survey 1 TEST
You stated that you are $\{\text{piping_text}\}$ with your overall perceived fitness. Please explain your answer in as much detail as necessary below.

We will now ask you a series of questions regarding your exercise behavior over the last 7 days.

Exercise is defined as any structured, musculoskeletal movement that requires energy and is performed with the goal of improving some aspect of fitness. This does not include activities related to transportation (i.e., walking to class, biking to campus), activities of daily living (i.e., cleaning, mowing the lawn), or general leisure-physical activity (i.e., hiking, using a standing desk).

Please keep in mind, some of the examples included in the following questions are provided to give you an estimation of intensity when exercising, but are not examples of exercise, specifically.

In the last 7 days (1 week), how many times have you engaged in the following kinds of exercise for more than 15 minutes during your free time. Type on each line the appropriate number (i.e., "4" not "four").

<table>
<thead>
<tr>
<th>Strenuous Exercise (Heart Beats Rapidly)</th>
<th>Number of times per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moderate Exercise (Not Exhausting)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mild/Light Exercise (Minimal Effort)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g., yoga, archery, fishing from river bank, bowling, horses hooves, golf, snowmobiling, easy walking</td>
<td></td>
</tr>
</tbody>
</table>
• In the last 7 days (1 week) have you engaged in any of the following exercises? Please check all that apply.
  - Running
  - Walking
  - Cycling
  - Weightlifting
  - Swimming
  - Kickboxing
  - Plyometrics
  - Bodyweight Exercises
  - Yoga
  - Pilates
  - Fitness Class (online or in-person)
  - Interval Training
  - Dancing
  - Other

• How many times in the last 7 days have you engaged piping_text?

• On average, how many minutes is each bout of piping_text?

• Listed below are common barriers reported by people for not exercising regularly. Based on your experience since retiring from sport, how important are the following barriers in preventing you from participating in regular exercise?
<table>
<thead>
<tr>
<th></th>
<th>Not at all important</th>
<th>Slightly important</th>
<th>Neutral</th>
<th>Very important</th>
<th>Extremely important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discomfort</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of family support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of friend support</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of self-discipline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not fun</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all important</td>
<td>Slightly important</td>
<td>Neutral</td>
<td>Very important</td>
<td>Extremely important</td>
</tr>
<tr>
<td>Self-conscious</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time - family activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time - part-time work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time - school work</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time - other interests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Think about your overall exercise behavior.

- You stated that you are $\{\text{piping_text}\}$ with your overall exercise behavior. Please explain your answer in as much detail as necessary below.
The next sets of questions will gauge your identities as both an athlete and an exerciser. Please answer these questions truthfully as they pertain to you in-the-moment, not as you were in the past or hope to be in the future.

- Please indicate the number that best reflects the extent to which you agree or disagree with each statement in relation to your own sports participation.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree 1</th>
<th>Moderately Disagree 2</th>
<th>Slightly Disagree 3</th>
<th>Neither Agree or Disagree 4</th>
<th>Slightly Agree 5</th>
<th>Moderately Agree 6</th>
<th>Strongly Agree 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>I consider myself an athlete.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have many goals related to sport.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Most of my friends are athletes.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Sport is the most important part of my life.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I spend more time thinking about sport than anything else.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I feel bad about myself when I do poorly in sport.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I would be very depressed if I were injured and could not compete in sport.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

- Please indicate the number that best reflects the extent to which you agree or disagree with each statement in relation to your own exercise participation.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree 1</th>
<th>Moderately Disagree 2</th>
<th>Slightly Disagree 3</th>
<th>Neither Agree or Disagree 4</th>
<th>Slightly Agree 5</th>
<th>Moderately Agree 6</th>
<th>Strongly Agree 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>I consider myself an exerciser.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>When I describe myself to others, I usually include my involvement in exercise.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I have numerous goals related to exercising.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Physical exercise is a central factor to my self-concept.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I need to exercise to feel good about myself.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Others see me as someone who exercises regularly.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>For me, being an exerciser means more than just exercising.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I would feel a real loss if I were forced to give up exercising.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Strongly Disagree 1</td>
<td>Moderately Disagree 2</td>
<td>Slightly Disagree 3</td>
<td>Neither Agree or Disagree 4</td>
<td>Slightly Agree 5</td>
<td>Moderately Agree 6</td>
<td>Strongly Agree 7</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------</td>
<td>---------------------</td>
<td>-----------------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Exercising is something I think about often</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td></td>
</tr>
</tbody>
</table>
Appendix V: Interview Guide

Introduction
- Greetings and Permission for Recording (start before informed consent overview)
- Informed Consent
- Choosing a Pseudonym

Questions
1. Based on your first survey, you wrote that in order to stay active during your freshman year you would do the following: (Insert information from the first survey).
   a. How well did you stick with what you originally wrote at the beginning of the semester? (Gather more info as necessary)
      i. What would you have done differently?
      ii. Would anything have helped you in staying active? If so, what?

2. Over the past 6 months, we sent you surveys designed to track how your perceived fitness, exercise behavior, and identity changed over time. Now, we’re going to do a brief overview of your results.

First, let’s look at how your perceptions of fitness changed over the course of the study.
   a. (Show and explain BMI and fitness graphs and open-ended responses) Take a minute to look over these graphs. When you’re ready, tell me what your initial thoughts are on your results.
      i. What were some things that affected your perceptions of your fitness over time?
   b. (Show and explain satisfaction graph and open-ended responses) Is there anything else you can add as to why your satisfaction changed/did not change over time?
      i. Based on your perceptions, what would have improved/maintained any of these aspects of your perceived fitness or satisfaction better?

Next, we’ll look at your exercise behavior.
   a. (Show and explain Godin exercise graphs and indicated types of activities and time spent being active) Take a minute to look over these graphs. When you’re ready, tell me what your initial thoughts are on your results.
      i. What were some things that affected your exercise behavior over time?
   b. (Show and explain barriers graph) Can you explain further how these factors affect your exercise behavior over time?
      i. How did you try to overcome these barriers?
      ii. Were there other barriers you faced not indicated in the survey? If so, how did you overcome those?
   c. What were some things that enabled you to keep exercising over the course of the study?
   d. (Show and explain satisfaction graph and open-ended responses) Is there anything else you can add as to why your satisfaction changed/did not change over time?
i. Based on your experiences, what would have improved/maintained your exercise behavior or satisfaction better? (Gather more info)

Lastly, we’ll look at your identity changes.

a. (Give definitions of athlete and exercise identity, then show and explain graphs) Take a minute to look over these graphs – When you’re ready, tell me what your initial thoughts are to your results.

   i. What were some things that you think affected your identity over time?

b. Research shows that athlete identity and exercise identity may affect exercise behavior in former athletes – (Show previous exercise behavior graphs) Based on your results, how do you think your identity affected your exercise behavior over the course of the study?

So based on everything we’ve discussed and looking at all of your graphs together – (Show all graphs)

a. …is there anything else you’d like to add or anything that comes to mind that explains your results further?

b. Now, over the past year, COVID-19 has drastically affected our world.

   a. How would you say the pandemic has affected your perceived fitness, exercise behavior, and identity in this study?

   b. How do you think your results would be different if there was no pandemic going on?

Is there anything else you would like to add or think we have missed in our discussion?
Appendix VI: Interview Informed Consent

Consent for Research Participation

**Research Study Title:**  Idiographic Exploration of Temporal Changes in Exercise Behavior, Fitness, and Identity in Former High School Athletes Entering College (Part II)

**Researcher(s):**  Paula-Marie M. Ferrara, University of Tennessee, Knoxville  
Kelley Strohacker, University of Tennessee, Knoxville

*Why am I being asked to be in this research study?*
We are asking you to be in this research study because you were a high school athlete, who is no longer participating in organized sport during your Freshman year of college, and who meets the following additional criteria:

1. Graduated high school and are entering their freshman year of college in the same calendar year
2. Played a high school sport for all four years and devoted at least 20 hours per week to training in-season
3. Not playing a college varsity or club sport in their freshman year
4. Do not have plans to try out for a varsity or club sport during their freshman year
5. At least 18 years of age
6. Own at least one device with internet and video capabilities that can access email, the Internet, and Zoom
7. Physically able to engage in exercise regularly (i.e., not permanently unable to be active due to previous injury or disease)

*What is this research study about?*
The purpose of the overall research study is to record and explain changes observed in exercise behavior, perceived fitness, and identity in former high school athletes during their first year of college when not participating in varsity or club sport. This half of the study is the continuation of this purpose, which is to explore participants’ experiences with exercise over the course of their first year of college and perceptions of their results from the first half of the study.

*How long will I be in the research study?*
The interview and review phase of this study will last 2 weeks. You will be asked to participate in a Zoom interview that will last approximately 60 minutes following the signing of this document. This interview will be audio and video-recorded and transcribed, after which you will receive a copy of the transcription to review. You will have one week to review the transcription and relay any edits back to the researchers. If you agree to be in the study, your participation will last for 1 hour for the interview, and approximately 1 hour for the transcription review.
What will happen if I say “Yes, I want to be in this research study”?

If you agree to be in this study, we will ask you to participate in an individual, semi-structured interview that will take place online via Zoom. Based on your results from the first half of this study in which you completed online surveys, we have created a profile depicting your changes in fitness, exercise behavior, and identity over time. These results will be presented and explained to you during the interview. Questions during this interview will involve gauging your perceptions of your profiled results and exploring your experiences with exercise over the course of the study. Interviews will be audio and video recorded for transcription purposes. You will receive a typed copy of what was said in the interview in the days following via email and will have one week to review it to assure what was transcribed accurately describes your experiences before returning it to the researchers with any edits.

What happens if I say “No, I do not want to be in this research study”?

Being in this study is up to you. You can say no now or leave the study later. Either way, your decision won’t affect your grades, your relationship with your instructors, or standing with the University of Tennessee.

What happens if I say “Yes” but change my mind later?

Even if you decide to be in the study now, you can change your mind and stop at any time. If you decide to stop before the study is completed, please inform the lead researcher of the study. She will stop the recording and end the interview. Any information collected from you will be excluded from our data analysis.

Are there any possible risks to me?

It is possible that someone could find out you were in this study or see your study information, but we believe this risk is small because of the procedures we use to protect your information. These procedures are described later in this form.

Are there any benefits to being in this research study?

We do not expect you to benefit from being in this study. Your participation will help us understand better why exercise, fitness, and identity change in former high school athletes when not participating in varsity or club sports in college. We hope the knowledge gained from this study will benefit others in the future.

Who can see or use the information collected for this research study?

Only members of the research team will have access to deidentified data; only the lead researcher will know whose identification numbers/pseudonyms associate with participants’ actual names. Such information will be kept on her password protected computer. If information from this study is published or presented at scientific meetings, your name and other personal information will not be used. You will be asked to pick a pseudonym to go by when your data is referred to in data analyses and
future presentations or publications. Further, your privacy will be respected; you will not be approached in a public location by members of the research team regarding the research study.

Individual interviews will be conducted and recorded on Zoom by the lead researcher and also transcribed via Zoom’s transcription function. Audio/video-recorded data and generated transcriptions will be downloaded from Zoom to the lead researcher’s password protected computer that only she has access to. Because transcriptions are generated automatically by Zoom’s software and not by a human being, it is prone to typos and mistakes throughout. As such, transcriptions will be reviewed and corrected for accuracy by the lead researcher based on your interview recordings before being sent to you for member checking. Once approved by you, deidentified transcripts will only be shared between members of the research team. Informed consent forms will be kept in the office of the lead researcher’s advisor to assure your real name is not connected with any of your deidentified information. Transcriptions and interview guides that have been deidentified will be stored in a locked filing cabinet in the exercise intervention space that only the PI has access to. All records will be kept on file for three years before being destroyed.

We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information or what information came from you. Although it is unlikely, there are times when others may need to see the information we collect about you. These include:

- People at the University of Tennessee, Knoxville who oversee research to make sure it is conducted properly.
- Government agencies (such as the Office for Human Research Protections in the U.S. Department of Health and Human Services), and others responsible for watching over the safety, effectiveness, and conduct of the research.
- If a law or court requires us to share the information, we would have to follow that law or final court ruling.

What will happen to my information after this study is over?
We will not keep your information to use for future research outside of our lab. Your name and other information that can directly identify you will be kept secure and stored separately from your research data collected as part of the study. We will not share your research data with other researchers.

What else do I need to know?
Your research data may be used to create products or to deliver services, including some that may be sold or make money for others. If this happens, there are no plans to provide financial payment to you or your family.

Who can answer my questions about this research study?
If you have questions or concerns about this study, or have experienced a research related problem or injury, contact the researchers, Paula Ferrara (pferrar1@vols.utk.edu) or Kelley Strohacker (kstrohac@utk.edu).
For questions or concerns about your rights or to speak with someone other than the research team about the study, please contact:

Institutional Review Board
The University of Tennessee, Knoxville
1534 White Avenue
Blount Hall, Room 408
Knoxville, TN 37996-1529
Phone: 865-974-7697
Email: utkirb@utk.edu

STATEMENT OF CONSENT
I have read this form and the research study has been explained to me. I have been given the chance to ask questions and my questions have been answered. If I have more questions, I have been told who to contact. I give permission for the researcher to sign below in my stead to show my agreement to be in this study. I will receive a copy of this document for my records.

______________________________
Name of Adult Participant

Researcher Signature (to be completed at time of informed consent)
I have explained the study to the participant and answered all of his/her questions. I believe that he/she understands the information described in this consent form and freely consents to be in the study.

______________________________  ________________________________  _________________
Name of Research Team Member  Signature of Research Team Member  Date
Vita

Paula-Marie Martinez Ferrara was born on October 12, 1993 in Lebanon, Pennsylvania. She is the daughter of Leonard and Alicia Ferrara and has two siblings, Teresa and John, a brother-in-law, Chris, and two nephews, Luke and Conor. In 2016, Paula earned her Bachelor of Science in Exercise Science from the University of Delaware in Newark, Delaware, along with finishing two minors in Coaching Science and Applied Music (Singing). She went on to earn her Master of Science in Clinical Exercise Physiology in 2017, also from the University of Delaware, and became an American College of Sports Medicine-certified Clinical Exercise Physiologist that same year. Paula then attended The University of Tennessee, Knoxville in Knoxville, Tennessee, where she obtained her Doctor of Philosophy in Kinesiology and Sport Studies with a specialization in Exercise Physiology in 2021 under the supervision of her advisor, Dr. Kelley Strohacker. Following earning her doctorate, Paula began her new position as an assistant professor in the Department of Kinesiology at Hope College in Holland, Michigan.