

Early Sport Specialization and Collegiate Injury Rates in NCAA Division I Athletes

By

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## ABSTRACT

Sport specialization in adolescence has become a prominent and influential aspect of sports. Specialization is the focused participation in a single sport for much of the year without involvement in other sports or activities. The purpose of this study was to examine if sport specialization was related to injury rate and scholarship attainment in National Collegiate Athletic Association (NCAA) athletes. A survey was distributed to two NCAA institutions, where the athletes were asked questions regarding demographic, sport history, and injury history. A total of 64 athletes completed the survey (47 females and 17 males) from nine sports. The mean age of initial specialization was  $8.3 \pm 3.4$  years. Sport specialization and injury occurrence were not significantly related ( $p = .866$ ). Further, the length of specialization was not significant in predicting whether an athlete would receive a scholarship ( $p = .392$ ). With increasing numbers of adolescents specializing in sport at younger ages, creating appropriate restrictions and guidelines is important to protect the health of the athletes. Further it is important for coaches, parents, and sport organizations to understand the potential lack of relationship between specialization and earning a collegiate sports scholarship.

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## CHAPTER I

### INTRODUCTION

Over the last few decades, organized youth sports have gained in popularity and involvement with nearly 60 million participants in 2014 (DiFiori et al., 2014). The definition of sport specialization can be seen as the focused participation in a single sport for much of the year without involvement in other sports or activities (Bell et al., 2021). In a survey of nearly 1,600 athletes over a 50-year competitive span, 18.1% of the athletes specialized in their sport before the age of 15 years. The most common sports of early specialization were gymnastics, tennis, swimming and diving, and soccer, with sports such as volleyball, ice hockey, basketball, and track and field showing significant percentages (Rugg et al., 2021).

There are many reasons for choosing early specialization in sport, including increased chance of scholarship attainment in college and later success in their careers. In a study of youth basketball parents, 69.7% believed early sport specialization would lead their young athlete to making a collegiate basketball team. In addition, half of the surveyed parents believed this specialization would lead to receiving a scholarship at the collegiate level (Post et al., 2021). For women in college athletics, there seems to be a stronger connection between receiving scholarships and specializing early in sport compared to their male counterparts. While scholarships may not always be attainable, success later in careers is another driving factor for specialization. In a mass survey of athletes from different levels of sport, high percentages of professional (61.7%), collegiate (80.6%), and high school (79.7%) athletes believed specialization at a young age led to playing at a higher level. With this link between early specialization and

success, also comes increased training loads on the young athlete. This single-sport training can lead to lower involvement and earlier dropout in later years of the primary sport (Wall & Cote, 2007), while also increasing injury rates later in adolescence.

Early sport specialization has been shown increase injury rates in high school aged athletes. Using the 3-point Jayanthi scale in examination of high school athletes, Bell et al. (2016) showed increased hip and knee injuries when athletes played their sport more than eight months of the year. Increased injury rate was shown in both the high and medium specialization categories of the high school athletes. Weekes et al. (2019) followed freshman athletes through their high school careers, finding early sport specialization was associated with higher percentages of injury, injury in the past, and decreased participation.

The higher injury rate after early sport specialization can be attributed to many mechanisms of injury, including incomplete development, earlier contact, and overuse. Incomplete development of the adolescent athlete can promote stress, chronic fatigue, and injury on the musculoskeletal system. Studies show the adolescent athlete is subject to higher chances of injury during their adolescent growth spurt (McKay et al., 2019), as their physal plates are less resistant to tensile, shear, and compressive forces (DiFiori et al., 2014). Along with incomplete development, younger exposure to physical contact increases injury rate in young athletes. In sports such as football, ice hockey, lacrosse, and soccer, higher probability of forceful contact led to higher injury rates (Bartley et al. 2017). In football, nearly half of the injuries reported were directly related to tackling or being tackled, while ice hockey and lacrosse athletes reported injuries related to checking or being checked (Bartley et al. 2017). In soccer, softball, and baseball, contact injuries

from other players or equipment showed increased admission to the emergency department (Farooqi et al. 2021; Pickett et al. 2005).

Overuse injuries also occur due to early specialization. Overuse can be defined as repetitive loading on the musculoskeletal system when rest is not adequately allowed for adaptation by the body (DiFiori et al., 2014). High sport specialization is shown to have an 81% higher chance of overuse injury, while moderate specialization shows a 39% increase in overuse injury. Overhand sports, such as baseball and softball, have higher probability of overuse injuries, as throwing eight months out of the year produces five times higher chances of surgery (Olsen et al., 2006). In the Little League World Series, pitchers who exceeded their pitch counts had increased risk of ulnar collateral ligament repair when playing in Major League Baseball (Erickson et al. 2017). In soccer, overuse injuries show prominence in affecting the knee, while also showing increased chances of overuse injury when participating on more than one soccer team (O’Kane et al., 2017).

Higher chances of overuse or contact injury can be related to the length of specialization of an adolescent athlete. Collegiate athletes who specialized early in their sport before the age of 14 years had higher injury rates compared to those who did not. Additionally, those who specialized early also showed a higher chance of reporting multiple injuries prior to involvement in collegiate athletics (Ahlquist et al., 2020). A longer time spent involved in a primary sport increases the length of exposure to injury mechanisms seen in adolescent athletics. In collegiate athletics, injury is a common occurrence among many athletes. Both time-loss and non-time loss injuries want to be avoided by student-athletes in both men’s and women’s sports, due to their impact on performance and playing time (Powell & Dompier, 2004).

Sports that present with high injury rates include football, men's soccer, and women's soccer in fall competition. Men's basketball, women's indoor track, and women's basketball showed the most reported injuries in winter competition. In spring competition, baseball, softball, and women's outdoor track presented with the highest incidence rate (Kerr et al. 2015). Many of these sports have a direct connection to early specialization, as high specialization rates in adolescents (Rugg et al., 2021) can be linked to higher injury rates in college.

### **Purpose of Study**

The primary purpose of this study was to examine how sport specialization affects injury rate and scholarship attainment in a subject pool of NCAA Division 1 athletes. Specific mechanisms of injury investigated include overuse, contact, frequency, and severity. The secondary purpose of this study was to examine what sports have the highest rate of early specialization. Primary research questions include:

1. Is there a difference in number of collegiate injuries in those who specialized and those who did not specialize?
2. Is there a relationship between length of specialization and rate of injuries during collegiate career?
3. Is there a relationship between length of specialization and scholarship status?
4. Is there a difference in scholarship status in those who did or did not specialize?
5. Is there a relationship between surgery incidence rate in college and length of specialization?

**Significance of Study**

Substantial research has been conducted on early sport specialization, but not on its combination with collegiate athletics. It is important to investigate these two aspects of sport because as athletes play competitive sports at an earlier age, more injuries can be seen later in their careers, possibly related to how long they have been playing a primary sport. It is also beneficial to investigate this potential association to create appropriate restrictions and guidelines in competitive youth sports. This information can be useful for athletic trainers, sports administrators, parents, and coaches, among other professions.

## **CHAPTER II**

### **REVIEW OF LITERATURE**

#### **Youth Sport Specialization**

Involvement in youth athletics has increased significantly compared to previous decades. According to the National Council of Youth Sports, 60 million youth between the ages of 6 to 18 years are involved in an organized sport in the United States, with nearly 27 million involved in team sports (DiFiori et al., 2014). With these numbers continuing to rise, youth athletes have trended toward specializing in one sport to gain a competitive advantage, sometimes because of added pressure from parents or coaches (Myer et al., 2016), to increase the likelihood of scholarship attainment in college, or increase the possibility of professional contracts. In their consensus definition, Bell et al. (2021) stated sport specialization is “the intentional and focused participation in a single sport for a majority of the year that restricts opportunities for engagement in other sports or activities” (p. 1251).

Sport specialization is seen in individual sports and team sports. Rugg et al. (2021) distributed a survey to National Collegiate Athletic Association (NCAA) athletes who participated in a sport from 1960 to 2018. Of the 1,550 athletes, 18.1% specialized in their respective sport before the age of 15 years old. The most common sports of early specialization were gymnastics (~75%), tennis (~62%), swimming and diving (~53%), and soccer (~33%). Sports such as volleyball, ice hockey, basketball, and track and field all fell within a 15-25% rate of specialization. Late specialization was also shown, with

sports such as baseball, softball, and football all falling under 10% of athletes specializing before the age of 15 years old (Rugg et. al., 2021).

Youth sport specialization has been linked by many athletes and their parents to increased chances of scholarship attainment in college. In their study, Post et al. (2021) surveyed the parents of 805 organized youth basketball players on their belief of sport specialization and scholarships. Parents (71.4%) believed specialization would lead to their child making their high school basketball team, while 69.7% believed it would lead to making a collegiate basketball team. Furthermore, nearly half (49.8%) believed specialization would lead to their child receiving an athletic scholarship with an NCAA program (Post et al., 2021) There is evidence of an association between specialization and scholarship attainment for females. Rugg et al. (2021) provided evidence of a significant difference in scholarship attainment in women who specialized early in a sport compared to males, showing women who specialized received a greater number of scholarships.

Success later in their career due to sport specialization has also been a driving factor of youth athletes to specialize at an early age. Buckley et al. (2017) surveyed over 3,000 athletes from high school ( $n = 503$ ), collegiate ( $n = 856$ ), and professional athletes ( $n = 1,731$ ) on the occurrence of specialization and their perceptions of success. For the professional athletes, 61.7% believed sport specialization led to youth athletes playing at a higher level, while 79.7% of high school and 80.6% of collegiate athletes also believed this to be true. With the temptation of success becoming a key motivator in sport specialization, the level of training in sport-specific skills increases. While this specialization creates a more skilled and developed adolescent athlete, the pressure and

stress to achieve greater sport-related milestones also increases. This single-sport training can hinder the success and involvement in the later years of sport for many adolescent athletes. Wall and Cote (2007) examined this idea through a survey given to parents of high-level, male, minor league ice hockey players, which consisted of both active and dropout players. It was found that both groups participated in relatively the same number of organized games, practices, training sessions, and camps, while the amount of off-ice training differed. Earlier dropout of ice-hockey participation was found in the athletes who began off-ice training at a younger age and invested more hours a year in off-ice training during their early teenage years.

Youth sport specialization is seen throughout many sports. Sports such as gymnastics, tennis, swimming and diving, and soccer have been shown to have the highest numbers of athletes who specialize early. This specialization has many driving factors, including added pressure, receiving scholarships in college, or greater success in sport. While these reasons seem beneficial to the athlete, they also increase the likelihood of injuries at the high school, college, or professional level.

### **Early Specialization and Injury**

As early sport specialization occurrence has risen in recent decades, a connection to increased injury rates has also become apparent. Bell et al. (2016) distributed both a sport specialization and injury history survey to over 300 high school athletes, where the athletes were classified as either low, moderate, or high specialization. This classification used the 3-point Jayanthi scale, which consists of three questions regarding athlete specialization. These questions included (1) if the athlete has quit all other sports to focus on the selected sport, (2) if the primary sport was seen as more important than other

sports, and (3) if more than eight months of the year was spent participating in the primary sport. If the athlete answered “yes” to a question, the question received one point: zero-one point was considered “low specialization,” two points considered “moderate specialization,” and three points considered “high specialization” (Jayanthi et al., 2019). The results of the survey showed the rate of reporting a hip or knee injury was nearly three times higher in athletes who competed in one sport for greater than eight months out of the year, primarily the high and moderate specialization categories (Bell et al., 2016).

Similar findings were reported by Weekes et al. (2019). These authors tracked 602 freshman athletes through their high school careers, comparing the possibility of sport specialization to increased incidence of athletic injury. During this four-year period, specialized athletes had an injury rate of 9%, while their non-specialized counterparts had a rate of 5%. Of the 602 participants, 255 reported being specialized, with 56.5% of them reporting an injury in their primary sport in the past (40% in non-specialization). Before their study began, 78% of the athletes that specialized reported an injury that limited their participation in the sport for some or the whole season, compared to 40% of non-specialized athletes.

Early sport specialization has been shown increase injury rates in high school aged athletes. Bell et al. (2016) provided evidence of increased numbers of hip and knee injuries in athletes that played there sport more than eight months of the year, while Weekes et al. (2019) showed specialization had higher percentages of injury, injury in the past, and decreased participation. The higher documented injury rate after early sport

specialization can be attributed to many possible reasons, including incomplete development, increased contact, and overuse.

### **Mechanisms of Injury**

#### **Incomplete Development**

One possible reason for injury in early sport specialization is incomplete development of the body, as many athletes are not fully mature when choosing a primary sport at a young age. This lack of maturation can promote stress on many parts of the body, creating chronic fatigue and injury. McKay et al. (2019) stated athletes are more prone to certain types of injury during the adolescent growth spurt of their development, specifically injuries that are related to overuse and the growth plate of their joints. This growth spurt in adolescents usually begins around ages 9-10 years in boys and ages 11-12 in girls, where the body undergoes varying changes in mass and height (Jayanthi et al., 2022). These rapid changes can cause different injuries relating to development, including Sinding-Larsen-Johansson syndrome, chondromalacia, Osgood-Schlatter and Sever disease, osteochondritis dissecans, and lower body stress fractures. Many of these injuries can be directly related to the physal plate near the joints during the adolescent growth spurt. This is due to the physes, apophyses, and articular surfaces in skeletally immature athletes being less resistant to tensile, shear, and compressive forces, compared to both mature bone or more prepubescent bone (DiFiori et al., 2014). Bone mineral density in these immature athletes becomes a vital aspect in withstanding the repeated stresses and forces found in early sport specialization.

## Physical Contact

Injuries during sport specialization can also be attributed to increased incidence of contact with other players or objects. As pediatric and adolescent athletes are becoming exposed to greater chances of forceful contact, as seen in football, ice hockey, lacrosse, and soccer, their rate of injuries, such as fractures, dislocations, and concussions increases. Bartley et al. (2017) examined exposure and injury incidence in adolescent athletes throughout these sports, documenting 35,000 injuries over almost 10 million exposures. In football, nearly half of the injuries reported were directly related to tackling or being tackled (46.6%), while ice hockey (41.1%) and lacrosse athletes (15.3%) reported injuries related to checking or being checked.

In soccer, Pickett et al. (2005) found that of 1,714 injuries reported, 235 involved the head or neck. These injuries were attributed to contact with other players (65.1%) or the ball (26.4%) and resulted in admission to the emergency department. Contact injuries are also becoming more apparent in youth baseball and softball participation. Farooqi et al. (2021) examined both youth softball ( $n = 13,162$ ) and baseball ( $n = 24,717$ ) injuries over a nine-year period that were reported to the emergency department. Most baseball (49.2%) and softball (39.7%) injuries seen in the emergency department were caused by contact with the ball, bat, or another player. Contact injuries were shown to occur more in the head, neck, and face in baseball (66%) and softball (57%) compared to other regions of the body.

## Overuse

The most common mechanism of injury due to early sport specialization is overuse. DiFiori et al. (2014) defined overuse injury as the repetitive submaximal loading

of the body when rest is not adequate to allow for structural adaptation to take place. These injuries can affect muscles, tendons, ligaments, bones, bursas, neurovascular structures, and physes. Using the Jayanthi 3-point scale, Bell et al. (2018) stated high sport specialization in adolescents is shown to have an 81% higher chance of musculoskeletal overuse injury compared to low sport specialization, while moderate sport specialization had a 39% increased chance of injury. Although time spent training and competing may vary among levels of specialization, increased volume, and effort among the high and moderate sport specialization groups is attributed to the increased chance of overuse injury. In overhand throwing sports, like baseball, overuse injury plays an important factor in time spent away from participation. Olsen et al. (2006) showed pitchers between the ages of 9 to 14 years who pitched more than eight months out of the year were five times more likely to have surgery due to overuse injury compared to those who pitched less than eight months. The injured group of the study reported pitching through arm fatigue (52%) and arm pain (67%) leading to an overuse injury, which was shown to be 36 times more likely to happen than a pitcher without fatigue or pain. Additionally, Erickson et al. (2017) found pitchers in the Little League World Series who exceeded their pitch counts were at a greater risk of ulnar collateral ligament repair when playing in Major League Baseball compared to those that did not exceed their pitch counts. In their study of adolescent female soccer players and injury risk, O'Kane et al. (2017) found in their 351 participants, 47% of overuse injuries were reported occurring to the knee. This study also showed a 2.5-fold increase in overuse knee injuries occurring in athletes who played on more than one soccer team. The soccer players who participated in other physical activities were shown to have a 61% less chance of overuse knee injury.

## Length of Specialization

The length of time between the initial onset of specialization and the end of the athlete's career is an important aspect when evaluating trends or mechanisms in sport injuries. The longer an athlete is exposed to the pressures and stresses of a single sport, the higher the chance of injuries from contact or overuse mechanisms may become.

Ahlquist, Cash, and Hame (2020) surveyed 202 athletes at a division 1 NCAA university on their age and reason of specialization, injury history, and training volume. The collegiate athletes who specialized early in their sport (before the age of 14 years) had an 86.9% injury rate in college, while the athletes who specialized after age 14 years old had an injury rate of 71.4%. Those who specialized early in their respective sports also reported a 16% higher chance of having multiple injuries prior to their collegiate status. These factors become important when analyzing time spent in college with injury, which showed a significant increase with early specialization athletes (15.2 weeks) compared to late specialization athletes (6.5 weeks).

In their survey of former NCAA athletes, Rugg et al. (2021) showed gymnastics, tennis, swimming and diving, soccer, ice hockey, volleyball, track and field, and golf had the highest percentages of early sport specialization. In many of these sports, utilization of a dominant extremity, coupled with a longer period of physiological stresses to body parts, showed an increase in injury occurrence when seen in the collegiate setting. At the collegiate level, many of the injuries seen are both chronic and acute. While there are vast differences in the reasons for these injuries, a longer time spent specializing in a sport increases the length of exposure to injury mechanisms.

Early sport specialization by athletes can influence the rate and severity of injuries they suffer throughout their adolescent years. These injuries can be provoked by many reasons, primarily seen through incomplete development of the musculoskeletal system, younger exposure to physical contact, and overuse. As these adolescent athletes specialize at younger ages, the length of their specialization also becomes an influential factor in rate of injury. Through their development as young adults into college athletics, many of these reasons become apparent in how often they suffer injuries in their respective collegiate sport.

### **Collegiate Sport Injuries and Sport Specialization**

While injury is common among nearly every sport in the NCAA, college athletes want to avoid suffering both time-loss and non-time-loss injuries throughout the season. This avoidance is due to many factors, including impaired performance, losing status on the team, losing playing time in competition, or even progressing to decreased scholarship levels. Powell and Dompier (2004) examined both time-loss injury and non-time-loss injury rates across 50 collegiate athletic programs over three years. The survey yielded nearly 70,000 injury incidences, with 22% being time-loss injuries in men's sports and 16% in women's sports. While the occurrence of non-time-loss injuries in both men's and women's sports is high, athletes still want to avoid any injury that could lead to impaired or poor performance. The authors also found football represented the highest numbers of non-time loss and time-loss injuries in men's sports, followed by basketball, baseball, and soccer. In women's sports, soccer represented the highest number of injuries in both categories, followed by basketball, softball, and volleyball.

In their analysis of collegiate injury rates from the 2009-2010 to 2013-2014 school years, Kerr et al. (2015) found similar values when evaluating injuries reported from 1,113 schools in the NCAA. The authors utilized the reporting of injuries from the athletic trainer to the NCAA Injury Surveillance Program (NCAA-ISP) for their conclusions. During the 5-year study period, fall sports such as football ( $n = 47,199$ ), women's soccer ( $n = 15,113$ ), and men's soccer ( $n = 13,435$ ) had the highest average number of reported injuries. In winter sports, men's basketball ( $n = 16,607$ ), women's indoor track ( $n = 11,519$ ), and women's basketball ( $n = 10,858$ ) presented with the highest number of injuries, while baseball ( $n = 13,292$ ), softball ( $n = 7,629$ ), and women's outdoor track ( $n = 6,167$ ) dominated the spring sports. These data retrieved from the NCAA-ISP shed light on recommendations for rule and regulation changes at the collegiate level but can also provide guidance and education on how early sport specialization can affect adolescents as they work to get there.

Comparing the groups of early specialization (Rugg et al. 2021) and injury rates (Kerr et al. 2015), it is shown sports such as soccer, basketball, and track and field have both high injury rates in college and evidence of early sport specialization. Soccer represented the highest combination of the two categories, seeing 15,113 injuries in women's soccer and 13,435 in men's soccer in college, while also showing a 33% rate of early specialization. Basketball presented ~22% of early sport specialization and collegiate injury rates of 16,607 in men's basketball and 10,858 in women's basketball. Indoor track and field were shown to have a rate of specialization of ~24% with an average injury rate of 11,519 per year. This provides a possible connection between high

levels of injury rates in collegiate athletes with high percentages of early sports specialization before the age of 15.

### **Overall Conclusions**

As more youth become involved in sport, the popularity of early sport specialization has also increased. Common sports of early specialization are gymnastics, tennis, swimming and diving, and soccer, with sports such as volleyball, ice hockey, basketball, and track and field falling close behind. This decision to choose a primary sport at a young age can be attributed to various reasons, but studies have shown this decision to be primarily influenced by increased chance of success in later years and scholarship attainment in college. Athletes who decide to specialize early have shown higher injury rates during their adolescent years, compared to their non-specialized counterparts. These increased injury rates have shown evidence of being provoked by incomplete development, earlier physical contact, and overuse mechanisms. As these mechanisms alone create injury problems in adolescents, exposing them to young athletes over longer periods of specialization can increase their rate or severity of injury. When early specialized athletes enter the collegiate athletic setting, these mechanisms of injury and length of specialization can further provoke injury and time-loss from their sport. Thus, the purpose of this study was to examine how the sport specialization affects injury rate and scholarship attainment in a subject pool of NCAA Division 1 athletes.

## **CHAPTER III**

### **METHODOLOGY**

#### **Participants**

Current NCAA Division I student-athletes ( $N = 64$ ) aged 18-23 years old from multiple institutions in the United States participated in the study. Athletes from all sports, excluding football, were included in the study. The University Institutional Review Board approved the methods and procedures utilized in the study and the participants provided informed consent through answering the consent questions to begin the online survey (see Appendix A).

#### **Instrumentation**

The questionnaire was estimated to take 10-15 minutes to complete. All questionnaire responses were recorded and managed using Qualtrics electronic software. The participants were not compensated for their involvement in the study.

The survey was divided into three parts: demographics, sport history, and injury history. Part one of the questionnaire consisted of 5 demographic questions including age, sex, academic year, sport, and scholarship status (0-49%, 50-99%, or 100%). The second part of the questionnaire consisted of 4 questions regarding age at start of specialization, length of sport specialization, and sports of specialization. The final section included 33 questions on injury history and severity of injury in collegiate competition and orthopedic surgery history during collegiate years. Sport specialization was defined as “the

intentional and focused participation in a single sport for most of the year that restricts opportunities for engagement in other sports or activities” (Bell et al., 2021, p.1251)

### **Procedures**

Participants were recruited through each school’s head athletic trainer, who forwarded an email to the institution’s student-athletes. Participants were emailed a study introduction and a link to the online questionnaire through their institutional email address. Student-athletes were given a 4-week window to complete the online questionnaire. Email reminders were sent at 14-day and 21-day intervals after the initial email was sent.

### **Statistical Analysis**

Descriptive statistics were performed to characterize the participant pool ( $n = 59$  specialized;  $n = 5$  non-specialized). A Point Biserial Correlation was run to determine a relationship in the injury rate of collegiate injuries and early sport specialization. A Point Biserial Correlation was run to investigate a relationship between length of specialization and number of injuries. Assuming normal distribution, a Point Biserial Correlation was performed to determine a relationship between length of specialization and scholarship status. A Chi Square was run to determine a difference in scholarship status in those who did or did not specialize. A Point Biserial Correlation was performed to investigate a relationship between surgery incidence rate and length of specialization. All statistical procedures were conducted using IBM SPSS statistics for Windows (IBM SPSS Statistics, Version 29; IBM Corp., Armonk, NY, U.S.A.). Statistical values were shown as mean  $\pm$  standard deviation and statistical significance was set at  $p < .05$ .

## CHAPTER IV

### RESULTS

A total of 70 athletes completed the survey (31% response rate) from two universities. There were 6 athletes excluded from the analysis due to incomplete or incorrect completion of the survey, which resulted in a final sample size of 64 athletes. There were 47 female (73.4 %) and 17 male (26.6%) participants in the study, with a mean age of 20.2 ( $SD = 1.8$ ) years ranging from 18-25 years of age. There was relatively even distribution of responses across academic years. The sports played by the athletes in the sample included nine sports, with the greatest numbers in softball, soccer, and volleyball, respectively. Athletes from the survey reported a wide range in their scholarship statuses. When asked if the athletes specialized in a sport between the ages of 10 and 13 years, most athletes reported “yes” (see Tables 1-4).

Athletes varied in their report of sports they specialized in as adolescents with the highest percentages in softball, soccer, volleyball, baseball, and basketball, respectively (see Table 5). In their response to the occurrence of sports-related injuries in college, nearly three-fourths of the athletes surveyed reported “yes” to having an injury, while a quarter of the athletes reported “no.” Of the 59 athletes who specialized in their sport, there was a high number of years spent specifically involved in the sport (see Table 6). Furthermore, in their specialization, most athletes reported between one and eight injuries while participating in their collegiate sport. There was a wide distribution of responses when athletes were asked to report their response to age of initial specialization,

Table 1

*Athlete Demographics by Academic Year*

Academic Year	<i>n</i>	Percent	Cumulative Percent
Freshman	20	31.3	31.3
Sophomore	14	21.9	53.1
Junior	11	17.2	70.3
Senior	12	18.8	89.1
Graduate	7	10.9	100.0

Note:  $N = 64$ .

Table 2

*Athlete Demographics by Sport*

Sport	<i>n</i>	Percent	Cumulative Percent
Baseball	7	10.9	10.9
Basketball	7	10.9	21.9
Cross Country	1	1.6	23.4
Golf	6	9.4	32.8
Soccer	10	15.6	48.4
Softball	20	31.3	79.7
Tennis	3	4.7	84.4
Track and Field	2	3.1	87.5
Volleyball	8	12.5	100.0

Note:  $N = 64$ .

Table 3

*Athlete Demographics by Current Scholarship Status*

Scholarship Percentage	<i>n</i>	Percent	Cumulative Percent
0%	2	3.1	3.1
10-49%	19	29.7	32.8
50-99%	23	35.9	68.8
100%	20	31.3	100.0
Total	64	100.0	

Table 4

*Athlete Response to Specialization Between 10-13 Years of Age.*

Response	<i>n</i>	Percent	Cumulative Percent
Yes	59	92.9	92.9
No	5	7.8	100.0
Total	64	100.0	

Table 5

*Athlete Specialization as Adolescent by Sport*

Sport of Specialization	<i>n</i>	Percent	Cumulative Percent
Non-Specialized	5	7.8	7.8
Baseball	7	10.9	18.8
Basketball	7	10.9	29.7
Cross Country	1	1.6	31.3
Golf	5	7.8	39.1
Soccer	10	15.6	54.7
Softball	17	26.6	81.3
Tennis	3	4.7	85.9
Track and Field	1	1.6	87.5
Volleyball	8	12.5	100.0
Total	64	100.0	

Table 6

*Athlete Responses to Sport Specialization Survey Questions*

Variable	<i>n</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Years participated in specialized sport	59	0	17	8.3	3.4
Sport-related injuries in collegiate career	47	1	8	2.1	1.3
Age of specialization (years)	59	3	18	10.1	3.1

Note: N = 59.

with an average age of 10 years old. Athletes were investigated in their sport specialization status and the number of injuries that occurred while in their collegiate sport. These two groups were compared using a point biserial correlation, where the comparison showed no statistical significance in determining if sport specialization would lead to whether the athlete would suffer an injury in college ( $r = -.025, p = .866$ ).

Athletes were asked to report their length of specialization and scholarship status in independent questions. The specialization and scholarship status groups were then compared using a point biserial correlation. The length of specialization was not significant in predicting whether the athlete would receive a scholarship ( $r = -.113, p = .392$ ). Similarly, there was no significance in predicting if specialization status would lead to a scholarship in college ( $r = -.169, p = .183$ ). It was also determined that length of specialization was not significantly related to the number of injuries in their sport ( $r = -.077, p = .620$ ). Furthermore, there was no significance in predicting if increased surgery incidences were affected by increased years of specialization ( $r = -.135, p = .632$ ).

## **CHAPTER V**

### **DISCUSSION**

This study examined the relationship between sport specialization and collegiate injury rate and scholarship status, respectively, in a population of NCAA Division I athletes, was examined. While early sport specialization was not statistically related to injury rate in college, sport specialization for a greater length of time as an adolescent was also not significant in predicting a greater occurrence of injury while participating at the collegiate level. Additionally, sport specialization was not statistically related to whether an athlete would earn a collegiate scholarship.

Rugg et al. (2021) examined scholarship attainment levels in their survey of 1,550 NCAA athletes over the span of 58 years. Overall, more than 60% of athletes received a scholarship, with nearly one-third earning a full scholarship. Similarly, in the current sample, 68.8% of athletes received a scholarship and 31.3% of athletes received a full scholarship. In our study, length of specialization was not significant in predicting whether the athlete would receive a scholarship, while also showing no significance in predicting if specialization status would lead to a scholarship in college. This can be attributed to how institutions in the NCAA distribute scholarships among their teams with in state or out-of-state athletes, while additionally determining how certain athletes fit within athletic or academic scholarships. The authors also found there was a significant difference in scholarship attainment in women who specialized early in a sport compared to males, showing women who specialized received a greater number of scholarships

(Rugg et al., 2021). Although data were not analyzed by sex groups in the current sample, there were a greater number of female participants ( $n = 47$  females; 17 males). This could be due to female athletes specializing earlier than males based on societal norms, which could be attributed to sports such as soccer, softball, and volleyball who push for this early specialization. Coaches, parents, or athletes can use this information to determine if the choice of specialization is appropriate and practical. Additionally, these findings provide evidence of the abundance of scholarships attained by the athletes in the study, which could translate to greater populations within the NCAA. This requires further research examining scholarship distribution across male and female sports.

Several researchers have investigated levels of participation and specialization in various sports. In their study, Rugg et al. (2021) found 18.1% of athletes specialized in their sport before the age of 15 years old. Additionally, the most common sports of specialization were gymnastics, tennis, swimming and diving, and soccer. Sports such as volleyball, ice hockey, basketball, and track and field also had significant levels of early specialization (Rugg et al., 2021). In the current study, softball (26.6%), soccer (15.6%), volleyball (12.5%), baseball (10.9%), and basketball (10.9%) had high levels of specialization between the ages of 13 years and 16 years (see Table 5). Although this sample was smaller than in the previously mentioned study, the percentages of specific sports that athletes specialized in was mirrored in the current study.

Kerr et al. (2015) examined injury rates among athletes at schools in the NCAA from 2009 to 2014. The authors found higher injury rates in football, soccer, basketball, indoor track, baseball, and softball. Similarly in our study, there were also more numerous injuries among soccer, basketball, baseball, and softball players. In conjunction

with the specialization data by sport in the current study and Rugg et al. (2021), sports with high early specialization are also the sports with high injury rates. Rugg et al. (2021) showed gymnastics, tennis, swimming and diving, soccer, ice hockey, volleyball, track and field, and golf having the highest percentages of early sport specialization. In comparison to our study, similar sports such as softball, soccer, volleyball, baseball, and basketball had high percentages of early sport specialization. This highlights the importance of understanding whether a longer period of specialization in these sports increases the likelihood of collegiate injury. This can be used to determine if an athlete will have a higher likelihood of suffering an injury in college.

Ahlquist et al. (2020) surveyed 202 athletes at a division I NCAA university on their age and reason of specialization, injury history, and training volume. The collegiate athletes who specialized early in their sport had a 15% higher injury rate in college, compared to those who did not specialize early (before the age of 14 years old). Those who specialized early in their respective sports also reported a 16% higher chance of having multiple injuries prior to their collegiate status. In the current study, it was found that length of specialization was not significant in predicting number of injuries in college. While repeated stress and force loads on specific body regions may be detrimental in any aspect, this finding can still be used to justify why specialization with appropriate restrictions and guidelines in adolescent athletes may be warranted

In overhand sports, such as baseball and softball, overuse injuries along with increased participation at a young age can lead to greater time-lost from the sport. DiFiori et al. (2014) defined overuse injury as repetitive loading on the body when rest is not adequately allowed for adaptation. These authors also showed that longer time spent in

sport specialization resulted in an 81% higher chance of an overuse injury, while moderate specialization had a 39% increased chance (DiFiori et al., 2014). Together, these studies provide evidence that athletes who specialize earlier in overhand sports are more prone to overuse injury due to the repetitive and forceful demands found in these sports. This led athletes who suffered overuse injuries to be five times more likely to have surgery (Olsen et al., 2006). Although many of the athletes surveyed in the current study reported overuse injuries, there was no significant correlation between specialization and surgery. Further research in differentiating between these types of injuries will become important for athletic trainers, coaches, administrators, and athletes. This still shows the importance of applying and maintaining appropriate guidelines and recommendations like pitch counts, education on proper biomechanics, and rest days for adolescent athletes.

### **Strengths and Limitations**

The strengths of this study include a diverse sport population within two NCAA Division I institutions and clear evidence regarding a high frequency of sport specialization in adolescence. These data can be used by a variety of professions to shed light on why assessing specialization and workload within youth sports is important. A limitation of the current study was the large number of specialized athletes who responded to the survey. This discrepancy limited the ability to adequately compare the specialized and non-specialized groups on study variables. Another limitation found within the study is recall bias. With many of the athletes reporting ages greater than 21 years of age, recall of previous injuries from the early specialization years may have been affected. Therefore, future research with a larger sample, more equally distributed across

athletes who did and did not specialize at an early age is encouraged. Additionally, research across NCAA divisions regarding specialization is also encouraged, due to some athletes in lower divisions likely playing multiple sports until collegiate participation.

### **Conclusions**

Current data suggest injury rates and scholarship status were not related to early sport specialization in a population of NCAA Division I student athletes. Specifically, specialization versus no specialization was not indicative of higher chances of injury or scholarship attainment. Additionally, length of specialization showed no correlation or significance in predicting surgery incidence due to seriousness of the injury. Current data did not indicate increased risk of injury with longer time spent in specialization within our athlete population. Although neither variable showed significance when correlated, specialization and injury rates remained prominent and impactful on the population surveyed. The athletes in our study showed high percentages of injuries and early specialization, so this emphasizes the need for education and proper adherence to protocols within sports. The findings of this study should be taken into consideration when sport administrators, coaches, parents, athletes, and other professions in youth sports investigate the safety and outcomes of early sport specialization.

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APPENDIX

## Appendix A: IRB Letter of Approval

Date: 4-17-2023

IRB #: IRB-FY2023-54

Title: Early Sport Specialization and Collegiate Sport Injuries in NCAA Athletes

Creation Date: 1-25-2023

End Date:

Status: **Approved**

Principal Investigator: Ahren Smith

Review Board: MTSU Institutional Review Board

Sponsor:

## Study History

Submission Type	Initial	Review Type	Exempt	Decision	Exempt
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